CHAPTER 1
HISTORY OF MEDICINE

Few important honours
- Father of (Modern) Medicine First true Epidemiologist: Hippocrates
- Father of Indian Medicine: Charaka
- Hindu God of Medicine: Dhanvantari
- Father of (Modern) Surgery: Ambroise Pare
- Father of Indian Surgery: Sushruta
- Father of Epidemiology/Modern Epidemiology: John Snow
- Father of Homeopathy: Samuel Hahnemann

India has eliminated 3 diseases till date
- Guinea Worm/Dracunculiasis (Feb 2000)
- Leprosy (Dec 2005)
- Yaws (Sep 2006)

Few important diseases in public health
- Father of Public Health: Cholera
- Barometer of Social Welfare: Tuberculosis
- Slums' Disease: HIV/AIDS
- Black Sickness: Kala-Azar (Leishmaniasis)
- Kick Death: Plague
- Break-bone fever: Dengue
- Monkey disease: KFD (Kyasanur Forest Disease)
- 8th day disease: Tetanus neonatorum
- 100-day cough: Pertussis (Whooping cough)
- Koch's Phenomenon: Tuberculosis
- Hansen's disease: Leprosy
- Bird Flu: Avian Influenza (H1N1)
- Modern epidemic: Coronary heart disease
- Silent Epidemic, of century: Alzheimer's disease

Theories in Public Health
- Germ theory of disease: Louis Pasteur
- Multi-factorial causation of disease: Pattenkoffer

Discoveries, inventions and developments in Public Health
- First vaccine developed: Small pox (Edward Jenner)
- Term 'Vaccination': Edward Jenner
- Term 'Vaccine': Louis Pasteur
- First antibiotic: Penicillin (Alexander Fleming)
- Homeopathy: Samuel Hahnemann
- Citrus fruits in prevention of Scurvy: James Lind
- Life cycle of Plasmodium: Ronald Ross

Few important definitions
- State Medicine: Provision of free medical services to the people at government expense
Socialised Medicine: Provision of medical service and professional education by the State (as in state medicine), but the programme is 'operated and regulated by professional groups' rather than by government.

Countries with first honours:
- First country to socialize medicine completely: Russia
- First country to introduce compulsory sickness insurance: Germany
- First country to start family planning programme: India
- First country to start blindness/control programme: India
- First country to establish a Finger-printing bureau: India (Calcutta)

Few important dates in Public Health:
- Small pox:
  - Last indigenous case of small pox in India: 17th May 1975 (Bihar)
  - Last known case of small pox in India: 24th May 1975 (Importation from Bangladesh)
  - India declared small pox free: April 1977
  - Last case of small pox in world: 26th October 1977 (Somalia)
  - WHO declared 'global eradication of small pox': 8th May 1980
- Constitution of WHO came into force: 7th April 1948
- WHO declared eradication of Small pox: 8th May 1980

World Health Organization (WHO):
- ISM&H (Indigenous Systems of Medicine & Homeopathy) have been now re-designated as AYUSH
  - Ayurveda
  - Yoga and Naturopathy
  - Unani
  - Siddha
  - Homeopathy

Systems of Medicine in India:
- Homeopathy system of medicine
- Ayurveda system of medicine
  - Ayurveda means the 'science of life'
  - Tridosha theory of disease: 3 doshas (humors), namely, Vata (wind), Pitta (gall) and Kapha (mucus)
- Siddha system of medicine (Tamil speaking parts in India and abroad)
- Unani system of medicine (Originated from Greece)
- AYUSH system of medicine

Isolation versus quarantine:

<table>
<thead>
<tr>
<th>Separation of Cases</th>
<th>Isolation</th>
<th>Quarantine</th>
</tr>
</thead>
<tbody>
<tr>
<td>done for cases themselves</td>
<td>Healthy contacts of cases</td>
<td>Other persons around</td>
</tr>
<tr>
<td>Level of Prevention</td>
<td>Secondary (Treatment)</td>
<td>Primary (Specific Protection)</td>
</tr>
<tr>
<td>Duration</td>
<td>Till recovery (period of communicability)</td>
<td>Till maximum incubation period</td>
</tr>
</tbody>
</table>

- 'Isolation' applies to persons who are known to be ill with a contagious disease
- 'Quarantine' (meaning '40 Days detention') is applied to those who have been exposed to a contagious disease but who may or may not become ill
  - Quarantine was first applied for plague
  - Quarantine period for Yellow fever: 6 days (maximum IP)
Important indices in Public Health

- **O Sullivan's Index**: Life Expectancy MINUS Probable duration of bed disability and inability to perform major activities
- **Disability adjusted life years (DALYs)**: Is a measure of the burden of disease in a defined population and the effectiveness of interventions; It expresses years lost to premature death and years lived with disability adjusted for its' severity
- **Human Development Index (HDI)**: Comprises of 3 indicators,
  - Longevity - life expectancy at birth ($L_{E_b}$)
  - Income (Real GDP per capita in PPP US$)
  - Knowledge (Mean years of schooling - Gross enrolment ratio & Literacy rate)
- **Physical Quality of Life index (PQLI)**: Comprises of 3 indicators,
  - Life expectancy at 1 year age ($L_{E_1}$)
  - Infant mortality rate (IMR)
  - Literacy rate
- **Chandler's Index**: Hookworm eggs/gm of stool
- **Pearl Index**: Pregnancy rate per HWY (Failure rate of Contraceptives)

Concepts of control of disease

- **Disease control**: Is reducing the transmission of disease agent to such a low level that it ceases to be a public health problem; it aims at reducing,
  - Incidence of the disease
  - Duration of the disease
  - Effects of infection
  - Financial burden to the community
- **Disease elimination**: Is complete interruption of transmission of disease in a defined geographical area, but the causative organism may be persisting somewhere
  - Disease elimination is a 'geographical term', i.e. can be used only for a country or a region
  - India has eliminated 3 diseases till date:
    1. Guineaworm (Dracunculiasis): February 2001
    2. Leprosy: December 2005 (Elimination criteria: < 1/10,000)
- **Disease eradication**: Is complete 'extermination' of organism ('tearing out by roots')
  - Disease eradication is a 'global term' (whole planet)
  - World has eradicated ONLY 1 disease till date: Small pox (declared eradicated on 8 May, 1980)

Indicators of socio-economic development

- **Best indicator of socio-economic development of a country**: Under-live mortality rate (USMR) BEST
  - Infant mortality rate (IMR) 2nd BEST

Millennium Development Goals (MDGs)

- All MDGs have to be achieved by 2015: Baseline year was taken as 1990
- 3 of 8 goals (Goal 4, 5, 6), 8 of 18 targets and 18 of 48 indicators are 'directly' health related
  - **Goal 1**: Eradicate extreme poverty and hunger
  - **Goal 2**: Achieve universal primary education
• **Goal 3:** Promote gender equality and empower women  
• **Goal 4:** Reduce child mortality (Reduce by two-thirds the under-five mortality rate)  
• **Goal 5:** Improve maternal health (Reduce-by-three-quarters the maternal mortality ratio)  
• **Goal 6:** Combat HIV/AIDS, malaria and other diseases  
• **Goal 7:** Ensure environmental sustainability  
• **Goal 8:** Develop a global partnership for development  

**Disease-Impairment-Disability-Handicap**

- **Disease:** Any abnormal condition of an organism that impairs function  
- **Impairment:** Any loss or abnormality of psychological, physiological or anatomical structure or function  
- **Disability:** (Because of impairment,) any restriction or inability to perform an activity in a range considered normal for a human being  
- **Handicap:** A disadvantage for a given individual, resulting from an impairment/disability, that limits/prevents fulfillment of a role considered normal (depending on age, sex, social, cultural factors) for that individual  

**ICD-10**

- ICD-10 is an abbreviation for the International Statistical Classification of Disease and Related Health Problems (10th revision)  
- Attempts to make a uniform classification for morbidity & mortality data throughout the world  
- ICD-10 is arranged in 3 volumes, 21 chapters  

**Levels of prevention**

<table>
<thead>
<tr>
<th>Level of prevention</th>
<th>Modes of intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Level</td>
<td>Health Promotion &amp; Specific Protection</td>
</tr>
<tr>
<td>Secondary Level</td>
<td>Early Diagnosis &amp; Treatment</td>
</tr>
<tr>
<td>Tertiary Level</td>
<td>Disability Limitation &amp; Rehabilitation</td>
</tr>
</tbody>
</table>

- **Primordial Level of Prevention:**
  - Prevention of the emergence or development of risk factors  
  - **Modes of Intervention:**
    1. Individual Education  
    2. Mass Education  

- **Primary Level of Prevention:**
  - Is the action taken prior to onset of disease  
  - **Modes of Intervention:**
    1) Health Promotion: Through Health Education, Environmental modifications  
    2) Specific, Protection: Through a specific intervention  

- **Secondary Level of Prevention:**
  - Is applied when disease has possibly set in  
  - **Modes of Intervention:**
    1) Early Diagnosis  
    2) Treatment  

- **Tertiary Level of Prevention:**
  - Is applied when disease has advanced beyond early stages; It aims to reduce or limit impairments and disabilities  
  - **Modes of Intervention:**
    1) Disability Limitation  
    2) Rehabilitation
**Modified Kuppuswami scale** is a 'Scale of Socio-economic Status of Urban families'

- It comprises of 3 components:
  - Education Status of head of family
  - Occupation Status of head of family
  - Income per capita per month

**Iceberg phenomenon of disease**

- **Concept**: A disease in a community may be compared to an iceberg
  - **Floating tip of iceberg (Visible portion)** - Clinical cases (what physician sees in the community)
    1. Detected by diagnostic tests
    2. Is of prime importance to a clinician.
  - **Submerged part of iceberg (Hidden portion)** - Latent, inapparent, presymptomatic, undiagnosed and undiagnosed cases and carriers (hidden mass of the disease)
    1. Detected by screening tests
    2. Is of prime importance to an epidemiologist
  - **Line of demarcation (Water surface)** - Demarcation between apparent and inapparent disease

**Differences in portions of iceberg phenomenon of disease**:

<table>
<thead>
<tr>
<th></th>
<th>Tip of iceberg</th>
<th>Submerged part of iceberg</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Composition</strong></td>
<td>Clinical cases</td>
<td>Latent, inapparent, presymptomatic, undiagnosed &amp; undiagnosed cases and carriers</td>
</tr>
<tr>
<td><strong>Visibility to clinician</strong></td>
<td>Visible</td>
<td>Invisible</td>
</tr>
<tr>
<td><strong>Prime importance for</strong></td>
<td>Clinician</td>
<td>Epidemiologist</td>
</tr>
<tr>
<td><strong>Detection</strong></td>
<td>Diagnostic tests</td>
<td>Screening tests</td>
</tr>
<tr>
<td><strong>Useful level of prevention</strong></td>
<td>Secondary</td>
<td>Primary</td>
</tr>
</tbody>
</table>

- Iceberg phenomenon of a disease is not shown by:
  - Rabies
  - Tetanus
  - Measles
  - Rubella

- Iceberg phenomenon of a disease is also known as: Biological spectrum of a disease, Nose of a Crocodile phenomenon, Ears of a Hippopotamus phenomenon

**Case fatality rate (CFR)**

- CFR represents 'killing power of a disease'
  - It is closely related to virulence of organism'

CFR = Total no. of deaths due to a disease / Total no. of cases due to a disease \( \times 100\)

- CFR is a Proportion: Always expressed in percentage

**CFR of few important diseases**:

<table>
<thead>
<tr>
<th>Diseases</th>
<th>Case fatality rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japanese encephalitis</td>
<td>20 - 40%</td>
</tr>
<tr>
<td>Yellow fever</td>
<td>80%</td>
</tr>
<tr>
<td>Chicken pox</td>
<td>&lt; 1%</td>
</tr>
<tr>
<td>Rabies</td>
<td>100%</td>
</tr>
</tbody>
</table>
**Limitations of CFR:**
- Time interval is not specified
- Not useful for chronic diseases

**Time distribution of disease**

**Short term fluctuations**
- *Epidemic:*  
  1) Occurrence of no. of cases of a disease *'clearly in excess of normal expectancy (NE)'*  
    i. Normal expectancy is derived by looking at average of no. of cases of the disease in previous 3-5 years  
  2) Statistically speaking, epidemic is when no. of cases *'exceed twice the standard deviation'*  
    i. No. of cases > Mean + 2SD ( > \(\bar{x} + 2\sigma\))

**Types of epidemics:**
1) Common-source epidemics:  
   i. Single exposure or 'Point source' epidemics  
   ii. Continuous or multiple exposure epidemics  
2) Propagated epidemics:  
   i. Person-to-person  
3) Slow (modern) epidemics

**Periodic fluctuations**
- *Seasonal trends:*  
  1) Is seasonal variation/ Fluctuation in occurrence of a disease  
  2) Examples: Measles, URI, GIT infections
- *Cyclical trends:*  
  1) Is occurrence of a disease in cycles spread over short periods of time (days, weeks, months or years)  
  2) Examples: Measles (every 2-3 yrs), Rubella (every 6-9 yrs)

**Long term fluctuations** *(SECULAR TRENDS)*
- Implies changes in occurrence of a disease over a long period of time, generally several years or decades  
- Examples: Communicable diseases (Poliomyelitis, Diphtheria, Pertussis) are reducing in India in past few decades; Non-communicable diseases (Diabetes, Hypertension, Obesity) are increasing in India in past few decades

**Chemoprophylaxis**
- *Chemoprophylaxis: implies the protection from, or prevention of disease (primary level of prevention)*

<table>
<thead>
<tr>
<th>Disease</th>
<th>Chemoprophylaxis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cholera</td>
<td>Tetracycline/Furazolidone</td>
</tr>
<tr>
<td>Diphtheria</td>
<td>Erythromycin &amp; 1st dose of vaccine</td>
</tr>
<tr>
<td>Malaria</td>
<td>Doxycycline/Mefloquine</td>
</tr>
<tr>
<td>Meningococcal meningitis</td>
<td>Rifampicin</td>
</tr>
<tr>
<td>Plague</td>
<td>Tetracycline</td>
</tr>
</tbody>
</table>
Epidemic

**Definitions of epidemic:**

- Occurrence of no. of cases of a disease 'clearly in excess of normal expectancy (NE)'  
  1) Normal expectancy is derived by looking at average of no. of cases of the disease in previous 3 - 5 years

- Statistically speaking, epidemic is when no. of cases 'exceed twice the standard deviation'

\[
\text{No. of cases} > \text{Mean} + 2\text{SD} \quad (> \text{ju.} + 26)
\]

**Types of epidemics:**

- Common-source epidemics
  - Single exposure or 'Point source' epidemics
  - Continuous or multiple exposure epidemics

- Propagated epidemics
  - Person-to-person
  - Slow (modern) epidemics

**Single exposure or 'Point source' epidemics:**

- 'Sharp rise and sharp fall' in no. of cases \(N_i\)
- 'Clustering of cases' in a narrow interval of time \(V\)
- All 'cases develop within one incubation period' of the disease
- Examples: Food poisoning, Measles, Chicken pox, Cholera, BHOPAL GAS TRAGEDY

**'Common source', continuous or repeated exposure epidemics:**

- 'Sharp rise' in no. of cases
- Fall in no. of cases is interrupted by 'Secondary waves/peaks'
- Examples: Contaminated well in a village

**Propagated epidemics:**

- 'Gradual rise and gradual fall' over a long time (Tail off)
- Results from 'person-to-person transmission'
- Examples: HIV, tuberculosis

**Epidemic curve:** Is drawn between no. of cases in epidemic and time elapsed (time distribution of epidemic cases)

Endemic: Constant presence of a disease or infectious agent in a defined geographical area

- Is the 'usual or expected frequency' of a disease in a population

Pandemic: An epidemic usually affecting a large proportion of the population, occurring over a large geographical area such as part of a nation, nation, continent or world

Sporadic: Cases which are 'scattered about'

- Cases are widely separated in space and time
- Show little or no connection with each other

**Source and reservoir**

- **Source:** Is a person, animal, object or substance from which an infectious agent passes or is disseminated to the host

  - Source refers to immediate source of infection & may or may not be part of reservoir

- **Reservoir:** Is any person, animal, arthropod, plant, soil or substance (or combination of these) in which an infectious agent lives & multiplies, on which it primarily depends for survival, & where it reproduces itself in such a manner that it can be transmitted to a susceptible host
<table>
<thead>
<tr>
<th>Infection</th>
<th>Source</th>
<th>Reservoir</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hookworm</td>
<td>Soil</td>
<td>Man</td>
</tr>
<tr>
<td>Tetanus</td>
<td>Soil</td>
<td>Soil</td>
</tr>
<tr>
<td>Typhoid</td>
<td>Feces/urine/Food/Milk/Water</td>
<td>Case/Carrier</td>
</tr>
</tbody>
</table>

**Human Reservoir.**

- **Cases:** Persons having particular disease, health disorder or condition
- **Carriers:** Infected person or animal that harbors a specific agent in the absence of discernible clinical disease, & serves as a potential source of infection for others
  1) Carriers by type:
    - *Incubatory Carriers:* shed infectious agent during incubation period of disease. E.g. Measles, Mumps, Polio, Pertussis, Influenza, Diphtheria, Hepatitis-B
    - *Convalescent Carriers:* shed the disease agent during the period of Convalescence. E.g. Typhoid, Bacillary Dysentery, Amoebic Dysentery, Cholera, Diphtheria & Pertussis
    - *Healthy carriers:* emerge from subclinical cases without suffering from overt disease. E.g. Poliomyelitis, Cholera, Meningococcal Meningitis, Diphtheria & Salmonellosis

  2) Carriers by duration:
    - *Temporary Carriers:* shed infectious agent for short periods of time. E.g. Incubatory carriers, Convalescent carriers; Healthy carriers.
    - *Chronic Carriers:* excretes infectious agents for indefinite periods. E.g. Typhoid, Hepatitis-B, Dysentery, Meningococcal Meningitis, Malaria, Gonorrhoea, etc

  3) Carriers by portal of exit:
    - Urinary carriers
    - Intestinal carriers
    - Nasal carriers
    - Respiratory carriers

**Animal reservoir:** E.g. Rabies, Influenza, Yellow Fever, Histoplasmosis

**Reservoir in non-living things:** E.g. Soil harbour agents for Tetanus, Anthrax, Coccidiomycosis, Mycetoma

- Reservoir(s) of important diseases:

<table>
<thead>
<tr>
<th>Disease</th>
<th>Microorganism</th>
<th>Reservoir(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epidemic Typhus</td>
<td>Rickettsia prowazekii</td>
<td>Humans</td>
</tr>
<tr>
<td>Endemic Typhus</td>
<td>Rickettsia typhi,</td>
<td>Rodents</td>
</tr>
<tr>
<td>Scrub Typhus</td>
<td>Rickettsia tsutsugamushi</td>
<td>Rodents</td>
</tr>
<tr>
<td>Indian Tick Typhus</td>
<td>Rickettsia conori</td>
<td>Rodents</td>
</tr>
<tr>
<td>RMSF</td>
<td>Rickettsia rickettsii,</td>
<td>Rodents</td>
</tr>
<tr>
<td>Rickettsial Pox</td>
<td>Rickettsia akari</td>
<td>Mice</td>
</tr>
<tr>
<td>Trench fever</td>
<td>Bartonella quintana</td>
<td>Humans</td>
</tr>
<tr>
<td>Q fever</td>
<td>Coxiella burnetti</td>
<td>Cattle, sheep, goat</td>
</tr>
<tr>
<td>Dracunculiasis</td>
<td>Dracunculus medinensis</td>
<td>Humans</td>
</tr>
<tr>
<td>Ascariasis</td>
<td>Ascaris l unin.bricoid.es</td>
<td>Humans</td>
</tr>
<tr>
<td>Ancylostomiasis</td>
<td>Ancylostoma diodenedale</td>
<td>Humans</td>
</tr>
</tbody>
</table>
Surveillance

Surveillance: Is the ongoing systematic collection and analysis of data and the provision of information which leads to action being taken to prevent and control a disease, usually one of an infectious nature.

- Surveillance is of many types:
  - Passive Surveillance: Data is itself reported to the health system; For e.g., A patient with fever coming on his own to the PHC, CHC, Dispensary, Private Practitioner, Hospital
  - Active Surveillance: Health system seeks out 'actively' the collection of data, i.e., goes out to community to collect data; For e.g., Health worker goes house to house every fortnight to detect fever cases, collect blood slides and provide presumptive treatment (under malaria component of National Vector Borne Disease Control Programme- NVBDCP)
  - Sentinel Surveillance: Monitoring of rate of occurrence of specific conditions to assess the stability or change in health levels of a population, It is also the study of disease rates in a specific cohort, geographic area, population subgroup, etc. to estimate trends in larger population; For e.g., Use of health practitioners to monitor trends of a health event in a population
    1) Sentinel Surveillance helps in 'identifying missing cases' and 'supplementing notified cases'

Surveillance in India:

- Passive Surveillance in most of the national health programmes in India rely on Passive Surveillance
- Active Surveillance is seen in NVBDCP (Health worker goes house to house every fortnight to detect fever cases, collect blood slides and provide presumptive treatment under malaria component) and National Leprosy Elimination Programme and National Polio Elimination Program
- Sentinel Surveillance is done in National AIDS Control Programme
Incidence
- Is defined as the 'no. of new cases' occurring in a defined population during a specified period of time
- Incidence can be determined from: Cohort study
- For a given period,
  \[
  \text{Incidence} = \frac{\text{No. of new cases}}{\text{Population at risk}} \times 1000
  \]
- Incidence is a RATE, expressed per 1000.

Prevalence
- Prevalence is defined as all current cases (old + new) at a given point of time
  \[
  \text{Prevalence} = \frac{\text{No. of all current cases of a disease at a time}}{\text{Estimated total population at that time}} \times 100
  \]
- Prevalence can be determined from: Cross Sectional Study
- PREVALENCE IS A PROPORTION (Prevalence IS NOT A RATIO): Numerator is a part of denominator and is always expressed in percentage.
- Prevalence describes the balance between incidence, mortality and recovery
  \[
  \text{Prevalence} = \text{Incidence} \times \text{mean duration of the disease (P = I \times d)}
  \]
- Prevalence of few important infections in India:

<table>
<thead>
<tr>
<th>Infection</th>
<th>Prevalence (India)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuberculosis infection</td>
<td>40%</td>
</tr>
<tr>
<td>HIV infection</td>
<td>0.31%</td>
</tr>
</tbody>
</table>

- Prevalence is total current (Old + New) cases in a given population over of time

Tools of measurement in epidemiology
- Rate: Numerator (a) is a part of denominator (b) and multiplier is 1000 or 10,000 or 100,000 or so on...
- Ratio: Numerator (a) is not a part of denominator, (b) and BOTH numerator and denominator are unrelated
- Proportion: Numerator (a) is a part of denominator (b) and multiplier is 100
  - Proportion is always expressed in percentage (%)

Examples of tools of measurement in epidemiology:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Formula</th>
<th>Numerator (N) &amp; Denominator (D)</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infant mortality rate (IMR)</td>
<td>No. of infant deaths \times 1000 No. of Live births</td>
<td>N is ? part of D; multiplier NOT 100</td>
<td>Rate</td>
</tr>
<tr>
<td>Maternal mortality rate (MMR)</td>
<td>No. of maternal deaths \times 100000 No. of Live births</td>
<td>N is NOT a part of D; both unrelated</td>
<td>Ratio</td>
</tr>
<tr>
<td>Measure</td>
<td>Formula</td>
<td>Notes</td>
<td>Units</td>
</tr>
<tr>
<td>---------</td>
<td>---------</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td>Sex ratio (SR)</td>
<td>( \frac{\text{No. of females} \times 1000}{\text{No. of males}} )</td>
<td>N is NOT a part of D; both unrelated</td>
<td>Ratio</td>
</tr>
<tr>
<td>Incidence</td>
<td>( \frac{\text{No. of new cases} \times 1000}{\text{Total population}} )</td>
<td>N is a part of D; multiplier NOT 100</td>
<td>Rate</td>
</tr>
<tr>
<td>Prevalence</td>
<td>( \frac{\text{No. of new + old cases} \times 100}{\text{Total population}} )</td>
<td>N is a part of D; multiplier 100</td>
<td>Proportion</td>
</tr>
<tr>
<td>Case fatality rate (CFR)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relative risk (RR)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Types of epidemiological studies**

<table>
<thead>
<tr>
<th>Type of epidemiological study</th>
<th>Unit of study</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Observational studies</td>
<td></td>
</tr>
<tr>
<td>a. Descriptive studies (Hypothesis formulation)</td>
<td></td>
</tr>
<tr>
<td>b. Analytical studies (Hypothesis testing)</td>
<td></td>
</tr>
<tr>
<td>i. Cohort study</td>
<td>Individual</td>
</tr>
<tr>
<td>ii. Case control study</td>
<td>Individual</td>
</tr>
<tr>
<td>iii. Cross sectional study</td>
<td>Individual</td>
</tr>
<tr>
<td>iv. Ecological study</td>
<td>Population</td>
</tr>
<tr>
<td>2. Experimental studies (Hypothesis testing)</td>
<td></td>
</tr>
<tr>
<td>a. Randomized controlled trial</td>
<td>Patients</td>
</tr>
<tr>
<td>b. Field trial</td>
<td>Healthy people</td>
</tr>
<tr>
<td>c. Community trial</td>
<td>Community</td>
</tr>
</tbody>
</table>

**Synonyms of names of epidemiological studies:**

- **Cohort study**
  - Prospective study
  - Forward looking study
  - Cause to effect study
  - Risk factor to disease study
  - Exposure to outcome study
  - Follow-up study
  - Incidence study

- **Case control study**
  - Retrospective study
  - Backward looking study
  - Effect to cause study
  - Disease to risk factor study
  - Outcome to exposure study: TROHOC study

- **Cross sectional study**
  - Prevalence study
  - SNAPSHOT of population study

- **Ecological study**
  - Correlational study

**Most preferable observational/analytical study design:** Cohort study

**Preference of epidemiological studies for establishing causality:**

- 1st preference: Meta-analysis
- 2nd preference: Randomised controlled trials (RCTs): X
- 3rd preference: Cohort study
- 4th preference: Case control study
- 5th preference: Cross-sectional study
- 6th preference: Ecological study

**Useful Parameter(s) obtained by epidemiological studies:**
### Epidemiological studies

<table>
<thead>
<tr>
<th>Study Type</th>
<th>Useful Parameter(s) Obtained</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cohort study</td>
<td>Incidence, Relative risk, Attributable risk, Population attributable risk</td>
</tr>
<tr>
<td>Case control study</td>
<td>Odds ratio</td>
</tr>
<tr>
<td>Cross sectional study</td>
<td>Prevalence</td>
</tr>
<tr>
<td>Ecological study</td>
<td>Group characteristics</td>
</tr>
</tbody>
</table>

### Cohort studies versus Case control studies

<table>
<thead>
<tr>
<th></th>
<th>Cohort Studies</th>
<th>Case Control Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before start</td>
<td>Only exposure has occurred</td>
<td>-Both exposure as well as outcome have occurred</td>
</tr>
<tr>
<td>Synonyms</td>
<td>Prospective study ^ Forward looking study Cause to effect study Exposure to outcome study Risk factor to disease study Incidence study Follow up study</td>
<td>Retrospective study Backward looking study Effect to cause to study Outcome to exposure study Disease to risk factor study TROHOC study</td>
</tr>
<tr>
<td>Advantages</td>
<td>• Provides Incidence, Relative risk Allows study of several etiological factors simultaneously</td>
<td>Easy to carry out Inexpensive Rapid No risk to subjects Minimal ethical problems No loss to follow up (No Attrition) Particularly suitable to investigate rare diseases</td>
</tr>
<tr>
<td>Disadvantages</td>
<td>Ethical problems Loss to follow up (attrition) Time consuming Expensive Not suitable to investigate rare diseases</td>
<td>Selection of an appropriate control-group maybe difficult Cannot measure incidence Can only estimate Odds ratio</td>
</tr>
</tbody>
</table>

- **COHORT STUDY IS BETTER THAN A CASE CONTROL STUDY** (despite problems of ethics, attrition, expensive & time-consuming): As Relative risk (RR) is a better estimate of strength of association than Odds ratio (OR)

### Controls in a case control study

- Cases are diseased individuals, Controls are those free from the disease under study
- Controls must be similar to cases, as much as possible except for the absence of disease under study
- If the study group is small, choose up to 4 controls per case (4 controls: 1 case)
- **Sources of controls:** Hospital controls, Neighbourhood controls, Relatives, General population
- **Matching:** Is selection of controls so that they are similar to cases in various respects
  - Matching is done to 'eliminate known confounding'
  - Cases and controls are matched for every factor 'except risk factor under study'

### Strength of association

- **In a cohort study is evaluated by.** Relative risk (RR)
- **In a case control study is evaluated by.** Odds ratio (OR)
**Relative risk**

- Relative Risk (RISK RATIO) is used to estimate risk of disease (calculated as incidence of that disease) with exposure to a factor.
- Relative Risk (RR) = Incidence among exposed / Incidence among non-exposed

### Relative Risk

| RR > 1 | $I_{exp} > I_{nonexp}$ | So many times chances/. incidence of disease development is more among exposed as compared to non-exposed | Smoking | Lung Cancer |
| RR = 1 | $I_{exp} = I_{nonexp}$ | Chances/incidence of disease development is same among exposed as compared to non-exposed | Smoking | HIV/AIDS |
| RR < 1 | $I_{exp} < I_{nonexp}$ | Chances/incidence of disease development is less among exposed as compared to non-exposed | Vitamin-A intake | Epithelial cancers |

- Relative risk can ONLY be determined exactly from a Cohort Study,
- Case Control Study cannot provide with incidences, so Relative Risk cannot be calculated
  - In a Case Control Study, we calculate 'an estimate of Relative Risk', known as 'Odds Ratio' (CROSS PRODUCT RATIO)

**Odds Ratio**

- Odds ratio (OR): Ratio of odds that cases were exposed to a risk factor to the odds that the controls were exposed
  - Is used to 'measure strength of association in a case control study'
  - Is also known as 'Cross product ratio' or 'Relative odds'
  - Is an 'estimate of Relative risk (RR)', which is used to measure strength of association in a cohort study
  - 'RR is more accurate than OR as a measure of strength of association
  - OR calculation: CORRECT TABLE CONSTRUCTION in a case control study requires that table will have disease at the top (row) and history of exposure/ risk factor on the left (column)

<table>
<thead>
<tr>
<th>Disease</th>
<th>Present (cases)</th>
<th>Absent (Controls)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exposure present</td>
<td>a</td>
<td>V&quot; b</td>
</tr>
<tr>
<td>Exposure absent</td>
<td>' .. c .</td>
<td>&quot;   d</td>
</tr>
</tbody>
</table>

**Odds Ratio (Cross Product Ratio) = ad/bc**
### Odds ratio

<table>
<thead>
<tr>
<th>Odds ratio</th>
<th>INTERPRETATION</th>
<th>EXAMPLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>$OR &gt; 1$</td>
<td>So many times odds that cases were exposed to a risk factor is more to the odds that the controls were exposed (Positive Association)</td>
<td>OCPs</td>
</tr>
<tr>
<td>$OR = 1$</td>
<td>Odds that cases were exposed to a risk factor is same as the odds that the controls were exposed (No Association)</td>
<td>Smoking</td>
</tr>
<tr>
<td>$OR &lt; 1$</td>
<td>So many times odds that cases were exposed to a risk factor is less than the odds that the controls were exposed (Negative Association)</td>
<td>Regular physical activity</td>
</tr>
</tbody>
</table>

### Cross-sectional study
- Is based on the single examination of a cross-section of a population 'at one point of time', results of sample are then projected to whole population
- Is simplest form of observational epidemiological study
- Provides 'Prevalence of the disease' under study
- More useful for chronic diseases
- Cannot establish causality as 'does not establish time sequence'

### Ecological study (Correlational study)
- Type of analytical (observational) epidemiological study which provide the 'least satisfactory type of evidence on causality'
- **Units of study**: Population
- **Advantage**: Data can be used from populations with different characteristics
- **Ecological fallacy**: Is an error of interpretation of statistical data in an ecological study, whereby characteristics are ascribed to a group of individuals which they may not possess as individuals

### Randomisation in RCTs
- Randomization is superior to BOTH matching and blinding:

<table>
<thead>
<tr>
<th>Technique</th>
<th>Removes or minimizes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Matching</td>
<td>Known confounding factors</td>
</tr>
<tr>
<td>Blinding</td>
<td>BIAS</td>
</tr>
<tr>
<td>Single blinding</td>
<td>Subject bias</td>
</tr>
<tr>
<td>Double blinding</td>
<td>Subject bias + Investigator bias</td>
</tr>
<tr>
<td>Triple blinding</td>
<td>Subject bias + Investigator bias + Analyzer bias</td>
</tr>
<tr>
<td>Randomisation</td>
<td>Selection bias (Investigator bias)</td>
</tr>
<tr>
<td></td>
<td>Known confounding factors</td>
</tr>
<tr>
<td></td>
<td>Unknown confounding factors</td>
</tr>
</tbody>
</table>

### Pre-post clinical trial
- Does not have a true control group: Patient as his or her own control

### Hill's criteria of causal association (Surgeon General's Criteria)
- Temporal association:
<table>
<thead>
<tr>
<th>Type</th>
<th>Method</th>
<th>Minimizes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single blinding</td>
<td>Study subjects are not aware of the treatment they are receiving.</td>
<td>Subject bias</td>
</tr>
<tr>
<td>Double blinding</td>
<td>Study subjects as well as investigator are not aware of the treatment study subjects are receiving</td>
<td>Subject bias +Investigator bias</td>
</tr>
<tr>
<td>Triple blinding</td>
<td>Study subjects, investigator as well as analyzer are not aware of the treatment study subjects are receiving</td>
<td>Subject bias +Investigator bias + Analyzer bias</td>
</tr>
</tbody>
</table>

- **Randomization**: in Randomized Controlled trial (RCT) is a statistical procedure by which participants are allocated into either of two groups, viz., 'Experimental Group' (in which intervention is given) and 'Reference Group' (in which intervention is not given) to ensure
  1. Participants have 'Equal and Known Chance' of falling into either 'Experimental Group' or 'Reference Group'
  2. To eliminate Selection Bias
  3. To ensure comparability among two groups
  4. To have 'similar prognostic factors' among two groups

- **Matching**: Process of selecting controls in such a way that they are similar to cases (with regard to certain pertinent selected variables which may influence the outcome of disease, thereby distorting the results)
  1. Matching eliminates confounding: Matching distributes known confounding factors equally in two groups

**Confounding**
- Confounding: Any factor associated with both exposure and outcome, and has an independent effect in causation of outcome is a confounder
- Matching eliminates confounding: Matching distributes known confounding factors equally in two groups

**Incubation period**
- Incubation period: Is the time interval between invasion by an infectious agent and appearance of the first sign or symptom of the disease in question
- Generally communicable disease are not communicable in incubation period EXCEPT:
  - Measles
  - Chicken pox
  - Whooping cough (Pertussis)
  - Hepatitis A
- Incubation periods of few diseases:

<table>
<thead>
<tr>
<th>Disease</th>
<th>Causative organism</th>
<th>IP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small pox</td>
<td>Variola virus</td>
<td>7 - 17 days</td>
</tr>
<tr>
<td>Chicken pox</td>
<td>Human (alpha) herpes virus 3</td>
<td>14 - 16 days</td>
</tr>
<tr>
<td>Measles (Rubeolla)</td>
<td>RNA paramyxovirus</td>
<td>10 - 14 days</td>
</tr>
<tr>
<td>Rubella (German Measles)</td>
<td>RNA Togavirus</td>
<td>14-21 days</td>
</tr>
<tr>
<td>Mumps</td>
<td>RNA Myxovirus</td>
<td>14-21 days</td>
</tr>
<tr>
<td>Influenza</td>
<td>Orthomyxovirus</td>
<td>18-72 hours</td>
</tr>
<tr>
<td>Diphtheria</td>
<td>Corynebacterium diphtheriae</td>
<td>2 - 6 days</td>
</tr>
<tr>
<td>Disease</td>
<td>Type/Agent</td>
<td>Incubation Period</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-----------------------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>Swine flu</td>
<td>H1N1 Type A Influenza virus</td>
<td>2-7 days</td>
</tr>
<tr>
<td>Crimean Conge fever</td>
<td>Nairavirus-Bunyavirus</td>
<td>1-9 days</td>
</tr>
<tr>
<td>Tuberculosis *</td>
<td>Mycobacterium tuberculosis</td>
<td>Weeks - years</td>
</tr>
<tr>
<td>Poliomyelitis</td>
<td>Poliovirus</td>
<td>7-14 days</td>
</tr>
<tr>
<td>Hepatitis A</td>
<td>Enterovirus 72 (Picornavirus)</td>
<td>15—45 days</td>
</tr>
<tr>
<td>Hepatitis B</td>
<td>Hepadna virus</td>
<td>4.5 - 180 days</td>
</tr>
<tr>
<td>Hepatitis C</td>
<td>Hepacivirus</td>
<td>30 - 120 days</td>
</tr>
<tr>
<td>Hepatitis D</td>
<td>Deltavirus</td>
<td>21 - 45 days</td>
</tr>
<tr>
<td>Hepatitis E</td>
<td>Calcivirus</td>
<td>21 - 60 days</td>
</tr>
<tr>
<td>Cholera</td>
<td>Vibrio cholerae</td>
<td>1 - 2 days</td>
</tr>
<tr>
<td>Typhoid fever</td>
<td>Salmonella typhi</td>
<td>10 - 14 days</td>
</tr>
<tr>
<td>Staphylococcal food poisoning</td>
<td>Staphylococcus aureus</td>
<td>1 - 6 hours</td>
</tr>
<tr>
<td>Ascariasis</td>
<td>Ascaris lumbricoides</td>
<td>2 months</td>
</tr>
<tr>
<td>Dengue</td>
<td>Arbovirus</td>
<td>3 - 15 days</td>
</tr>
<tr>
<td>Malaria</td>
<td>Plasmodium vivax</td>
<td>8 - 17 days</td>
</tr>
<tr>
<td></td>
<td>Plasmodium falciparum</td>
<td>9 - 14 days</td>
</tr>
<tr>
<td></td>
<td>Plasmodium malariae</td>
<td>18 - 40 days</td>
</tr>
<tr>
<td></td>
<td>Plasmodium ovale</td>
<td>16 - 18 days</td>
</tr>
<tr>
<td>Rabies</td>
<td>Lyssavirus type 1 (Rhabdovirus)</td>
<td>3 - 8 weeks</td>
</tr>
<tr>
<td>Yellow fever</td>
<td>Flavivirus fibricus</td>
<td>2 - 6 days</td>
</tr>
<tr>
<td>Bubonic plague</td>
<td>Yersinia pestis</td>
<td>2 - 7 days</td>
</tr>
<tr>
<td>Pneumonic plague</td>
<td>Yersinia pestis</td>
<td>1 - 3 days</td>
</tr>
<tr>
<td>Septicemic plague</td>
<td>Yersinia pestis</td>
<td>2 - 7 days</td>
</tr>
<tr>
<td>Leishmaniasis (Kala azar)</td>
<td>L. donovani</td>
<td>1 - 4 months</td>
</tr>
<tr>
<td>Tetanus</td>
<td>Clostridium tetani</td>
<td>6 - 10 days</td>
</tr>
<tr>
<td>HIV/ AIDS</td>
<td>HIV/ HTLV - III/ LAV</td>
<td>Months - 10 years</td>
</tr>
<tr>
<td>YF</td>
<td>Flavivirus fibricus</td>
<td>2-6 days</td>
</tr>
</tbody>
</table>

- Median incubation period: Is the time required for 50% of cases to occur following exposure
- Latent period: Is the period from disease initiation to disease detection, used in non-infectious diseases as equivalent of incubation period
- Serial interval: Is the gap in onset between primary case (first case in the community) and secondary case (case developing through infection from the primary case)
  - By collecting information on series of secondary cases with serial intervals, one can guess the incubation period of a disease
- Generation time: is the time taken for a person from receipt of infection to develop maximum infectivity
  - Is roughly equal to the incubation period of the disease
- Period of communicability: is the time during which an infectious agent may be transferred directly/indirectly from an infected person to another person, from infected animal to man or from an infected person to animal, including arthropods
  - An important measure of communicability is secondary attack rate

**Framingham Heart Study**
- Is a classical example of cohort study
- Initiated in 1948 by US Public Health Service at Framingham, a town in Massachusetts, USA
- Aim: To study the relationship of risk factors (serum cholesterol, blood pressure, weight, smoking) to The subsequent development of cardiovascular diseases
- Age group: 30 - 62 years
Sample size: 5127 (4469 - 69% of the sample actually underwent first examination)

Method: Multiple exposure were studied, as well as complex interactions among the exposures using multivariate techniques

Follow-up:
- Study population was examined every 2 years for 20 years
- Daily surveillance of hospitalizations at only hospital in Framingham

Findings of study:
- Increasing risk of CHD with increasing age & more frequently in males
- Hypertensive have a greater risk of CHD
- Elevated blood cholesterol level is associated with CHD
- Tobacco smoking and habitual use of alcohol are associated with increased risk of CHD
- Increased physical activity is associated with decrease in CHD development
- Increase in body weight is associated predisposes to CHD
- Diabetes mellitus increases risk of CHD

Evaluation of Health Services
- Efficacy: Is the effect or usefulness of an agent/ drug/ vaccine under ideal 'controlled laboratory' conditions
- Effectiveness: Is the effect or usefulness of an agent/ drug/ vaccine in real life community situations
- Efficiency: Is the measure of relationship between the results achieved and the effort expended in terms of money, resources and time
  - Efficiency: Output/ Input
  - Evaluation of efficiency:
    1) Cost-benefit analysis: Both input as well as output is in monetary terms
    2) Cost-effectiveness analysis (CEA): Input is in monetary terms whereas output is in terms of 'results achieved'
      i) CEA is expressed as no. of attacks of a disease prevented, 'no. of lives saved', no of infections reduced

Steps for Investigation of an epidemic
- Verification of diagnosis
  - Is the first step in investigation of an epidemic
- Confirmation of existence of an epidemic:
  - Epidemic threshold: An arbitrary limit of '2 standard errors from the endemic occurrence'
- Defining the population at risk
- Rapid search for all cases and their characteristics: Medical survey, Epidemiological case sheet
  - Searching for more cases: Search for new cases is carried out everyday, till the area is declared free of epidemic; this period is usually taken as 'twice the incubation period of the disease since the occurrence of last case'
- Data analysis: Time (epidemic curve), Place (spot map), Person (age, sex, occupation and other risk factors)
- Formulation of hypothesis
- Testing of hypothesis
- Evaluation of ecological factors
- Further investigation of population at risk
- Writing the report

Key definitions
- Infectivity: Number infected/ Number exposed
- Pathogenicity: Number of diseased/ Number infected
- Virulence: Number of serious condition & mortality/ Number diseased
- Case fatality. Number of deaths/ Number of cases
- 'Serial Interval' is gap in onset between primary case (first case in the community) and secondary case (case developing through infection from the primary case)
- 'Generation Time' is time taken for a person from receipt of infection to develop maximum infectivity
- 'Communicable Period' is the time during which an infectious agent may be transferred directly/indirectly from an infected person to another person, from infected animal to man or from an infected person to animal, including arthropods
- 'Incubation Period' is the time interval between invasion by an infectious agent and appearance of the first sign or symptom of the disease in question
CHAPTER 4
VACCINES AND COLD CHAIN

Immunity

<table>
<thead>
<tr>
<th></th>
<th>Active Immunity</th>
<th>Passive Immunity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition</td>
<td>Immunity as a result of antibody production in the body. It depends on humoral and cellular responses of host.</td>
<td>The host body does not produce its own but depends on ready-made antibodies to be transferred to it.</td>
</tr>
<tr>
<td>Modes of acquiring</td>
<td>Following clinical infection,</td>
<td>Administering immunoglobulin/antiserum</td>
</tr>
<tr>
<td></td>
<td>Following subclinical/inapparent infection</td>
<td>Transplacental; transfer of antibodies</td>
</tr>
<tr>
<td></td>
<td>Following immunization with an antigen</td>
<td>Transfer of lymphocytes</td>
</tr>
</tbody>
</table>

Herd Immunity

- **Herd Immunity** is the level of resistance of a community or group of people to a particular disease.
  - It refers to group protection beyond what is afforded by the protection of immunized individuals.
  - It describes a type of immunity that occurs when the vaccination of a portion of the population (or herd) provides protection to un-vaccinated individuals.

- **Elements contributing to herd immunity are:**
  - Occurrence of clinical/subclinical infections in herd.
  - Immunization of herd.
  - Structure of herd (hosts, alternative animal hosts, insect vectors, environmental & social factors).

- It is 'neither possible nor necessary to achieve 100% herd immunity' to control a disease.

- Herd immunity may be determined by 'Serological Surveys'.

- Herd immunity does not protect the individual in the case of tetanus.

- **Herd Immunity Threshold:** Virologists have found that when a certain percentage of a population is vaccinated, the spread of the disease is effectively stopped. This critical percentage (HIT) depends on the disease and the vaccine.

<table>
<thead>
<tr>
<th>Disease</th>
<th>Herd immunity threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diphtheria</td>
<td>85%</td>
</tr>
<tr>
<td>Pertussis</td>
<td>92-94%</td>
</tr>
<tr>
<td>Measles</td>
<td>83-94%</td>
</tr>
<tr>
<td>Mumps</td>
<td>75-86%</td>
</tr>
<tr>
<td>Rubella</td>
<td>80-85%</td>
</tr>
<tr>
<td>Polio</td>
<td>80-86%</td>
</tr>
<tr>
<td>Small Pox</td>
<td>83-85%</td>
</tr>
</tbody>
</table>

Vaccines

- **Vaccine:** Is an immuno-biological substance designed to produce specific protection against a given disease.

Types of vaccines

- **Live 'attenuated' vaccines:**
  - Are prepared from repeated passage of organisms in tissue culture or chick embryos.
  - More potent immunizing agents than killed vaccines.
**Inactivated/Killed vaccines:**

- Organisms killed by heat or chemicals stimulate active immunity, when introduced in body
- Safe but less efficacious than live vaccines
- Usually administered by intramuscular or subcutaneous route

**Toxoids:**

- Toxins produced by organisms are detoxicated and used for vaccine preparation
- Highly efficacious and safe

**Cellular fractions:**

- Vaccines are prepared from extracted cellular fractions

**Combination (or Mixed) vaccines:**

- More than one kind of immunizing agents is used in vaccine

<table>
<thead>
<tr>
<th>Live 'attenuated' vaccines</th>
<th>Killed 'inactivated' vaccines</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCG</td>
<td>Pertussis</td>
</tr>
<tr>
<td>OPV (Sabin - Oral polio vaccine)</td>
<td>IPV (Salk - Inactivated polio vaccine)</td>
</tr>
<tr>
<td>Measles vaccine</td>
<td>Rabies vaccine</td>
</tr>
<tr>
<td>Mumps vaccine</td>
<td>Cholera vaccine</td>
</tr>
<tr>
<td>Rubella vaccine</td>
<td>Meningococcal vaccine</td>
</tr>
<tr>
<td>Yellow fever vaccine</td>
<td>Hepatitis B vaccine</td>
</tr>
<tr>
<td>Typhoral</td>
<td>Typhim - Vi vaccine</td>
</tr>
<tr>
<td>Live plague vaccine</td>
<td>Killed plague vaccine</td>
</tr>
<tr>
<td>LAIV (live attenuated influenza vaccine)</td>
<td>Killed influenza vaccine</td>
</tr>
<tr>
<td>Varicella vaccine</td>
<td>JE (Japanese encephalitis) vaccine</td>
</tr>
<tr>
<td>Epidemic typhus vaccine</td>
<td>KFD (Kyasanur forest disease) vaccine</td>
</tr>
</tbody>
</table>

**Toxoids**

- Diphtheria toxoid
- Tetanus toxoid

**Combination vaccines**

- DPT
dt
- DT
- MMR
- TAB
- DPTP

**Live attenuated vaccines**

- Are prepared from live attenuated organisms
  - Attenuation: Reduced pathogenicity/virulence BUT Maintained antigenicity/immunogenicity
- Immunization is generally achieved with a single dose (EXCEPT OPV)
- Should not be administered to immuno-deficient or immuno-suppressed persons
- 2 live vaccines can be administered simultaneously at different sites (or at an interval of 3 weeks)

**Specific contraindications of vaccines**

- Vaccines contraindicated in Pregnancy: All live vaccines EXCEPT Yellow fever vaccine and OPV
- Vaccines contraindicated in HIV:
  - Asymptomatic HIV: NONE
  - Symptomatic HIV: All live vaccines EXCEPT BCG vaccine and MMR
- Vaccines contraindicated in Immuno-suppression: All live vaccines
- Vaccines contraindicated in Corticosteroid therapy: All live vaccines
- Vaccines contraindicated in fever: Typhoidal vaccines

<table>
<thead>
<tr>
<th>Cellular fractions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meningococcal vaccine</td>
</tr>
<tr>
<td>Pneumococcal vaccine</td>
</tr>
<tr>
<td>Hepatitis B vaccine</td>
</tr>
</tbody>
</table>

**Varicella vaccine**

- JE (Japanese encephalitis) vaccine
- KFD (Kyasanur forest disease) vaccine
• Typhim - Vi
• TAB

- Vaccines contraindicated in ARTI/ diarrhoea: NONE
- Vaccines contraindicated together. Yellow fever and Cholera vaccine

**Vaccines contraindicated in age < 1 year (infants):**
- Yellow fever vaccine
- Meningococcal vaccine
- Pneumococcal vaccine

/ • Typhoid vaccines

- Vaccines contraindicated in age > 2 year (infants): Pertussis vaccine (may lead to neurological complications - 1 per 1,70,000 vaccines)
- Vaccines contraindicated in progressive neurological disease: Pertussis vaccine (Pertussis vaccine IS NOT CONTRAINDICATED IN epilepsy controlled on medications, Cerebral palsy)
- Only absolute contraindication to killed vaccines: Severe local or general reaction to a previous dose

**Specific side-effects of vaccines**
- Guillain Barre Syndrome: Killed influenza vaccine
- Vaccine associated paralysis: OPV (Sabin)
- Toxic shock syndrome (TSS): Measles vaccine, MMR
- Shock: Hep-B, DPT, Pertussis vaccine
- Hypersensitivity: Hep-B, Meningococcal vaccine, DPT, dT

**General rules for multiple vaccine administration**
- 2 live vaccines can be given together
- Live and killed vaccines can be given together
- Cholera vaccine and Yellow fever vaccine cannot be given together
- OPV is a live vaccine where single dose is not sufficient for immunization

**History of vaccination**
- Term 'Vaccine' was coined by: Louis Pasteur
- Term 'Vaccination' was coined by: Edward Jenner
- First vaccine to be developed: Small pox (1798)
- First vaccine was developed by: Edward Jenner
- Important milestones in vaccination:

<table>
<thead>
<tr>
<th>Year</th>
<th>Vaccine</th>
</tr>
</thead>
<tbody>
<tr>
<td>1798</td>
<td>Small pox vaccine</td>
</tr>
<tr>
<td>1885</td>
<td>Rabies vaccine</td>
</tr>
<tr>
<td>1892</td>
<td>Cholera vaccine</td>
</tr>
<tr>
<td>1921</td>
<td>BCG vaccine</td>
</tr>
<tr>
<td>1923</td>
<td>Diphtheria toxoid</td>
</tr>
<tr>
<td>1923</td>
<td>Pertussis vaccine</td>
</tr>
<tr>
<td>1927</td>
<td>Tetanus toxoid</td>
</tr>
<tr>
<td>1937</td>
<td>Influenza vaccine</td>
</tr>
<tr>
<td>1937</td>
<td>Yellow fever vaccine</td>
</tr>
<tr>
<td>1949</td>
<td>Mumps vaccine</td>
</tr>
<tr>
<td>1954</td>
<td>IPV</td>
</tr>
<tr>
<td>1957</td>
<td>OPV</td>
</tr>
<tr>
<td>1960</td>
<td>Measles vaccine</td>
</tr>
<tr>
<td>1962</td>
<td>Rubella vaccine</td>
</tr>
<tr>
<td>1968</td>
<td>Type C meningococcal vaccine</td>
</tr>
<tr>
<td>1971</td>
<td>Type A meningococcal vaccine</td>
</tr>
<tr>
<td>1976</td>
<td>Hepatitis B vaccine</td>
</tr>
</tbody>
</table>
Polyvalent vaccines: Vaccines prepared from two or more strains of same species

Autogenous vaccines: Organism in the vaccine is obtained from the same patient

Hepatitis B is a 'Subunit vaccine'

H. influenza B (HiB) vaccine is a 'Conjugate vaccine'

**BCG Vaccine**

- BCG stands for 'Bacille Calmette Guerin' - an 'avirulent strain' produced by 230 subcultures over a period of 13 years

- Type of vaccine: Live attenuated vaccine
  - Liquid (fresh) type vaccine
  - Freeze dried (lyophilized) vaccine: More stable; used currently

- **WHO recommended strain:** DANISH 1331 strain
  - Vaccine strain is derived from 'Mycobacterium bovis'
  - Prepared at BCG laboratory, Guindy, Chennai in India

- **BCG is a lyophilized (freeze-dried) vaccine:**
  - Is reconstituted with Normal Saline (NaCl) as diluent
  - Must be used within 1 hour of reconstitution

- **Dose:**
  - For newborns aged < 28 days: 0.05 ml
  - For infants aged > 28 days: 0.1 ml

- **Strength:** 0.1 mg in 0.1 ml

- **Route:** Intra-dermal
  - Tuberculin syringe (Omega microstat syringe, 26 gauge needle)

- **Site:** Skin over left deltoid muscle
  - Left deltoid muscle is chosen for BCG vaccination ONLY by convention

- **Age for vaccination:**
  - Direct BCG: Is administered up to 1 year of age, without Mantoux Test
  - Indirect BCG: Beyond age 1 year, it is recommended after, prior Mantoux Test

- **Phenomena after vaccination:**
  - After 2 - 3 weeks: Papule formation
  - 5 weeks: 4 - 8 mm diameter of papule
  - 6 - 8 weeks: Breaks into a shallow ulcer, seen covered with a crust
  - 6 - 12 weeks: Permanent tiny, round scar, typically 4 - 8 mm diameter
  - 8 - 14 weeks: Mantoux test becomes positive

- **Protective efficacy:**
  - For pulmonary tuberculosis: 0% (Zero)
  - For severe forms of tuberculosis: 0 - 80% (median 50%)
  - For Leprosy: 20 - 40%

- **Protective duration:** 20 years

- **Complications:**
  - Prolonged severe ulceration at site of vaccination
  - Suppurative lymphadenitis
  - Osteomyelitis
  - Disseminated BCG infection
  - Death

- **BCG is contraindicated in (Being a live vaccine):**
  - Pregnancy
  - Immunosuppressive states
  - During corticosteroid therapy
WHO recommended policy on BCG vaccination in HIV:
- Asymptomatic HIV positive infants in high endemic areas: BCG can be given
- Asymptomatic HIV positive infants in low endemic areas: BCG need not be given

DPT Vaccine
- Type: Combined TRIPLE vaccine for Diphtheria, Pertussis & Tetanus; D & T are Toxoids, P is killed acellular bacilli
- 0.5 ml
- Route: intramuscular
- Site: Anterolateral aspect of thigh, middle 1/3 (earlier it was administered at gluteal region, but presence of fat in buttocks breaks the adjuvant & reduces absorption of DPT vaccine)
- Composition of DPT Vaccine:

<table>
<thead>
<tr>
<th>Contents</th>
<th>Amount per dose (0.5 ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diphtheria Toxoid</td>
<td>25 Lf</td>
</tr>
<tr>
<td>Tetanus Toxoid</td>
<td>5 Lf</td>
</tr>
<tr>
<td>Pertussis killed acellular bacilli</td>
<td>20,000 million</td>
</tr>
<tr>
<td>Aluminium phosphate</td>
<td>2.5 mg</td>
</tr>
<tr>
<td>Thiomersal</td>
<td>0.01 %</td>
</tr>
</tbody>
</table>

- Aluminium phosphate or aluminium hydroxide is used as adjuvant in DPT vaccine: It increases immunogenicity of vaccine
- Thiomersal is used as preservative in DPT Vaccine
- Absolute Contraindications to DPT vaccine:
  - Severe hypersensitivity reaction to previous dose
  - Progressive neurological disease (E.g. active Epilepsy) [Cerebral palsy & seizures controlled on anti-epileptics do not preclude the use of DPT; DPT should be given under these circumstances]

<table>
<thead>
<tr>
<th>Disease</th>
<th>Vaccine status for DPT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active Epilepsy</td>
<td>Contraindicated</td>
</tr>
<tr>
<td>Epilepsy controlled on antiepileptic</td>
<td>Can be given</td>
</tr>
<tr>
<td>Cerebral Palsy</td>
<td>Can be given</td>
</tr>
</tbody>
</table>

- DPT vaccine (& Measles vaccine) can result in fever: Antipyretic is given with DPT vaccine as 'take home, need based' medication
- Cold Chain Temperature of DPT: +2° to +8° C
  - If DPT vaccine gets frozen accidentally: discard the vaccine

Vaccines for Poliomyelitis

<table>
<thead>
<tr>
<th></th>
<th>OPV (Sabin)</th>
<th>IPV (Salk)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of vaccine</td>
<td>Live attenuated virus</td>
<td>Killed formalised virus</td>
</tr>
<tr>
<td>Mode of administration</td>
<td>Oral</td>
<td>Subcutaneous or i.m.</td>
</tr>
<tr>
<td>Type of immunity</td>
<td>Humoral + Intestinal (local)</td>
<td>Humoral</td>
</tr>
<tr>
<td>Prevention of</td>
<td>Paralysis + intestinal re-infection</td>
<td>Paralysis ..</td>
</tr>
<tr>
<td>Control of epidemics</td>
<td>Effective</td>
<td>Not useful</td>
</tr>
<tr>
<td>Manufacture</td>
<td>Easy</td>
<td>Difficult</td>
</tr>
<tr>
<td>Cost</td>
<td>Cheaper</td>
<td>Expensive</td>
</tr>
<tr>
<td>Storage &amp; transport</td>
<td>Require sub-zero temperatures</td>
<td>Less stringent conditions</td>
</tr>
<tr>
<td>Shelf life</td>
<td>Short</td>
<td>Longer</td>
</tr>
<tr>
<td>VAPP</td>
<td>1 per 1 million vaccinees</td>
<td>Zero incidence</td>
</tr>
</tbody>
</table>
o **Inactivated (Salk) Polio Vaccine (IPV):**
  - Is a type of killed vaccine
    * **Schedule:** First 3 doses at 1-2 month interval each and 4th dose after 6-12 months of last dose
    - Induces Humoral immunity (IgM, IgG, IgA); NO LOCAL IMMUNITY
  - **Composition of IPV:**
    |
    | **Components** | **Strength** |
    |----------------|--------------|
    | Polio virus type 1 | 20 D antigen units |
    | Polio virus type 2 | 2 D antigen units |
    | Polio virus type 3 | 4 D antigen units |

- **Advantages of IPV:**
  1) Safe in immunodeficiency disorders
  2) Safe in persons on radiation therapy/ corticosteroid therapy
  3) Useful in those over 50 years age
  4) Safe during pregnancy.
  5) No risk of Vaccine associated paralytic polio (VAPP)

* **IPV is unsuitable in epidemics:**
  1) Immunity is not rapidly achieved as > 1 doses required
  2) Injections can precipitate paralysis during epidemics

o **Oral (Sabin) Polio Vaccine (OPV):**
  - Is a live attenuated 'trivalent' vaccine: Contains 3 strains of polio virus
  - **Mechanism of action:**
    1) **Primary multiplication:** Intestinal epithelial cells
    2) **SECONDARY MULTIPLICATION:** Peyer's patches (leads to viraemia)
  - Induces 'both systemic as well as local immunity' (Nasal & duodenal IgA, Serum IgM, IgQ IgA)
  - **Composition of OPV:**
    |
    | **Components** | **Strength** |
    |----------------|--------------|
    | Polio virus type 1 | 3 lac TCID 50 |
    | Polio virus type 2 | 1 lac TCID 50 |
    | Polio virus type 3 | 3 lac TCID 50 |

- **Dose:** 2 drops (EQUIVALENT TO 0.1 ml)
- **Advantages of OPV:**
  1) Easy to administer
  2) Induces both humoral and systemic immunity
  3) Single dose also produces substantial immunity
  4) Vaccinees spread immunity to others by excretion of virus
  5) Relatively inexpensive
  6) Useful in controlling epidemics
- **Complication:** Can lead to Vaccine associated paralytic poliomyelitis (VAPP) - 1 case per 1 million vaccines
- **OPV is quite a thermolabile vaccine**
- **OPV should not be repeatedly freezeed and thawed**
  * **Cold chain temperature:** +2° to +8° C
- **During transportation, OPV should be kept on:**
  1) Dry ice (solidified carbon dioxide)
  2) A freezing mixture (wet ice + ammonium chloride)
• Heat-stabilized OPV vaccine: Can be kept without losing potency for 1 year at 4° C and for a month at room temperature

Vaccine Vial Monitor (VVM)
- WM is a marker of potency: WM is a simple tool which enables vaccinator to know if vaccine is potent at the time of administration
  - WM is a label containing a heat-sensitive material which is placed on a vaccine vial to register cumulative heat exposure over time
- VVM indicates efficiency of cold chain (temperature maintenance)
- WM is a mark on OPV vial consisting of (NOW WM is marked on most, of the vaccines)
  - An outer circle
  - An inner square (made of heat sensitive material)
- WHO grading of WM in OPV:
  - Is based on colour changes in WM: ONLY INNER SQUARE CHANGES COLOUR, circle always remain blue

<table>
<thead>
<tr>
<th>WHO Grade</th>
<th>Outer Circle</th>
<th>Inner Square</th>
<th>Inference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade I</td>
<td>Blue</td>
<td>White</td>
<td>OPV can be used</td>
</tr>
<tr>
<td>Grade II</td>
<td>Blue</td>
<td>Light blue</td>
<td>OPV can be used</td>
</tr>
<tr>
<td>Grade III</td>
<td>Blue</td>
<td>Blue</td>
<td>OPV CANNOT be used</td>
</tr>
<tr>
<td>Grade IV</td>
<td>Blue</td>
<td>Purple/ Black</td>
<td>OPV CANNOT be used</td>
</tr>
</tbody>
</table>

- Rules for WM use in India:
  - Rule 1: If the inner square is lighter than the outer circle, the vaccine may be used
  - Rule 2: If the inner square is the same colour as, or darker than, the outer circle, the vaccine must not be used

Measles vaccine
- Type: Live attenuated, lyophilized (Freeze dried) vaccine (Tissue culture vaccines - Chick embryo or Human diploid cell line)
- Strains used:
  - Edmonston Zagreb Strain (Most Common)
  - Schwartz Strain
  - Moraten Strain
- Dose: 0.5 ml
- Route: Subcutaneous
- Site: Antero-lateral aspect of thigh (middle one-third)
- Age of administration in National Immunization schedule (India): 9 months (can be lowered to 6-9 months in epidemics & malnutrition)
- Diluent for Reconstitution: Distilled Water or sterile water
  - Use within 1 hr after reconstitution with diluent
- Measles (& MMR) vaccine can lead to Toxic Shock Syndrome
- Measles vaccine is contraindicated in pregnancy
- Cold chain Temperature for storage: +2 to +8 degree C
- Protective efficacy: > 95% (with one dose)
- Duration of Protection: Life long
- IP of vaccine induced measles: 7 days
- Ideal gap between 2 successive doses of Measles vaccine: 6 months
Tetanus toxoid in pregnancy

- **TT in Pregnancy.** Two doses of Tetanus Toxoid (TT, and TT₂) are given, one month apart, preferably at 4th and 5th months of pregnancy. If second pregnancy occurs to a completely immunized woman (2 doses of TT one month apart) within next/subsequent 5 years, ONLY ONE BOOSTER TT DOSE is sufficient/administered 4th month onwards.

  - Infants born to unimmunized mothers (those who have not received 2 doses of TT) should be administered 750 IU Heterologous Serum within 6 hours of birth.

- Guidelines on TT in pregnancy:
  - **Primigravida:** 2 doses 1 month apart, after 1 trimester
  - **DURATION OF PROTECTION WITH 2 DOSES:** ALL SUBSEQUENT PREGNANCIES IN NEXT 5 YEARS
  - **Multigravida (completely immunized in last 5 years):** 1 booster dose is sufficient
  - **Multigravida (partially immunized in previous pregnancy in last 5 years):** 2 doses, 1 month apart, after 1 trimester
  - **Multigravida (unimmunized in previous pregnancy in last 5 years):** 2 doses, 1 month apart, after 1 trimester
  - **RULE OF THUMB FOR TT in pregnancy (as per Period of gestation - POG):** Give 2 doses of TT, 1 month apart, anytime after 1st trimester of pregnancy, IRRESPECTIVE OF TIME OF DELIVERY (so as to provide protection for atleast next 5 years)

<table>
<thead>
<tr>
<th>Situations (pregnant female reporting for the 1st time at)</th>
<th>Recommendation</th>
<th>Status of patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>4’th month POG</td>
<td>2 doses; 1 each at 4½m &amp; 5 ½2 m POG</td>
<td>Completely immunized for current pregnancy; subsequent protection for next 5 years</td>
</tr>
<tr>
<td>5’th month POG</td>
<td>2 doses; 1 each at 5th m &amp; 6th m POG</td>
<td>Completely immunized for current pregnancy; subsequent protection for next 5 years</td>
</tr>
<tr>
<td>6’th month POG</td>
<td>2 doses; 1 each at 6th m &amp; 7th m POG</td>
<td>Completely immunized for current pregnancy; subsequent protection for next 5 years</td>
</tr>
<tr>
<td>7’th month POG</td>
<td>2 doses; 1 each at 7th m &amp; 8th m POG</td>
<td>Completely immunized for current pregnancy; subsequent protection for next 5 years</td>
</tr>
<tr>
<td>8’th month POG</td>
<td>2 doses; 1 each at 8th m &amp; 9th m POG</td>
<td>Partially immunized for current pregnancy; subsequent protection for next 5 years</td>
</tr>
<tr>
<td>9’th month POG</td>
<td>2 doses; 1 each at 9th m POG &amp; 1 m after (post-delivery)</td>
<td>Partially immunized for current pregnancy; subsequent protection for next 5 years</td>
</tr>
<tr>
<td>Just before delivery</td>
<td>2 doses; 1 each at just before delivery &amp; 1 m after (post-delivery)</td>
<td>Unimmunized for current pregnancy; subsequent protection for next 5 years</td>
</tr>
<tr>
<td>Post delivery</td>
<td>2 doses; 1 each at just after delivery &amp; 1 m later (post-delivery)</td>
<td>Unimmunized for current pregnancy; subsequent protection for next 5 years</td>
</tr>
</tbody>
</table>

H1N1 (Swine flu) Vaccine:

- **H1NI Inactivated vaccine:** Single i/m injection
  - **Strain:** A/California/7/2009 (H1N1) V like strain
• Storage temperature: H-2° to +8° C

... Contraindications: History of anaphylaxis/severe reaction/Guillain Barre Syndrome, Infants <6 months, Moderate-to-severe illness with fever

• Protective immunity: Develops after 14' days. (NOT 100%)

O HIN1 Live attenuated vaccine: Nasal spray

• Side effects: Rhinorrhea, nasal congestion, cough, sore throat, fever, wheezing, vomiting

O Priority groups (in order) for Influenza vaccines:

• Pregnant women
• Age > 6 months with chronic medical conditions
• 15-49 years healthy young adults
• Healthy young children
• Healthy adults 49-65 years
• Healthy adults >65 years

Status of Vaccine during pregnancy

O Vaccines contraindicated in Pregnancy: ALL LIVE VACCINES (barring Yellow fever Vaccine) and MENINGOCOCCAL VACCINE

• BCG
• OPV
• Yellow fever
• Measles vaccine
• MMR (Measles, Mumps & Rubella)
• Oral Typhoid (Ty 21a)
• Varicella
• Live Plague vaccine
• LAIV (Live attenuated Influenza viral vaccine)
• Varicella vaccine
• Meningococcal Vaccine

• Live vaccines are usually not given in pregnancy' due to the potential risk of causing the disease in the fetus: Vaccination of pregnant women with inactivated/killed vaccines has not been shown to cause an increase risk to the fetus.

However, when the likelihood of disease exposure is high or when infection would pose a risk to the mother or fetus, then vaccination with a live vaccine is generally recommended in exceptional cases (especially with OPV and Yellow Fever vaccines)

What if a live vaccine is accidentally given during pregnancy? Does this mean that the pregnancy should be terminated? No. This alone would not be considered a medical reason to end a pregnancy because the chance of the fetus being infected is generally very low: Counseling by a knowledgeable healthcare provider would be recommended,

O Rubella vaccine during pregnancy:

• Women are advised not to receive the rubella vaccine during pregnancy as a safety precaution based on the theoretical possibility of a live vaccine causing disease, in this case 'Congenital Rubella Syndrome' (CRS)

• A female who has been administered Rubella vaccine should not get pregnant for next 8 weeks

• Priority groups for Rubella vaccination in India:
  1) 1st priority group: 15-49 years reproductive age group females
  2) 2nd priority group: 1-14 years aged children
  3) 3rd priority group: 0-1 year aged infants
National Immunization Schedule (NIS - Government of India) (NEW MODIFIED IN 2010-11)

<table>
<thead>
<tr>
<th>Age</th>
<th>Vaccines Given</th>
</tr>
</thead>
<tbody>
<tr>
<td>At birth</td>
<td>BCG, OPVO, HepB</td>
</tr>
<tr>
<td>At 06 weeks (1/2 months)</td>
<td>DPT1, OPV1, HepB1</td>
</tr>
<tr>
<td>At 10 weeks (2/3 months)</td>
<td>DPT2, OPV2, HepB2</td>
</tr>
<tr>
<td>At 14 weeks (3/4 months)</td>
<td>DPT3, OPV3, HepB3</td>
</tr>
<tr>
<td>At 9 months (completed)</td>
<td>Measles, Vitamin-A (1 Lac IU)</td>
</tr>
<tr>
<td>16-24 months</td>
<td>Vitamin-A (2 Lac IU) every 6 months till age of 5 years</td>
</tr>
<tr>
<td>At 5-6 years</td>
<td>DT</td>
</tr>
<tr>
<td>At 10 years</td>
<td>TT</td>
</tr>
<tr>
<td>At 16 years</td>
<td>TT</td>
</tr>
<tr>
<td>For pregnant women</td>
<td>TT1 and TT2 (one month apart)</td>
</tr>
</tbody>
</table>

In Delhi’s Immunization Schedule, there are 2 additional vaccines:
- MMR (single dose at 15 months of age)
- Typhim-Vi (single dose at 2-5 years of age)

**Delayed Immunization**

**Age limits for delayed immunization in NIS India:**

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Age limit</th>
<th>Reason for limit (if any)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCG</td>
<td>Upto 1 year of age (Direct BCG)</td>
<td>Subclinical immunity develops after 1 yr age</td>
</tr>
<tr>
<td>OPV</td>
<td>Upto 5 years of age</td>
<td>Polio cases are MC in &lt; 5 yrs age</td>
</tr>
<tr>
<td>DPT</td>
<td>Upto 2 years of age</td>
<td>Pertussis cause neuro-complications &gt;2 yr</td>
</tr>
<tr>
<td>HepB</td>
<td>Upto 1 year of age</td>
<td></td>
</tr>
<tr>
<td>Measles</td>
<td>Upto 5 year of age</td>
<td>Measles cases MC in &lt; 5 yrs age</td>
</tr>
<tr>
<td>Vitamin A</td>
<td>Upto 5 year of age*</td>
<td>Xerophthalmia cases MC in &lt; 5 yrs age</td>
</tr>
<tr>
<td>DT</td>
<td>Upto 7 year of age</td>
<td>Diphtheria cases MC in &lt; 7 yrs age</td>
</tr>
<tr>
<td>TT</td>
<td>NO AGE LIMIT</td>
<td></td>
</tr>
</tbody>
</table>

(* Vitamin A was earlier given till the age of 3 years)

- Vaccines to be given in situations of delayed immunizations in India:
  - 9 month old unimmunized child comes for immunization first time:
    1) BCG (Direct)
    2) OPV, (3 successive doses 1 month apart, booster after 1 year of 3rd dose)
    3) DPT, (3 successive doses 1 month apart, booster after 1 year of 3rd dose)
    4) HepB, (3 successive doses 1 month apart)
   5) ‘Measles ‘
    6) Vitamin A (A Lac IU)
  - 1 ‘A yr old unimmunized child comes for immunization first time:
    1) BCG (Indirect)
    2) OPV, (3 successive doses 1 month apart, booster after 1 year of 3rd dose)
3) DPT, (3 successive doses 1 month apart, booster after 1 year of 3rd dose)
4) Measles
5) Vitamin A (2 Lac IU)

- 3/4 yr old unimmunized child comes for immunization first time:
  2) BCG (Indirect)
  3) OPV, (3 successive doses 1 month apart, booster after 1 year of 3rd dose)
  4) DT, (3 successive doses 1 month apart, booster after 1 year of 3rd dose)
  5) Measles
  6) Vitamin A (2 Lac IU)

**Important Practical Considerations in immunization**

- **Vitamin-A**: is given at 9th, 18th, 24th, 30th, 36th, 42nd, 48th, 54th and 60th months (A total of 1 Lac + 2 Lac + 2 Lac + 2 Lac + 2 Lac + 2 Lac + 2 Lac + 2 Lac = 17 Lac IU is given to a completely immunized child by 5 years of age)
- **OPV**: Minimum 5 doses are required for development of immunity
- **DPT**: Minimum 3 doses are given a month apart with booster after 1 year of 3rd dose
- **TT**: A fully immunized adult (excluding pregnancy in females) would have received 7 doses of Tt

**Immunoglobulins**

- **Types of immunoglobulins**:
  - IgG: comprises 85% of total serum immunoglobulins, largely extravascular, 'only class of immunoglobulins to cross placenta'
  - IgM: comprises 10% of total serum immunoglobulins, 'indicative of recent infection', has high agglutinating and complement-fixating ability
  - IgA: comprises 15% of total serum immunoglobulins, predominantly found in secretions, 'primary defence mechanism at mucous membranes'
  - IgD: exact function not known
  - IgE: concentrated in submucous tissues, 'responsible for immediate allergic anaphylaxis reaction'

- **Preparations of immunoglobulins**:

<table>
<thead>
<tr>
<th>Source</th>
<th>Human normal Ig's</th>
<th>Human specific Ig's</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Antibody-rich fraction obtained from a pool of &gt; 1000 donors</td>
<td>Plasma of recovered patients or immunized individuals</td>
</tr>
</tbody>
</table>

| Composition | > 90% IgG; less IgA | 5 times antibody potential of standard preparation |

<table>
<thead>
<tr>
<th>Examples</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hepatitis A</td>
<td>Hepatitis B</td>
</tr>
<tr>
<td></td>
<td>Measles</td>
<td>Varicella</td>
</tr>
<tr>
<td></td>
<td>Mumps</td>
<td>Diphtheria</td>
</tr>
<tr>
<td></td>
<td>Rabies</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tetanus</td>
<td></td>
</tr>
</tbody>
</table>

**Cold Chain**

- **Cold chain**: Is a system of storage and transportation of vaccines from the point of manufacture to the point of administration (actual vaccination site)

- **Cold chain temperature of vaccines available in India**:
  - **Yellow fever vaccine**: -30°C to +5°C
  - **All other vaccines**: +2°C to +8°C (Also known as the 'cold chain temperature of vaccines in India')
  - **Diluents**: Can be stored in +2°C to +8°C OR can be kept outside cold chain (at room temperature)
  - **Vitamin A**: Is stored outside cold chain (at room temperature)

**Cold chain components (equipments) and levels in India**:
<table>
<thead>
<tr>
<th>Level</th>
<th>Component</th>
<th>Temperature</th>
<th>Storage duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>State/ Regional, level</td>
<td>Walk-in-cold rooms (WIC)</td>
<td>+2°C to +8°C</td>
<td>3 months</td>
</tr>
<tr>
<td></td>
<td>Walk-in-freezers (WIF)</td>
<td>-20°C to -40°C</td>
<td></td>
</tr>
<tr>
<td>District level</td>
<td>Large ILRs (Ice-lined refrigerator)</td>
<td>+2°C to +8°C</td>
<td>1 month</td>
</tr>
<tr>
<td></td>
<td>Large DFs (Deep freezers)</td>
<td>-20°C to -40°C</td>
<td></td>
</tr>
<tr>
<td>PHC level</td>
<td>Small ILRs</td>
<td>+2°C to +8°C</td>
<td>1 month</td>
</tr>
<tr>
<td></td>
<td>Small DFs</td>
<td>-20°C to -40°C</td>
<td></td>
</tr>
<tr>
<td>Sub-centre level</td>
<td>Vaccine carriers</td>
<td>+2°C to +8°C</td>
<td>48 - 72 hours</td>
</tr>
<tr>
<td></td>
<td>Day carriers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Session level</td>
<td>Fully frozen icepack</td>
<td>+2°C to +8°C</td>
<td>1 - 3 hours</td>
</tr>
</tbody>
</table>

- Most important component of cold chain in India: ILR
- Temperature of cold chain in India: +2°C to +8°C
- Minimum level of vaccine storage (in cold chain) in India: Primary health centre (below PHC level, vaccines are 'transported to sub-centres on immunization days' in vaccine carriers and day carriers)
- Maximum chance of cold chain failure in India: Sub-centre and village level
- Instrument used to monitor the temperature of cold chain at PHC: Dial Thermometer
- Ice-lined refrigerator (ILR):
  - Is 'most important component of cold chain' in India
  - Temperature of ILR (Cold chain) in India: +2°C to +8°C
  - Temperature monitoring of ILR: Dial thermometer (Twice daily)
  - ILR is used for storage of: All vaccines (Yellow fever vaccine is not apart of National immunization schedule of India, hence not stored in ILR)
  - 300/240 litres ILRs are supplied to districts and 140 litres ILR is supplied to PHCs
  - ILRs must be kept on a horizontal leveled surface, at least 10 cms away from walls
  - ILRs can maintain temperature of vaccines if provided 'with even 8 hours of uninterrupted electricity per day'
- Ice-pack:
  - Is prepared by keeping in a Deep freezer
  - Is used for:
    1) Temperature maintenance during vaccine transportation, in a vaccine carrier
    2) Temperature maintenance during an immunization session
  - Is of total 320 - 340 ml capacity
  - Has a 'horizontal mark' - water fill level (as water expands on freezing)
  - NOTHING* should be added to water for freezing in an ice-pack
  - Has generally 2 holes V MEANT FOR keeping vaccines
- OPV is only vaccine in National immunization schedule (NIS) of India which may be stored at a sub-zero temperature (-20°C to -40°C) thus it is also known as 'Urban vaccine'
- Reverse Cold Chain: Is the term used for transportation of stools samples from a suspected polio case for diagnosis (National Polio Elimination Programme)
  - Temperature of Reverse Cold Chain: +2°C to +8°C
  - Specific red vaccine carrier is used in reverse cold chain
- Warm chain: Keeping a preterm, pre-mature newborn against the body to mother to prevent neonatal hypothermia (NNH) - 'Kangaroo Mother Care'

Dial thermometer
- Is the instrument used to monitor the temperature of cold chain at PHC
- Is kept in ILR (Ice-lined refrigerator- component of cold chain) at PHC
- Is 'based on principle of thermocouple'
- Recommended temperature monitoring at PHC level is: Twice daily
CHAPTER 5
DISINFECTION

Physical agents for disinfection

- **Sunlight:**
  - Primary action is due to UV rays

- **Drying:**
  - Spores are unaffected by drying

- **Heat:**
  - 'Most reliable method of sterilization'
  - 'Method of choice', unless contraindicated

- **Dry heat:** [Efficiency test: Spores of Clostridium tetani]
  - Flaming: Useful for inoculating loops or wires, points of forceps and searing spatulas
  - Incineration: Useful for soiled dressings, animal carcasses, bedding and pathological materials
  - Hot air oven:
    1. Holding period of 160° C X 1 hour
    2. Used for forceps, glassware, scissors, scalpels, glass-syringes, swabs and few pharmaceutical products (liquid paraffin, fats, grease)

- **Moist heat:**
  - Temp below 100° C: Pasteurization of milk at 63° C X 30 min (Holder Method) or at 72° C X 15 seconds (Flash Method)
  - Temp at 100° C: (Boiling)
    1. Not recommended for instruments used in surgical procedures

- **Steam under pressure (autoclaving):** [Efficiency test: Spores of Bacillus stearothermophilus]
  - Used for dressings, instruments, laboratory-ware, media, and pharmaceutical products

- **Filtration:**
  - Useful for antibiotics solutions, sera, carbohydrate solutions

- **Radiation:**
  - Non-ionizing radiation
  - Ionizing Radiation (Cold Sterilization)
    1. Gamma-radiation is used for plastics, syringes, swabs, culture plates, catheter, feeds, rubber, oils, greases, metal foils

- **Ultrasonic and sonic vibration**

Chemical agents for disinfection

<table>
<thead>
<tr>
<th>Phenol &amp; related compounds</th>
<th>Quaternary ammonia compounds</th>
<th>Halogens &amp; related compounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>J°henol</td>
<td>Cetrimide</td>
<td>Bleaching powder</td>
</tr>
<tr>
<td>Crude phenol</td>
<td>Savion</td>
<td>Sodium hypochlorite</td>
</tr>
<tr>
<td>Cresol</td>
<td></td>
<td>Halozone tablets</td>
</tr>
<tr>
<td>Cresol emulsions</td>
<td></td>
<td>Iodine</td>
</tr>
<tr>
<td>Chlorhexidine (Hibitane)</td>
<td></td>
<td>Iodophors</td>
</tr>
<tr>
<td>Hexachlorphane</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dettol</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alcohols</td>
<td>Formaldehyde</td>
<td>Miscellaneous</td>
</tr>
<tr>
<td>Ethyl alcohol</td>
<td>Formalin</td>
<td>Lime</td>
</tr>
<tr>
<td>Isopropyl alcohol</td>
<td>Formaldehyde gas</td>
<td>Ethylene oxide</td>
</tr>
</tbody>
</table>
Glutaraldehyde:
- Useful for cystoscopes, bronchoscopes, rubber tubes, face-masks, endotracheal tubes

Ethylene oxide:
- Used for heart-lung machines, sutures, books, equipments, dental equipments

Formaldehyde:
- Used for fumigation of OTs and other rooms

Beta-propionolactone:
- Used for biological products

Disinfectants recommended:

<table>
<thead>
<tr>
<th>For</th>
<th>Disinfectants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rooms</td>
<td>Formaldehyde</td>
</tr>
<tr>
<td>Lippes loop</td>
<td>1/2500 aqueous solution of Iodine; Normal strength savlon</td>
</tr>
<tr>
<td>Handlotions</td>
<td>Hibitane (Chlorhexidine)</td>
</tr>
<tr>
<td>Infant feeding bottles</td>
<td>Sodium hypochlorite (100 — 200 ppm of available Cl₂)</td>
</tr>
<tr>
<td>Sputum</td>
<td>Burning</td>
</tr>
</tbody>
</table>

- Pure phenol is not an effective disinfectant.
  - *Crude phenol*: Phenol - b Cresol

- Cresol emulsions are very powerful disinfectants:
  - Lysol (50 - 60% cresol)
  - *izai*
  - Cyllin

- *Dettol (Chlorxylenol)*: Suitable for instruments and plastic, equipments

- *Savlon*: Cetavlon (Cetrimide) Hibitane (Chlorhexidine)

- *Betadine*: povidoneiodine

- Bleaching powder (*CaOCl₂*):
  - BP contains *33% available chlorine*
  - *Stabilised bleach*: Mixing with lime, to stabilize bleaching powder
  - *Amount of BP required to disinfect. 1000 litres of water. 2.5 grams*

- *Most effective skin antiseptics*: Alcoholic solutions of Chlorhexidine (Hibitane) & Iodine

- *Cresol is known as All purpose general disinfectant*'

- *Cheapest disinfectant*: Lime

Rideal Walker Coefficient (RWC)
- Also known as 'Carbolic acid coefficient'
- Is used to 'represent germicidal power: of a disinfectant'.
- *Standard used for comparison*: Phenol (RWC - 1)
  - *RWC = 10 implies*. Given disinfectant is 10 times more potent than phenol (standard)

- *Organism used for testing*: Salmonella typhi

- *In presence of organic matter, RWC is ineffective*. Chic Martin test is employed
  - Organism used for testing: 1. Salmonella typhi; 2. Staphylococcus aureus
CHAPTER 6
SCREENING OF DISEASE

Screening of disease

- Screening test: Is used to search for an unrecognized diseases or defect, in apparently healthy individuals, by means of rapidly applied tests, examinations or other procedures

- Types of screening:

<table>
<thead>
<tr>
<th>Prescriptive screening</th>
<th>Prospective screening</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Definition</strong></td>
<td>People screened for own's benefit</td>
</tr>
<tr>
<td><strong>Essential purpose</strong></td>
<td>Case detection</td>
</tr>
<tr>
<td><strong>Example(s)</strong></td>
<td>Neonatal screening</td>
</tr>
<tr>
<td></td>
<td>Pap smear</td>
</tr>
<tr>
<td></td>
<td>Urine for sugar</td>
</tr>
</tbody>
</table>

- Screening versus Diagnosis:

<table>
<thead>
<tr>
<th>Screening</th>
<th>Diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Done on</strong></td>
<td>Apparently healthy</td>
</tr>
<tr>
<td><strong>Applied on</strong></td>
<td>Groups, populations</td>
</tr>
<tr>
<td><strong>Based on</strong></td>
<td>One criterion (cut-off)</td>
</tr>
<tr>
<td><strong>Cost</strong></td>
<td>Relatively cheaper</td>
</tr>
<tr>
<td><strong>Time taken</strong></td>
<td>Relatively rapid</td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>Relatively inaccurate</td>
</tr>
<tr>
<td><strong>Basis for treatment</strong></td>
<td>Cannot be used as basis</td>
</tr>
</tbody>
</table>

- Examples of important screening tests used:

<table>
<thead>
<tr>
<th>Screening Test(s)</th>
<th>Disease screened</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pap an icolau (Pap) smear test</td>
<td>Cervical cancer</td>
</tr>
<tr>
<td>Breast self examination (BSE)</td>
<td>Breast cancer</td>
</tr>
<tr>
<td>Mammography</td>
<td>Breast cancer</td>
</tr>
<tr>
<td>Bimanual oral examination</td>
<td>Oral cancer</td>
</tr>
<tr>
<td>ELISA, RAPID, SIMPLE</td>
<td>HIV (National AIDS Control Programme)</td>
</tr>
<tr>
<td>Urine for Sugar, Random blood sugar</td>
<td>Diabetes mellitus</td>
</tr>
<tr>
<td>AFP (alpha fetoprotein)</td>
<td>Developmental anomalies in fetus</td>
</tr>
<tr>
<td>Digital rectal examination (PRE)</td>
<td>Prostate cancer</td>
</tr>
<tr>
<td>Prostate specific antigen (PSA)</td>
<td>Prostate cancer</td>
</tr>
<tr>
<td>Fecal occult blood test</td>
<td>Colorectal cancer</td>
</tr>
</tbody>
</table>

Principles of Screening (WHO): SUITABILITY OF A DISEASE FOR SCREENING (CRITERIA)

- The disease should be an important health problem
- There should be an effective treatment available for the disease
- Facilities for diagnosis and treatment should be available
• There should be a latent or early asymptomatic stage of the disease
• There should be a test or examination for the diagnosis of disease
• The test should be acceptable to the population
• The natural history of the disease should be adequately understood
• There should be an agreed policy on who to treat
• The total cost of finding a case should be economically balanced in relation to medical expenditure as a whole
• ‘Case-finding should be a continuous process, not just a ‘once and for all’ project

Lead time in Screening

• Lead time is the advantage gained by screening (leading the time of diagnosis): Early detection of disease will ensure earlier institution of treatment, thus better prognosis

Properties of a screening test

Results of a screening test: RULES FOR CONSTRUCTION OF 2X2 TABLE:

<table>
<thead>
<tr>
<th>Results of a screening test for a disease</th>
<th>Disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>a (TP)</td>
</tr>
<tr>
<td>Negative</td>
<td>c (FN)</td>
</tr>
</tbody>
</table>

• 'a' are known as True positive (TP): Population having the disease and showing screening test results as positive
• 'd' are known as True negative (TN): Population not having the disease and showing screening test results as negative
• 'b' are known as False positive (FP): Population not having the disease but erroneously showing screening test results as positive
• 'c' are known as False negative (FN): Population having the disease but erroneously showing screening test results as negative

1) Total population having the disease, i.e. cases: 'a + c' (True positive + False negative)
2) Total population not having the disease, i.e. healthy: 'b + d' (False positive + True negative)

Evaluation of a screening test (properties):

• Sensitivity: Ability of a screening test to identify correctly all those who have the disease (cases)

Sensitivity = a/ (a + c) X 100 = TP/ (TP + FN) X 100

• Specificity: Ability of a screening test to identify correctly all those who do not have the disease (healthy)

Specificity = d/ (b + d) X 100 = TN/ (TN + FP) X 100

• Positive predictive value (PPV): Ability of a screening test to identify correctly all those who have the disease, out of all those who test positive on a screening test

PPV = a/ (a + b) X 100 = TP/ (TP + FP) X 100

• Negative predictive value (NPV): Ability of a screening test to identify correctly all those who do not have the disease, out of all those who test negative on a screening test

NPV = d/ (c + d) X 100 = TN/ (FN + TN) X 100
• There should be a latent or early asymptomatic stage of the disease
• There should be a test or examination for the diagnosis of disease
• The test should be acceptable to the population
• The natural history of the disease should be adequately understood
• There should be an agreed policy on who to treat
• The total, cost of finding a case should be economically balanced in relation to medical expenditure as a whole>
• 'Case-finding should be a continuous process, not just a 'once and for all' project

Lead time in Screening

• Lead time is the advantage gained by screening (leading the time of diagnosis): Early detection of disease will ensure earlier institution of treatment, thus better prognosis

Properties of a screening test

o Results of a screening test: RULES FOR CONSTRUCTION OF 2X2 .TABLE:

<table>
<thead>
<tr>
<th>Results of a screening test for a disease</th>
<th>Disease</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>a (TP)</td>
<td>b (FP)</td>
</tr>
<tr>
<td>Negative</td>
<td>c (FN)</td>
<td>d (TN)</td>
</tr>
</tbody>
</table>

• 'a' are known as True positive (TP): Population having the disease and showing screening test results as positive
• 'd' are known as True negative (TN): Population not having the disease and showing screening test results as negative
• 'b' are known as False positive (FP): Population not having the disease but erroneously showing screening test results as positive
• 'c' are known as False negative (FN): Population having the disease but erroneously showing screening test results as negative

1) Total population having the disease, i.e. cases: 'a + c' (True positive + False negative)
2) Total population not having the disease, i.e. healthy: 'b + d' (False positive + True negative)

Evaluation of a screening test (properties):

• Sensitivity: Ability of a screening test to identify correctly all those who have the disease (cases)

\[
\text{Sensitivity} = \frac{a}{a + c} \times 100 = \frac{\text{TP}}{\text{TP} + \text{FN}} \times 100
\]

" Specificity: Ability of a screening test to identify correctly all those who do not have the disease (healthy)

\[
\text{Specificity} = \frac{d}{b + d} \times 100 = \frac{\text{TN}}{\text{TN} + \text{FP}} \times 100
\]

• Positive predictive value (PPV): Ability of a screening test to identify correctly all those who have the disease, out of all those who test positive on a screening test

\[
\text{PPV} = \frac{a}{a + b} \times 100 = \frac{\text{TP}}{\text{TP} + \text{FP}} \times 100
\]

• Negative predictive value (NPV): Ability of a screening test to identify correctly all those who do not have the disease, out of all those who test negative on a screening test

\[
\text{NPV} = \frac{d}{c + d} \times 100 = \frac{\text{TN}}{\text{FN} + \text{TN}} \times 100
\]
Some useful facts about screening

- 'Usefulness of a screening test' is given by: Sensitivity
- Diagnostic power of a screening test: Predictive accuracy
  - Diagnostic power of a screening test to correctly identify a disease: Positive predictive value (PPV)
  - Diagnostic power of a screening test to correctly exclude a disease: Negative predictive value (NPV)
- Predictive value of a screening test depends on:
  1. Sensitivity
  2. Specificity
  3. Prevalence of disease in the population
- PPV is directly proportional AND NPV is inversely proportional to the prevalence of disease in the population

Few useful formulae

- False positive rate = 1 - specificity
- False negative rate = 1 - sensitivity
- Power of a test (sensitivity) = 1 — \( \frac{3}{3} \)
- Baye's Theorm: Gives relationship between PPV of a screening test and Sensitivity, Specificity & Prevalence of disease in a population

\[
\text{PPV} = \frac{[\text{Sensitivity} \times \text{Prevalence}]}{[\text{Sensitivity} \times \text{Prevalence}] + [(1 - \text{Specificity}) \times (1 - \text{Prevalence})]} \times 100
\]

\[
\text{NPV} = \frac{[\text{Specificity} \times (1 - \text{Prevalence})]}{[\text{Specificity} \times (1 - \text{Prevalence})] + [(1 - \text{Sensitivity}) \times \text{Prevalence}]} \times 100
\]

Screening tests used in combination

| Combined sensitivity | Decreases in series | Increases in parallel |
| Combined specificity | Increases in series | Decreases in parallel |

Neonatal Screening (NNS)

- NNS is primarily a Secondary Level of Prevention
- Neonatal hypothyroidism (NNH):
  1. Most common neonatal disorder to be screened is Neonatal hypothyroidism (NNH)
  2. Blood sample of choice: Umbilical cord blood
  3. Detection of: TSH, T₄
- Phenylketonuria (PKU):
  1. PKU is an autosomal recessive trait (1 in 10,000 births)
  2. Enzyme deficient in PKU: Phenylalanine hydroxylase
  3. Treatment of PKU: restricting or eliminating foods high in phenylalanine
  4. Guthrie Test: Is done in neonates for mass screening of Phenylketonuria (PKU)
  5. Chemicals detected: Phenylalanine, Phenylpyruvate and Phenyllactate

- Guthrie test was the first screening test used in neonates
- Guthrie test can detect PKU. Galactosemia and Maple syrup urine disease
- Phenylalanine, Phenylpyruvate and Phenyllactate
- It is a semiquantitative test
**Accuracy versus Precision**

- **Accuracy**: degree of closeness of a measured or calculated quantity to its actual (true) value.
- **Precision**: the degree to which further measurements or calculations show the same or similar results.
- **Precision versus Accuracy**.

<table>
<thead>
<tr>
<th>Precision</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition</td>
<td>Degree of closeness of a measured or calculated quantity to its actual (true) value.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Test(s)</td>
<td></td>
</tr>
<tr>
<td>Range chart</td>
<td>Mean chart</td>
</tr>
<tr>
<td>R - chart</td>
<td>Levy Jennings (LJ) chart</td>
</tr>
<tr>
<td></td>
<td>Shewhart control chart</td>
</tr>
</tbody>
</table>
CHAPTER I

COMMUNICABLE AND NON-COMMUNICABLE DISEASES

5A. RESPIRATORY INFECTIONS |

CHICKEN POX

- **Causative agent:** 'Varicella' zoster virus (Human (alpha) Herpes Virus - 3)
- **Period of communicability:** 1 - 2 days before to 4 - 5 days after appearance of rash
- **Secondary Attack rate:** 90%
- **Source of infection:** Case (person-to-person contact)
- **Incubation period:** 14 - 16 days
- **Rash:** Had to be differentiated from rash of Small pox

<table>
<thead>
<tr>
<th>Chicken pox rash</th>
<th>Small pox rash</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dew drop on rose petal appearance</td>
<td>.</td>
</tr>
<tr>
<td>Centripetal distribution</td>
<td>Centrifugal distribution</td>
</tr>
<tr>
<td>Pleomorphic rash</td>
<td>Non-pleomorphic ..</td>
</tr>
</tbody>
</table>

- MC late complication of chicken pox: Shingles (caused by reactivation of the virus decades after the initial episode of chickenpox)
- Aspirin must *not be given to children with chickenpox*: Risk of Reye's Syndrome
- Most rapid and sensitive, means of diagnosis: Examination of vesicle fluid under electron microscope (shows round particles)
- Strain of Live attenuated Chicken pox Vaccine: OKA strain
- Congenital Varicella: Most threatening if transmitted, in 1st trimester of pregnancy

MEASLES (RUBEOLA)

- **Causative agent:** RNA paramyxovirus
- **Incubation Period:** 10-14 days
- **Source of Infection:** cases (carriers are not known to occur)
- **Period of Communicability:** 4 days before & 5 days after the appearance of rash (Rash: Retro-auricular origin)
- **Measles has no second attacks** (life long immunity seen)
- **Secondary attack rate, of Measles:** 80%
- **Measles shows a cyclical trend:** Increase every 2-3 years
- **Pathognomic clinical feature of Measles:** Kopile spots (on buccal mucosa opposite upper 2nd molar)
- **MC complication of measles in young children:** Otitis media
- **SSPE (Subacute Sclerosing Pan Encephalitis)** is a rare complication of measles
- **Epidemic of measles occur:** if proportion of susceptible children is >40%
- **If Measles is introduced in a virgin community:** it infects >90% children
- **WHO MEASLES ELIMINATION STRATEGY** comprises a 3-Part Vaccination strategy, *'Catch up, Keep up, Follow up'*

RUBELLA (GERMAN MEASLES)

- **Causative agent:** RNA virus of Togavirus family
- **Incubation period:** 14-21 days ( -18 days)
- **There is 'no known carrier state'** for postnatally acquired rubella
- **40% women in reproductive age group are susceptible to rubella in India**
Rubella vaccine: live attenuated, 'strain RA 27/3'

Rubella vaccine is contraindicated in pregnancy.

If female vaccinated for rubella. Advise against pregnancy for next 3 months,

Priority groups for rubella vaccination in India: (Vaccination strategy)
- 1st priority: 15-49 years reproductive age group females
- 2nd priority: All children 1 - 14 years age
- 3rd priority: Routine universal immunization of all children aged 1

CONGENITAL RUBELLA SYNDROME (CRS)

Major determinant of extent of fetal infection in CRS: Gestational age at which fetal transmission occurs,

Infection in 1 trimester:
1) Abortions
2) Stillbirths
3) Skin lesions: blueberry muffin lesions
4) 'TRIAD OF CONGENITAL RUBELLA SYNDROME'
i. Sensori-neural deafness
ii. Congenital heart defects (MC is PDA)
iii. Cataracts

Infection in early part of II Trimester: Deafness (only)

Infection after 16 weeks POG: No major abnormalities

INFLUENZA

Causative agent: Orthomyxovirus, 3 types: A, B, C
- Type A:
  1) MC cause of outbreaks/ epidemics
  2) Only cause, of pandemics
- Type B
- Type C:
  1) Not circulating currently

Currently circulating influenza viruses in world:
- H1N1, (Type A) - Cause of Swine Flu
- H2N2 (Type A)
- H3N2, (Type A) - Cause of Avian influenza (Birdflu)
- Type B

Cyclical trends in Influenza:
- Type A epidemics every 2 - 3 years
- Type B epidemics every 4 - 7 years
- Type A pandemics every 10 - 15 years

Antigenic variations in Influenza: (MC in Type A)

<table>
<thead>
<tr>
<th>Antigenic shift</th>
<th>Antigenic drift</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occurs due to</td>
<td></td>
</tr>
<tr>
<td>Genetic recombination/</td>
<td>Point mutation</td>
</tr>
<tr>
<td>re-assortment/ rearrangement</td>
<td></td>
</tr>
</tbody>
</table>

Nature:
- Sudden / ..
- Gradual/insidious

May lead to:
- Epidemics/Pandemics
- Sporadic cases

Period of infectivity: 1 - 2 days before to 1 - 2 days after onset of symptoms

Incubation period: 18 - 72 hours.
Vaccines for Influenza:

- **Killed vaccines**:
  1. 2 doses, 3 - 4 weeks apart, 0.5 ml (for age > 3 years), subcutaneous
  2. 70 - 90% protective efficacy; duration 3 - 6 months
  3. Is rarely associated With Guillain Barre Syndrome (GBS)

- **Live attenuated vaccines**:
  1. Stimulate local + systemic immunity
  2. Antigenic variations presents difficulties in manufacture

- **Newer vaccines**:
  1. Split virus vaccine: 'Sub-virion vaccine' flower antigenicity, fewer side effects
  2. Neuraminidase specific vaccine: 'Submit vaccine'
  3. Recombinant vaccine

Avian Influenza

- Also known as 'Bird flu' or 'Highly pathogenic avian influenza'
- **Causative agent**: H5N1, (Type A Influenza virus)
- **Avian Influenza is a Pandemic**: Origin from Hong Kong (1997)
- **Drug of choice**: Oseltamivir (Tamiflu) 75 mg BD X 5 days (contraindicated in infants)

H1N1 INFLUENZA (SWINE FLU)

- **Causative agent**: H1N1, (Type A Influenza virus)
- **H1N1 Influenza is a Pandemic**: Origin from Mexico (2009)
- **Drug of choice**: Oseltamivir (Tamiflu) 75 mg BD X 5 days (contraindicated in infants)

INFLUENZA: PANDEMIC (H1N1) 2009 INFLUENZA

- **WHO declaration of Influenza pandemic**: 11 June 2009
- World is now post-pandemic EXCEPT: INDIA & NEW ZEALAND (locally intense transmission)
- **Problem statement India**: 46,131 cases, 2278 deaths [May 2009 - November 2012]
- **Incubation period**: 2-3 days

- **Clinical features**:
  - Uncomplicated influenza: Influenza like illness (Fever, cough, sorethroat, rhinorrhoea, headache, muscle pain), GIT illness (diarrhoea WITHOUT dehydration)
  - Complicated/severe influenza: Pneumonia, CNS involvement, Severe diarrhoea, Secondary complications, Exacerbation of chronic diseases
  - Progressive disease: Oxygen impairment/cardio pulmonary insufficiency, CNS complications, Invasive secondary bacterial infection, Severe dehydration

- **Risk factors of severe disease**:
  - Infants & children < 2 years
  - Pregnant females
  - COPD
  - Chronic cardiac disease
  - Metabolic disorders
  - Chronic renal/hepatic/neurological/hemoglobinopathies/immunosuppression (INCLUDING HIV) disorders
  - Children on aspirinotherapy
  - Persons aged > 65 years
  - Morbid obesity

- **Laboratory diagnosis**:
  - Most timely & sensitive detection: RT-PCR test
**Samples**: Nasopharyngeal + throat swabs [Tracheal/bronchial aspirates in lower respiratory tract infection cases]

**Point-of-care/Rapid diagnostic tests**: Not recommended

**Duration of isolation**: for 7 days after onset of illness OR 24 hours after resolution of fever/respiratory symptoms whichever is longer

**Antiviral therapy**:
- **Severe/progressive clinical illness**: Oseltamivir (if not available or resistance, use Zanamivir)
- **High risk of severe/complicated illness**: Oseltamivir OR Zanamivir
- **Not high risk OR Uncomplicated confirmed/ suspected illness**: No need of treatment

**Dosage**:
- Oseltamivir 75 mg BD X 5 days
- Zanamivir 2 inhalations (2 X 5 mg) BD X 5 days

### Diphtheria

- **Causative agent**: Corynebacterium diphtheriae
- **Source of infection**: Case or carrier
- **Carriers are more important as source of infection**
  - Nasal carriers are more dangerous than throat carriers
  - Immunization does not prevent carrier state
- **Period of Infectivity**: 14-28 days from onset of disease
- **Mode of transmission**: droplet infection (main mode), cutaneous lesions & fomites
- **Incubation Period**: 2-6 days

### SCHICK TEST

- **Intradermal test to test**: ...
  - Immunity status, and
  - Hypersensitivity to diphtheria toxin
- **Test**: 0.2 ml (1/50 MLD) of schick test toxin intradermal in forearm

<table>
<thead>
<tr>
<th>Observation</th>
<th>Control arm</th>
<th>Reading</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>No reaction</td>
<td>No reaction</td>
<td>NEGATIVE</td>
<td>Immune to diphtheria</td>
</tr>
<tr>
<td>Red flush</td>
<td>No reaction</td>
<td>POSITIVE</td>
<td>Susceptible to diphtheria</td>
</tr>
<tr>
<td>Red flush fading by 4th day</td>
<td>£</td>
<td>PSEUDOPOSITIVE</td>
<td>Hypersensitivity</td>
</tr>
<tr>
<td>Red flush(Positive)</td>
<td>Pseudopositive reaction</td>
<td>COMBINED</td>
<td>Susceptibility &amp; Hypersensitivity</td>
</tr>
</tbody>
</table>

### Pertussis (Whooping Cough)

- **Causative agent**: Bordetella pertussis (5% cases by B. parapertussis)
- **Also known as**: 'Whooping: Cough' or 'TOO Day Cough'
- **Source of Infection**: Case 
  - There is no subclinical or chronic carrier state
- **Mode of transmission**: Droplet, infection, direct contact
- **Neither vaccination nor.infection confers long-term immunity**
- **Secondary Attack rate**: > 90%
- **Incubation period**: 7 - 14 days
- **Leukocytosis** does not correlate with the severity of cough
- **Lab diagnosis**: culturing of nasopharyngeal swabs on Bordet-Gengou medium.
Drug of choice: Erythromycin (10 mg/kg QID X 10 days)

MENINGOCOCCAL MENINGITIS

- Also known as ‘cerebrospinal fever’
- Causative agent. Neisseria meningitidis
  - Gram -ve diplococci
  - Common serotypes: A, B, C, W-135, Y
- Most important source of infection: Carriers
- Mode of Transmission: droplet infection
- Reservoir. Human beings (only)
- Incubation period: 2 - 10 days (~ 3 to 4 days)
- Case fatality rate: 80%
- Diagnosis: Culturing the organism on a chocolate agar plate (Specimen: CSF)
- Drug of Choice:
  - Cases: Penicillin (Does not eradicate carrier state) i;
  - Chemoprophylaxis of contacts: Rifampicin (600 mg BD X 2 days)
  - Carriers: Rifampicin

Meningococcal vaccine:
- Polysaccharide vaccine with boosters every 3 years
- Prepared against serotypes A, C, W-135, Y
- NO VACCINE AVAILABLE FOR SEROTYPE B as Group B polysaccharide is non-immunogenic
- Contraindicated in:
  1) Pregnancy
  2) Children < 2 years age (as vaccine against type C causes Immunologic Tolerance in children; now conjugate vaccines have been developed to counter this problem)

CLASSIFICATION OF PNEUMONIA (ARIs)

- No Pneumonia: Cough or cold
  - No chest indrawing, No fast breathing
  - Management: No antibiotics necessary; treat symptomatically
  - If cough >30 days, refer for assessment
- Pneumonia (Not severe):
  - No chest indrawing
  - Fast breathing present (based on respiratory rate - RR)

<table>
<thead>
<tr>
<th>Age group</th>
<th>Respiratory rate cut-off for fast breathing</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-2 months</td>
<td>RR &gt; 60 per minute</td>
</tr>
<tr>
<td>2 - 12 months</td>
<td>RR &gt; 50 per minute</td>
</tr>
<tr>
<td>12 months - 5 years</td>
<td>RR &gt; 40 per minute</td>
</tr>
</tbody>
</table>

- Management: At home; Give antibiotics - Drug of choice Cotrimoxazole| Reassessment after 2 days

- Severe Pneumonia:
  - Signs:
    1) Chest indrawing
    2) Nasal flaring
    3) Grunting
    4) Cyanosis

  - Management: Give first dose of referral antibiotic (Ampicillin + Gentamicin); REFER URGENTLY to hospital; Drugs of Choice - Benzyl Penicillin (or Ampicillin or Chloramphenicol) for first 48 hours and then Procaine Penicillin (or Ampicillin or Chloramphenicol) for next 3 days; Antibiotics to be changed if there is no improvement after first 48 hours
Very severe Pneumonia:  
- Signs:
  1) Convulsions, abnormally sleepy or difficult to awake
  2) Stridor when calm
  3) Stopped feeding
  4) Wheezing
  5) Fever or low body temperature
  6) Severe malnutrition
- Management: Give first dose of referral antibiotic (Ampicillin + Gentamicin); REFER URGENTLY to hospital; Drug of Choice - Chloramphenicol i/m for first 48 hours and then oral chloramphenicol till total 10 days; Antibiotics to be changed (to i/m Cloxacillin + Gentamicin) if there is no improvement after first 48 hours

TUBERCULIN TEST
- Tuberculin test is the 'only way of estimating the prevalence of infection in a population'
- Positive reaction to the test', evidence of past or present infection by M. tuberculosis .
- Tuberculin: Purified protein derivative (PPD) [WHO advocates 'PPD-RT-23 with Tween-80']
- Dosage: First strength (ITU), Intermediate strength (5TU), Second strength (250TU) •
- Mantoux test:
  - Dose: 1 TU of PPD in 0.1 ml injected intradermally on forearm →
  - Result read after 72 hrs (3d)
  - Only induration is measured:
    1) Induration > 9mm: Positive
    2) Induration 6 - 9 mm: Doubtful (Atypical mycobacteria)
    • 3) Induration < 6mm: Negative
  - Is a test of prognostic significance
  - Has limited validity due to lack of specificity
- Tuberculin test conversion', is defined as an increase of 10 mm or more within a 2-year period, regardless of age

TESTS IN TUBERCULOSIS :
- Tuberculin: Purified protein derivative (PPD)
- Mantoux test: ...
- False Reactions:
  - False +ve Mantoux
    - Faulty technique of injection -
    - Using degraded tuberculin
    - Too deep injection
    - Infection of other mycobacterium
    - Repeated tuberculin testing
    - Prior BCG vaccine
    - Use of anti-allergic drugs
  - False -ve Mantoux
    - Pre-allergic phase
    - High fever
    - Measles and chicken pox
    - Whooping cough
    - Malnutrition
    - HIV/AIDS
    - Use of immuno-suppressants

- Sputum smear examination (Z-N Staining) by direct microscopy: is the 'method of choice as a case finding tool for tuberculosis'
  - In RNTCP, mainstay of diagnosis is Sputum microscopy
  - Sputum smears are stained for acid fast Bacilli (AFB) with 'Zeihl Neelson (ZN) Stain'
- Sputum culture examination: Culture (IUAT - LJ Medium)
- Mass Miniature Radiography (MMR - Abreugraphy): Is not used now as a case finding tool,
- BACTEC Radiometric System:
  - C14 radio-labelled with palmette acid
• Detect as early as 7 - 14 days
• 95% sensitivity

**PCR Test (Nucleic acid amplification tests - NAAT):**
- Detect within 1 day
- Extremely sensitive; +ve even with '1-10 bacilli per ml sputum'

### ANTI-TUBERCULAR DRUGS (ATT)

<table>
<thead>
<tr>
<th>Bactericidal drugs</th>
<th>Bacteriostatic drugs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isoniazid</td>
<td>Ethambutol</td>
</tr>
<tr>
<td>Rifampicin</td>
<td></td>
</tr>
<tr>
<td>Streptomycin</td>
<td></td>
</tr>
<tr>
<td>Pyrazinamide</td>
<td>Thiacetazone</td>
</tr>
<tr>
<td>Ciprofloxacin</td>
<td>Cycloserine</td>
</tr>
<tr>
<td>Ofloxacin</td>
<td>PAS</td>
</tr>
<tr>
<td>Kanamycin</td>
<td>Ethionamide</td>
</tr>
</tbody>
</table>

- **Isoniazid:**  
  - First effective bactericidal drug used to treat tuberculosis  
  - May be bacteriostatic at lower concentrations  
  - Acts on extracellular as well as intracellular organisms

- **Rifampicin:**  
  - Only bactericidal drug effective against 'persisters' or dormant bacilli in solid caseous lesions  
  - Acts on extracellular as well as intracellular organisms
  - Acts best on slowly or intermittently dividing (spurters)

- **Pyrazinamide:**  
  - Acts on intracellular bacilli  
  - Acts on bacilli at sites of inflammatory response

### DOSAGES OF ANTITUBERCULAR DRUGS:

<table>
<thead>
<tr>
<th>Drugs</th>
<th>Daily therapy</th>
<th>Thrice weekly therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isoniazid</td>
<td>5 mg/kg</td>
<td>10 - 15 mg/kg</td>
</tr>
<tr>
<td>Rifampicin</td>
<td>10 mg/kg</td>
<td>10 mg/kg</td>
</tr>
<tr>
<td>Pyrazinamide</td>
<td>25 mg/kg</td>
<td>35 mg/kg</td>
</tr>
<tr>
<td>Streptomycin</td>
<td>15 mg/kg</td>
<td>15 mg/kg</td>
</tr>
<tr>
<td>Ethambutol</td>
<td>15 mg/kg</td>
<td>30 mg/kg</td>
</tr>
</tbody>
</table>

- **Most effective anti-tubercular drug:** Rifampicin
- **Most bactericidal antitubercular drug:** Rifampicin
- **Most toxic antitubercular drug:** Rifampicin
- **Antitubercular drug causing rapid sputum conversion:** Rifampicin
- **Antitubercular drug causing orange discoloration of urine:** Rifampicin
- **Antitubercular drug first to develop resistance:** Isoniazid
- **Antitubercular drug contraindicated AIDS patients on Proimse'Witors:** Rifampicin
- **Antitubercular drug contraindicated in HIV:** Thiacetazone (Exfoliative dermatitis)
- **Antitubercular drugs contained in all phases of all categories of DOTS:** Rifampicin and Isoniazid
Injectable Antitubercular drug: Streptomycin
Antitubercular drug contraindicated in pregnancy: Streptomycin
Antitubercular drug contraindicated in children < 6 years age: Ethambutol
Antitubercular drug causing Optic neuritis (Red-Green color blindness): Ethambutol
Antitubercular drug causing vestibular damage: Streptomycin
Pregnant women with active TB: Should start or continue their anti-TB treatment
  • Streptomycin should not be given during pregnancy as it crosses the placenta and may cause damage to the fetus
  • Breast feeding of infants should continue irrespective of the TB status of mother

Drug Resistance in TB
Primary (Initial) Resistance: When a person contract infection from a person with resistant bacilli of TB
Secondary (Acquired) Resistance: Resistance developing during the course of treatment for TB
Multidrug Resistant TB (MDR-TB): Resistance to Isoniazid and Rifampicin ‘with or without resistance to other drugs’
Management of MDR - TB (DOTS - PLUS): Refers to DOTS programmes that add components for V1DR-TB diagnosis, management and treatment


<table>
<thead>
<tr>
<th>Category</th>
<th>Type of patient</th>
<th>Regimen</th>
<th>Duration (months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cat IV</td>
<td>MDR-TB</td>
<td>4(KOCZEEt)</td>
<td>12-18(OCEEt)</td>
</tr>
</tbody>
</table>

[Letters: E - Ethambutol, Z - Pyrazinamide, K - Kanamycin, O - Ofloxacin, Et - Ethionamide, C - Cycloserine; Numbers: The numbers before letters refer to months of treatment (4 imply four months of treatment)]

5B INTESTINAL INFECTIONS

Causative agent: Poliovirus (serotypes 1, 2 and 3)
  • P1 is MCC of epidemics
  • P2 is Most antigenic and Most easily eradicable
  • P3 is MCC of VAPP (Vaccine associated paralytic poliomyelitis) - 1 per 1 million chance
Reservoir: Man (No chronic carriers)
MC clinical occurrence: Subclinical cases
  • For every 1 clinical case of polio: there are 1000 subclinical cases in children and 75 subclinical cases in adults
Infectious material: Faeces and oro-pharyngeal secretions
Period of communicability: 7-10 days before and after onset of symptoms
Incubation period: 3 - 3.5 days (usually 7 - 14 days)
Clinical presentation:

<table>
<thead>
<tr>
<th>Clinical spectrum</th>
<th>% of infections</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inapparent (Subclinical) infection</td>
<td>95%</td>
<td>No presenting symptoms; recognisable by isolation or rising antibody titres</td>
</tr>
<tr>
<td>Abortive polio (Minor illness)</td>
<td>4 - 8%</td>
<td>Mild or self-limiting illness; recognisable by isolation or rising antibody titres</td>
</tr>
<tr>
<td>Non-paralytic polio</td>
<td>1%</td>
<td>Synonymous with aseptic meningitis</td>
</tr>
<tr>
<td>Paralytic polio</td>
<td>&lt; 1%</td>
<td>Descending asymmetric flaccid paralysis</td>
</tr>
</tbody>
</table>
• 'History of fever at onset of paralysis' is suggestive of polio
• There is no sensory loss in polio

**Poliomyelitis situation 2011 WORLD [as on 30 September 2011]**
• 4 endemic countries:
  1) Afghanistan
  2) India
  3) Pakistan
  4) Nigeria

**Countries with re-established transmission:**
1) Angola
2) Chad
3) Congo
4) Sudan

**Poliomyelitis situation 2012 INDIA [as on 30 October 2012]**
• Total cases: One
  1) Wild polio virus: NIL
  2) Vaccine derived polio virus: One (P2)

**AVAILABLE DIAGNOSTIC TESTS FOR POLIOMYELITIS**

- **Stool examination:**
  - Isolation of wild poliovirus from stool is *the recommended method for laboratory confirmation of paralytic poliomyelitis*
  - Recommended in every case of AFP
  - Virus usually can be found in the feces 'from onset to up to > 8 weeks after paralysis, with *the highest probability of detection during the first 2 weeks after paralysis onset*'

- **Cerebrospinal Fluid (CSF) examination**
- **Throat examination**
- **Blood examination**

**VIRAL HEPATITIS**

- **Types of Viral Hepatitis:**

<table>
<thead>
<tr>
<th>Type</th>
<th>Causative agent</th>
<th>Incubation period</th>
<th>Common mode(s) of transmission</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hepatitis A</td>
<td>Enterovirus 72 (picornavirus)</td>
<td>15-45 days.</td>
<td>Faecal-oral, sexual</td>
</tr>
<tr>
<td>Hepatitis B</td>
<td>Hepadnavirus</td>
<td>30-180 days</td>
<td>Sexual, perinatal, percutaneous</td>
</tr>
<tr>
<td>Hepatitis C</td>
<td>Hepacivirus (Flavivirus)</td>
<td>15-160 days</td>
<td>Percutaneous</td>
</tr>
<tr>
<td>Hepatitis D</td>
<td>Viriods like</td>
<td>30-180 days</td>
<td>Sexual, perinatal, percutaneous</td>
</tr>
<tr>
<td>Hepatitis E</td>
<td>Calcivirus (alphavirus like)</td>
<td>15-60 days.</td>
<td>Faecal-oral</td>
</tr>
</tbody>
</table>

- **MC Hepatitis in India:** Hepatitis A
- **MC cause of carriers in viral hepatitis:** Hepatitis B
- **MC cause of chronicity in viral hepatitis:** Hepatitis C
- **MC cause of cancers in viral hepatitis:** Hepatitis C
HEPATITIS B

- Also known as 'Serum hepatitis';
- Causative agent: Hepatitis B virus (HBV) - a Hepadnavirus
  • Is double shelled DNA virus - 'Dane's particle'
- Incubation period: 45 - 180 days (6 weeks - 6 months)
- Modes of transmission: Blood borne, sexual, parenteral, perinatal
- Markers of Hepatitis B infection (in order of appearance in serum):
  - HBsAg (Hepatitis B surface antigen):
    1) Also known as 'Australia antigen'
    2) First antigen to appear in serum
    3) 'Epidemiological marker of Hepatitis B infection'
  - HBeAg (Hepatitis B core antigen):
  - HBeAg (Hepatitis B envelope antigen):
    1) 'Indicates active viral replication'
    2) 'Is a marker of infectivity for Hepatitis B'
  - Anti-HBc (Antibody to Hepatitis B core antigen):
    1) First antibody to appear in serum
    2) IgM Anti-HBc is a marker of 'Acute Hepatitis B'
  - Anti-HBe (Antibody to Hepatitis B envelope antigen):
    1) Signals 'stoppage of active viral replication'
    2) Indicates 'end of period of infectivity'
  - Anti-HBs (Antibody to Hepatitis B surface antigen):
    1) Signals 'recovery, end of period of communicability'
- Vaccines for Hepatitis B:
  • Plasma derived vaccine
  • rDNA yeast derived vaccine
- Mother to child transmission (MTCT) of HBV:
  • In presence of HBeAg: 90%
  • In presence of HBsAg: 20%

HEPATITIS E

- Enterically transmitted hepatitis non-A, non-B [HNANB]
- HEV is essentially a waterborne disease, transmitted through water or food supplies, contaminated by faeces
- Incubation Period: 2 - 9 weeks
- HEV in pregnancy: Fulminant form is common in Hepatitis E infection during Pregnancy (upto 20% cases) with a high case fatality rate (upto 80%)

CHOLERA

- Cholera is an acute diarrhoeal disease caused by Vibrio cholerae
  • Hybrid type (MC in India)
  • Classical biotype
  • El Tor biotype [Serotypes: Ogawa (MC in India), Inaba and Hikojima]
- Vibrio cholerae: 'Gram-negative bacterium' that produces cholera toxin (enterotoxin)
- Incubation period: 1 - 2 days (Few hours - 5 days)
- Essentials for treatment of cholera: Water and electrolyte replacement (ORS)
- Drug of Choice for Cholera:
  • adults: Doxycycline (300 mg stat)
  • children: Cotrimoxazole (TMP 5 mg/kg BD X 3 days)
• 

• pregnant females: Furazolidone (100 mg QID X 3 days)
• chemoprophylaxis: Tetracycline (500 mg BD X 5 days)

Cholera stools appearance: 'Rice watery diarrhoea'

Laboratory diagnosis for cholera:

- Holding or transport media
  1) Venkataraman-ramakrishnan (VR) medium
  2) Cary-Blair medium (most widely used)
  3) Autoclaved sep. water
- Enrichment media
  1) Alkaline peptone water
  2) Monsur's taurocholate tellurite peptone water
- Plating media
  1) Alkaline bile salt agar (BS A)
  2) Monsur's gelatin Tauro cholate trypticase tellurite agar (GTTA) medium
  3) TCBS medium (mostly widely used)

**TYPHOID FEVER**

- Causative agent: Salmonella typhi
- Reservoir of infection: Man (cases & carriers)
- Source of infection: faeces, urine of cases/ carriers (primary source) & water, food fingers, flies (secondary source)
- IP: 10-14 days
- Mode of transmission: Faeco-oral route, urine-oral route
- Clinical features:
  - Pea Soup diarrhoea'
  - Splenomegaly, relative bradycardia, dicrotic pulse, abdominal distension & tenderness
  - Rose spots (2nd week)
  - Intestinal perforation (3rd week) may be one of the complications

Laboratory Diagnosis: ['BASU' Mnemonic]

<table>
<thead>
<tr>
<th>Test of diagnosis</th>
<th>Time of diagnosis</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood culture</td>
<td>1st week</td>
<td>Mainstay of diagnosis</td>
</tr>
<tr>
<td>Antibodies (Widal test)</td>
<td>2nd week</td>
<td>Moderate sensitivity &amp; specificity</td>
</tr>
<tr>
<td>Stool culture</td>
<td>3rd week</td>
<td>Useful for carriers</td>
</tr>
<tr>
<td>Urine test</td>
<td>4th week</td>
<td>Useful for carriers</td>
</tr>
</tbody>
</table>

Drug of choice: Quinolones

- for carriers: Ampicillin/ Amoxycillin + Probenecid X 6 weeks

Immunisation for Typhoid:

- TYPHORAL (Live oral Ty21a) vaccine:
  1) Contains >10⁹ viable organism of attenuated S. typhi
  2) Schedule: One capsule each on days 1, 3, 5 (booster of 3 doses, once every 3 yrs)
  3) Protection duration: 3 years
- TYPHIM Vi Vaccine:
  1) Vi- Polysaccharide containing single dose i.m. or subcutaneous
  2) Not given in age < 2yrs
- TAB vaccine:
  1) Contains S.typhi, S.paratyphi A & S.paratyphi B
In chronic cases of Typhoid, organisms persist in: Gall Bladder & Biliary tract

Immunization doesn't give 100% protection.

**ORAL REHYDRATION SOLUTION (ORS)**

- WHO Oral Rehydration Solution (WHO ORS): Older ORS

<table>
<thead>
<tr>
<th>Composition (grams)</th>
<th>Osmolar concentration (mmol/litre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium chloride</td>
<td>3.5</td>
</tr>
<tr>
<td>Potassium chloride</td>
<td>1.5</td>
</tr>
<tr>
<td>Sodium bicarbonate/citrate</td>
<td>2.5/2.9</td>
</tr>
<tr>
<td>Glucose</td>
<td>20</td>
</tr>
<tr>
<td>Sodium</td>
<td>90</td>
</tr>
<tr>
<td>Potassium</td>
<td>20</td>
</tr>
<tr>
<td>Chloride</td>
<td>80</td>
</tr>
<tr>
<td>Bicarbonate/citrate</td>
<td>30/10</td>
</tr>
<tr>
<td>Glucose</td>
<td>111</td>
</tr>
<tr>
<td>Total</td>
<td>27.5/27.9</td>
</tr>
<tr>
<td>Total</td>
<td>331/311</td>
</tr>
</tbody>
</table>

- ReSoMal (Rehydration Solution for Malnourished): Is recommended for severely malnourished children

- WHO Reduced Osmolarity Oral Rehydration Solution (Low Na ORS): Newer ORS

<table>
<thead>
<tr>
<th>Composition (grams)</th>
<th>Osmolar concentration (mmol/litre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium chloride</td>
<td>2.6</td>
</tr>
<tr>
<td>Potassium chloride</td>
<td>1.5</td>
</tr>
<tr>
<td>Sodium citrate</td>
<td>2.9</td>
</tr>
<tr>
<td>Glucose</td>
<td>13.5</td>
</tr>
<tr>
<td>Sodium</td>
<td>75</td>
</tr>
<tr>
<td>Potassium</td>
<td>20</td>
</tr>
<tr>
<td>Chloride</td>
<td>65</td>
</tr>
<tr>
<td>Citrate</td>
<td>10</td>
</tr>
<tr>
<td>Glucose</td>
<td>75</td>
</tr>
<tr>
<td>Total</td>
<td>20.5</td>
</tr>
<tr>
<td>Total</td>
<td>245</td>
</tr>
</tbody>
</table>

- WHO/UNICEF recommended oral rehydration formulation: Reduced Osmolarity Oral Rehydration Solution (Low Na ORS)

- Intravenous rehydration:
  - Ringer's lactate solution (Hartmann's solution)
  - Diarrhoea treatment solution (DTS): WHO recommended 'ideal' polyelectrolyte solution for intravenous solution
  - Normal saline: Poorest solution

**FOOD POISONING**

- *Staphylococcal food poisoning:*
  - **Agent:** Enterotoxins of Staphylococcus aureus
    1) Toxins formed at 35° - 37° C
    2) Toxins are relatively heat stable and resist boiling for 30 min or more
  - **Incubation period:** 1 - 6 hours
  - **IP** is short because of 'preformed toxin'
  - **Mechanism of food poisoning:** Intra-dietetic toxins (ingestion of toxins pre-formed in food, in which bacteria have grown)

- *Botulism food poisoning:*
  - **Agent:** Clostridium botulinum type A, B, E
  - **IP:** 12 - 36 hours
  - **Mechanism of food poisoning:** Intra-dietetic toxins
  - **Prominent symptoms:** GIT SYMPTOMS ARE SLIGHT
    1) Dysphagia
    2) Diplopia
    3) Dysarthria
• Prophylaxis: 50,000-100,000 units anti-toxin
• Treatment: Guanidine hydrochloride

• Clostridium perfringens food poisoning:
  • Agent: Clostridium perfringens (welchii)
  • IP: 6-24 hours
  • Rapid recovery with no deaths

• Bacillus cereus food poisoning:
  • Agent: Bacillus cereus
  • IP: 1-6 hours (emetic form), 12-24 hours (diarrhoeal form)

HOOKWORM (ANCYLOSTOMIASIS)

• Causative agent: Ancylostoma duodenale & Necator americanus
• Reservoir of Infection: Man
• Mode of transmission: Direct penetration of skin of foot & by oral route
• Incubation Period:
  • 5 weeks -9 months (A. duodenale)
  • 7 weeks (N. americanus)
• Drugs of choice: Albendazole (A. duodenale) — Mebendazole (N. americanus)
• Endemic-Index (Chandler’s Index)
  • CI is average no of hookworm eggs per gram of faeces for the ‘entire community’
  • Interpretation of CI:
    • > 300 Important public health problem

Average no of eggs/gm stools | Interpretation
-------------------------------|-------------------
> 300                          | Important public health problem

• Average blood loss in hookworm infection: 0.03 - 0.2 ml per worm per day
• Hookworm infection is associated with: Iron Deficiency Anemia

GUINEAWORM (DRACUNCULIASIS)

• Causative agent: Dracunculus medinensis (nematode)
• Guinea worm disease in India:
  • Last case in India: July 1996 (Jodhpur, Rajasthan)
  • India certified for Elimination of Guinea worm (WHO): Feb 2000
  • India certified Guinea worm disease free: Feb 2001
• Reservoir of infection: an infected person (no animal reservoir)
• Type of biological transmission: Cyclo-developmental transmission
• Mode of transmission: Consumption of water containing Cyclops harbouring infective stage of parasite
• Guinea worm is amenable to eradication
• Treatment of cases: Drugs like Niridazole, Mebendazole and Metronidazole
• Most effective larvicide for Guinea worm control: Abate (Temephos)

5C. ARTHROPOD BORNE INFECTIONS

DENGUE

• Dengue viruses are arboviruses having 4 serotypes (Den - 1, 2, 3, 4)
• Vector for dengue: Aedes aegypti
• Reservoir: Man, Mosquito
• Incubation-period: 5 - 6 days
o Classical dengue fever (DF):
  • Also known as 'breakbone fever'
  • Clinical features: High grade fever (biphasic curve) with chills, intense headache, muscle and joint pains, retro-orbital pain, photophobia, colicky pain, abdominal tenderness, skin rash

o Dengue hemorrhagic fever (DHF): Severe form of DF, caused by infection with more than one dengue virus type
  • Incubation period: 4 - 6 days
  • Clinical features: Features of DF plus
    1) Rash less common
    2) Rising hematocrit value (> 20% of baseline)
    3) Moderate-to-marked thrombocytopenia (< 1 lac/ mm³)
    4) Hepatomegaly
    5) POSITIVE TOURNIQUET TEST: > 20 petechiae per sq. inch
  • Diagnosis of DHF: Fever + hemorrhagic manifestations + thrombocytopenia + hemoconcentration or rising hematocrit

o Dengue shock syndrome (DSS):
  • Diagnosis of DSS: DHF + shock [rapid & weak pulse, narrow pulse pressure (< 20 mm Hg) hypotension, cold clammy skin, restlessness]

LYMPHATIC FILARIASIS
o Lymphatic Filariasis covers infection with 3 closely related nematode worms
  o Causative Agents:
    • Wuchereria bancrofti
    • Brugiamalayi
    • Brugia timori
  o Definitive Host: Man
  o Intermediate Host: Mosquito
  o Vectors' of Lymphatic filariasis: Culex mosquito
  o Chemotherapy of Filariasis: Diethylcarbamazine (DEC)
    • Bancroftian filariasis: 6mg/kg/day X 12 days (Total 72 mg/kg)
  o DEC is effective in killing Mf
  o National Filaria Control Programme (NFCP), 1955 is now a component of National Vector Borne Diseases Control Programme (NVBDCP), 2003-04
    • NVBDCP covers Malaria, Filariasis, Japanese Encephalitis, Kala Azar & Dengue

MALARIA
  o Modes of Malaria Transmission
    • Bite of female anopheline mosquitoes: Infective forms are Sporozoites
    • Injection of blood of a malaria patient containing asexual forms: 'Trophozoite induced malaria'
      • Transfusion malaria
      • Congenital malaria
      • Malaria in drug addicts

LIFE CYCLE OF MOSQUITO:
  o Hosts involved in transmission of malaria:

<table>
<thead>
<tr>
<th>Man</th>
<th>Female anopheles mosquito</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secondary host</td>
<td>Primary host</td>
</tr>
<tr>
<td>Intermediate host</td>
<td>Definitive host</td>
</tr>
<tr>
<td>Asexual cycle</td>
<td>Sexual cycle</td>
</tr>
<tr>
<td>Schizogony</td>
<td>Sporogony</td>
</tr>
</tbody>
</table>
Human cycle of Plasmodium:
- **Pre-erythrocytic schizogony:**
  1) Development of sporozoites in liver parenchyma
  2) Liberated merozoites are called as 'Cryptozoites'
  3) No clinical manifestation; No pathological change
  4) Blood is sterile
- **Erythrocytic schizogony:**
  1) Parasite resides inside RBCs; passes through stages of Trophozoite, Schizont, Merozoite
  2) Parasitic multiplication brings clinical attack of malaria
- **Gametogony:**
  1) Some merozoites develop in RBCs of spleen and bone marrow to form 'Gametocytes'
- **Exo-erythrocytic schizogony:**
  1) Persistence of late tissue phase in liver
  2) Seen in P. vivax and P. ovale
  3) Cause relapses in Vivax and Ovale malaria
  4) Liberated merozoites are known as 'Phanerozoites'

Mosquito cycle of Plasmodium:
- **Completion of gametogony:**
  1) Exflagellation of microgamete and maturation of gametes
  2) Fusion of gametes form 'Zygote'; zygote matures to 'Ookinite'
- **Sporogony:**
  1) Ookinite develops into 'Oocyst'
  2) On 10th day of infection, oOcys ruptures, releasing sporozoites; sporozoites reach salivary glands
  3) Mosquito at this stage is capable of transmitting infection.

MALARIOMETRIC MEASURES IN PRE - ERADICATION ERA
- **Spleen rate:** Is Index used for measuring 'endemicity of malaria in a community'
- **Average enlarged spleen**
- **Parasite rate**
- **Parasite density index**
- **Infant parasite rate:** Is 'most sensitive index of recent malaria transmission' in a locality
- **Proportional case rate**

MALARIOMETRIC MEASURES IN ERADICATION ERA
- **Annual parasitic incidence (API):** Sophisticated measure of malaria incidence in a community
  \[
  API = \frac{\text{Confirmed cases during one year}}{\text{Population under surveillance}} \times 1000
  \]
- **Annual blood examination rate (ABER):**
  \[
  ABER = \frac{\text{Number of slides examined}}{\text{Population}} \times 100
  \]
- **ABER is the Index of Operational Efficiency in Malaria**
- **Prescribed yearly no. of examined malaria slides (MPO 1977): > 10% of population (1 % per month)**
- **Annual falciparum incidence (AFI)**
- **Slide positivity rate (SPR)**
  \[
  SPR = \frac{\text{No. of blood smears +ve for parasite}}{\text{No. of blood smears examined}} \times 100
  \]
- **Slide falciparum rate (SFR)**
Vector indices in malaria

- Human blood index: Indicates degree of anthropilism
- Sporozoite rate
- Mosquito density
- Man-biting rate
- Inoculation rate

NEW MALARIA TREATMENT GUIDELINES IN INDIA (2010 onwards)

UNCOMPPLICATED MALARIA:

A. WHERE MICROSCOPY RESULT IS AVAILABLE WITHIN 24 HOURS: Take slides for microscopy

- Plasmodium vivax (Pv): Chloroquine 3 days + Primaquine 14 days
- Plasmodium falciparum (Pf):
  - ACT 3 days + Primaquine single dose (listed areas), OR
  - Chloroquine 3 days + Primaquine single dose

COMPLICATED MALARIA:

- Initial treatment:
  - Parenteral Artemisin derivatives (Artesunate, Artmether, Arteether), OR
  - Parenteral Quinine
- Once patient can take Oral therapy:
  - Those on Parenteral Artemisin derivatives: Oral ACT (full course)
  - Those on Parenteral Quinine: Oral quinine + Doxycycline 7 days
- Complicated Malaria in pregnancy:
  - I trimester: Parenteral Quinine
  - II or III trimester: Parenteral Artemisin derivatives

CHEMOPROPHYLAXIS:

- Short term chemoprophylaxis (<6 weeks): Doxycycline (2 days before to 4 weeks after leaving area)
- Long term chemoprophylaxis (>6 weeks): Mefloquine (2 weeks before to 4 weeks after leaving area)

[NOTE: ACT: Artesunate - Suifalene - Pyrimethamine combination therapy]

PLEASE NOTE PLASMODIUM OVALE has occurred recently in Assam, Gujarat, Delhi, Orrisa & Kolkata

5D. ZOONOSES

Zoonoses: An infection or infectious disease transmissible under natural conditions from vertebrate animals to man

- Classification of Zoonoses:
  - Anthropozoonoses: Infections transmitted from animals (zoo) to man (anthro):
    1) Rabies
    2) Plague
    3) Anthrax
    4) Hydatid disease
    5) Trichinosis
  - Zooanthroponoses: Infections transmitted from man (anthro) to animals (zoo):
    1) Human TB in cattle
  - Amphixenosis: Infections transmitted in either direction between animals and man:
    1) Trypanosoma cruzi
    2) Schistosomajaponicum
Classification of Zoonoses based upon life cycle of infecting organism:

- **Direct zoonoses**: Transmitted from infected to susceptible vertebrate host by direct contact/fomite/vector. Examples: Rabies, Brucellosis, Trichinosis
- **Cyclo-zoonoses**: Involve more than one vertebrate species. Examples: Taeniasis, Echinococcosis
- **Meta-zoonoses**: Transmitted biologically by invertebrate vectors. Examples: Plague, Schistosomiasis, Arboviral infections.
- **Sapro-zoonoses**: Involves non-animal developmental sitcor reservoir. Examples: Mycoses, Larva migrans

- **Epizootic**: Outbreak (epidemic) of a disease in animal population
- **Enzootic**: Endemic of disease occurring in animals
- **Epidemic**: Outbreak (epidemic) of a disease in bird population

**BIES (HYDROPHOBIA)**

- **Hydrophobia** is pathognomic (though few consider Aerophobia as pathognomic)
- **Causative agent**: Lyssavirus Type 1 (Bullet shaped neurotropic RNA virus),
- **Types of rabies virus**: Street virus and Fixed virus

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Street Virus (SV)</th>
<th>Fixed Virus (FV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source</td>
<td>Naturally occurring cases</td>
<td>Serial brain passage of SV</td>
</tr>
<tr>
<td>Incubation period</td>
<td>20 - 60 days</td>
<td>4 - 6 days</td>
</tr>
<tr>
<td>Pathogenicity</td>
<td>For all mammals</td>
<td>Sometimes pathogenic</td>
</tr>
<tr>
<td>Negri Bodies</td>
<td>Formed</td>
<td>Not formed</td>
</tr>
<tr>
<td>Importance</td>
<td>Cause rabies</td>
<td>Used for vaccine preparation</td>
</tr>
</tbody>
</table>

- **Incubation period**: Variable [4 days to many years; ~ 3 to 8 weeks]
- **Rabies is a dead-end infection in man.**
- **Rabies is not seen in developed nations, land-locked countries,**
  - India: Rabies does not occur in Lakshadweep and Andaman & Nicobar Islands
- **Mode of transmission:**
  - Animal bites (dogs, cats, monkeys, cow, goat, sheep, buffalo, horses EXCEPT RAT BITE & HUMAN BITE)
  - Licks (on abraded skin or abraded/unabraded mucosa)
  - Aerosols (Rabies infected bats)
  - Person to person: Rare but possible
  - Corneal and organ transplantation

**Classification of exposures & recommended Post Exposure Prophylaxis (PEP):**

<table>
<thead>
<tr>
<th>Class &amp; risk</th>
<th>Types of exposures</th>
<th>Recommended PEP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class I</td>
<td>- Licks on unbroken skin</td>
<td>None (if history is reliable)</td>
</tr>
<tr>
<td>(Slight risk)</td>
<td>- Scratches without oozing of blood</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Consumption of unboiled milk of suspected animal</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Handling raw flesh of suspected animals</td>
<td></td>
</tr>
<tr>
<td>Class II</td>
<td>- Licks on fresh cuts</td>
<td>Start vaccine immediately</td>
</tr>
<tr>
<td>(Moderate risk)</td>
<td>- Scratches with oozing of blood</td>
<td>(May be discontinued if animal remains healthy after an observation period of 10 days or found -ve for rabies by diagnostic techniques)</td>
</tr>
<tr>
<td></td>
<td>- All bites except on head, neck, face, palms, fingers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Minor wounds &lt; 5</td>
<td></td>
</tr>
</tbody>
</table>
Class III (Severe risk)
- All bites or scratches with oozing of blood on head, neck, face, palms, fingers
- Lacerated wounds
- Multiple wounds > 5
- Bites from wild animals

Start rabies immunoglobulin and vaccine immediately. (May be discontinued if animal remains healthy after an observation period of 10 days or found -ve for rabies by diagnostic techniques)

Local Wound Treatment
- **Cleansing:** Plenty of soap and running water for > 5 minutes
- **Suturing:** NOT RECOMMENDED;
- **Anti-rabies serum**
- **Observe animal:** FOR 10 DAYS

Recommended schedule of Nervous Tissue Vaccines (NTV): Deep subcutaneous in anterior abdominal wall

<table>
<thead>
<tr>
<th>Exposure</th>
<th>Schedule of vaccination*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class I</td>
<td>BPL Vaccine&lt;sup&gt;6&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>2 ml X 7 days</td>
</tr>
<tr>
<td>Class II</td>
<td>5 ml X 14 days</td>
</tr>
<tr>
<td>Class III</td>
<td>10 ml X 14 days</td>
</tr>
</tbody>
</table>

<sup>*Recommended by CRI, Kasauli; Recommended by Pasteur Institute, Coonoor</sup>

Recommended schedules of Cell Culture and Purified Duck Embryo Vaccines:
- **POST EXPOSURE. PROPHYLAXIS:**
  - Intramuscular schedule:
    1. 6 doses (1 ml each)
    2. Day 0, 3, 7, 14, 28, 90
    3. Dose: 2.5 IU per ml
  - Intradermal schedule: (Dose 1/5<sup>th</sup> of intramuscular dose)

- **PRE EXPOSURE PROPHYLAXIS:** (lab staff working with vaccine virus, veterinarians, animal handlers and wild life officers)
  - Day 0,7,28
  - Boosters every 2 years

- **POST EXPOSURE PROPHYLAXIS IN THOSE VACCINATED PREVIOUSLY:**
  - Day 0, 3, 7

Rabies vaccine was first developed by: Louis Pasteur (& Emile Roux)

YELLOW FEVER
- **Causative agent:** Flavivirus fibricus (Togavirus Family, Gp B Arbovirus)
- **Reservoir of Infection:**
  - Forest (Sylvian) Cycle: Monkeys & Forest mosquitoes
  - Urban Cycle: Man (Sub clinical & clinical cases) & Aedes aegypti
- **Incubation Period:** 3 - 6 days
- **IP of 6 days recognized under International Health Regulations
- **YELLOW FEVER VACCINE:**
  - Live attenuated, lyophilized (Freeze dried) vaccine
  - **Strain:** 17D strain (Chick Embryo grown)
  - **Cold chain Temperature:** -30<sup>o</sup> to +5<sup>o</sup> C
**Indices of Surveillance of Aedes Mosquitoes:**

- **Container Index:** \[\text{Container Index} = \frac{\text{No of containers showing breeding of } \text{Aedes larvae}}{\text{Total no of containers surveyed}} \times 100\]
  
  \[= \frac{C + X}{C} \times 100\]

- **Jfpuje Index:** \[\text{Jfpuje Index} = \frac{\text{No of Houses showing breeding of } \text{Aedes Larvae}}{\text{Total no of houses surveyed}} \times 100\]
  
  \[= \frac{H + X}{H} \times 100\]

- **Aedes aegypti Index:** \[\text{Aedes aegypti Index} = \frac{\text{No of containers showing breeding of } \text{Aedes Larvae}}{\text{Total no of houses surveyed}} \times 100\]
  
  \[= \frac{C + X}{H} \times 100\]

Aedes aegypti index [BRJETEAU INDEX] should be < 1% in towns & seaports in endemic areas to ensure freedom from Yellow Fever

**Japanese Encephalitis**

- **Causative agent:** Group B arbovirus (Flavivirus)
- **Host factors:**
  - Pigs are Amplifier Hosts
  - Cattle & buffaloes are 'Mosquito attractants'
  - Birds are also involved in Natural History: pond herons, cattle egrets, poultry & ducks (Ardeid birds)
  - Man is an 'Incidental Dead end Host'.
- **Vectors of JE:** Culex tritaeniorhynchus (most important vector), Culex vishnuii
- **IP of JE in man:** 5 - 15 days (9 - 12 days in mosquitoes)
- **Case fatality rate:** 20 - 40% (may reach up to 58%)
- **JE Vaccines:**

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Strain(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse brain derived, purified &amp; inactivated vaccine</td>
<td>Nakayama Strain/Beijing Strain</td>
</tr>
<tr>
<td>Cell culture derived, inactivated vaccine</td>
<td>Beijing P3 Strain</td>
</tr>
<tr>
<td>Cell culture derived, live attenuated vaccine</td>
<td>SA 1H-14-2 Strain</td>
</tr>
</tbody>
</table>
KYASANUR FOREST DISEASE (KFD)
o KFD is also known as 'Monkey Disease’
o **Causative agent:** Group B TOgavirus (Flavivirus)
o **Amplifier hosts:** Pigs
o Man is 'incidental dead-end host'
o **Vectors of KFD:**
  - In India: Hemophysalis spinigera (Hard Tick)
  - Outside India: Soft Tick
o **IP:** 3 — 8 days

CRIMEAN CONGO FEVER (CCF)
o **Type of disease:** Zoonosis of domestic/ wild animals which may affect human beings
o **Causative agent:** Nairovirus (Bunyavirus)
o **Vector:** Hyalomma ticks (Hard ticks)
o **Incubation period:** 1-13 days (Median 5-6 days)
o **Case fatality rate:** 30%
o **Drug of choice:** Ribavrin
o **Situation in India:** Exotic-Epidemic in India (Gujarat, December 2010)

BRUCELLOSIS
o Also known as: Undulant fever, Malta fever, Mediterranean fever
o **Causative agent:** Brucella species
  - *Brucella melitensis*: Most virulent and invasive species
o **Reservoir:** Cattle, sheep, goats, swine, buffaloes, horses, dogs
o **Modes of transmission:**
  - *Contact infection:* direct contact with infected tissues, blood, urine, vaginal discharge, aborted fetuses and ESPECIALLY placenta
  - *Food-borne infections:* raw milk/ dairy products, fresh raw vegetables, water
  - *Air-borne infection:* aerosol
o **Incubation period:** usually 1 - 3 weeks
o **Antibiotic of choice:** Tetracycline 500 mg QID X 3 weeks

RICKETTSIAL ZOONOSES
Transmitted to man by Arthropod vectors (Q fever excepted)

<table>
<thead>
<tr>
<th>Disease</th>
<th>Agent</th>
<th>Vector</th>
<th>Reservoir</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typhus Group</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Epidemic typhus</td>
<td>R. prowazekii</td>
<td>Louse</td>
<td>Humans</td>
</tr>
<tr>
<td>Murine typhus</td>
<td>R. typhi</td>
<td>Flea</td>
<td>Rodents</td>
</tr>
<tr>
<td>Scrub typhus</td>
<td>R. tsutsugamushi</td>
<td>Trombiculid mite</td>
<td>Rodents</td>
</tr>
<tr>
<td>Spotted Fever Gp</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indian Tick typhus</td>
<td>R. conori</td>
<td>Tick</td>
<td>Rodents,dogs</td>
</tr>
<tr>
<td>RMSF</td>
<td>R. rickettsii</td>
<td>Tick</td>
<td>Rodents, dogs</td>
</tr>
<tr>
<td>Rickettsial pox</td>
<td>R. akari</td>
<td>Mite</td>
<td>Mice</td>
</tr>
<tr>
<td>Others</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q Fever</td>
<td>Coxiella burnetii</td>
<td>Nil</td>
<td>Cattle, sheep, goat</td>
</tr>
<tr>
<td>Trench Fever</td>
<td>Bartonella quintana</td>
<td>Louse</td>
<td>Humans</td>
</tr>
</tbody>
</table>
Q Fever.

- **Causative agent**: Coxiella burnetii
- **Cuťy Rickettsial disease without any vector** (soft tick in few animal cases)
- **Only Rickettsial disease without any skin lesion**
- **Mode of Transmission**: Inhalation of infected dust, aerosol transmission, direct contact, contaminated food like meat, milk & milk products

Scrub Typhus:

- **Most widespread Rickettsial Disease**
- **Causative agent**: Rickettsia tsutsugamushi
- **Reservoir**: Trombiculid Mite
- **Typical clinical features**: Eschar (punched out ulcer covered with a blackened scar, indicates location of mite bite)
- **Weil Felix Reaction is strongly positive with Proteus strain OXK**

'Brill Zinnser Disease' is the recrudescent form of Epidemic Typhus (Louse borne typhus)

Drug of choice for Rickettsial diseases: Tetracycline

PLAGUE (Black Sickness, Mahamari, The great death)

- **Causative agent**: Yersinia pestis (Gram negative, non-motile cocco-bacillus)
- **Bipolar staining with Wayson's stain**
- **Reservoir of Infection**: Wild rodents (Tatera indica in India)
- **Source of Infection**: Infected rodents, fleas & cases of pneumatic plague
- **Commonest & most efficient vector of Plague**: Rat flea (Xenopsylla cheopsis)
- **Mode of transmission**: Bite of an infected flea, direct contact with tissues of infected animal or droplet infection (pneumatic plague)

<table>
<thead>
<tr>
<th>Type</th>
<th>IP</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pneumonic Plague</td>
<td>1-3 days</td>
<td>Complication of Bubonic-Septicemic plague</td>
</tr>
<tr>
<td>Bubonic Plague</td>
<td>2-7 days</td>
<td>MC type of Plague</td>
</tr>
<tr>
<td>Septicemic Plague</td>
<td>2-7 days</td>
<td>Occurs of Accidental laboratory infections</td>
</tr>
</tbody>
</table>

- **Drug of choice for treatment**: Streptomycin 30 mg/kg i.m. X 7-10 days
- **Drug of choice for chemophylaxis**: Tetracycline 500 mg QID X 5 days
- **Recent most outbreak of Plague**: 16 cases of Pneumonic Plague in Hatkoti village, Shimla district, Himachal Pradesh (February 2002)
- **A partially blocked flea is more efficient transmitter of Plague** than a totally blocked flea
- **Most effective method to break chain of transmission of Plague**: Destruction of Rat fleas

TAENIASIS

- **Taeniasis are called as 'Cyclozoanoses'**: Require more than one vertebrate host species (but no invertebrate host) to complete their developmental cycles
- **T.solium & T.saginata may persist for several years in infected humans** (small intestines)
- **Mode of transmission**:
  - Ingestion of infective cysticerci in undercooked beef (T.saginata) or pork (T.solium)
  - Ingestion of food, water or vegetables contaminated with eggs
  - Reinfestation by reperistalsis of eggs (bowel to stomach) ...
- **IP**: 8-14 weeks
- **Most serious risk of T.solium infection**: Cysticereosis
- **Treatment**: Praziquantel & niclosamide
DOC Cysticercosis: Albendazole
Most effective method to prevent food borne infections: cooking of beef & pork

ECHINOCOCCUS GRANULOSUS
- Also known as 'Dog Tape Worm'
- Dog-sheep cycle with man as intermediate dead end host
  1) Definitive host: Dog
  2) Intermediate host: Sheep
- MC site of cyst: Right lobe liver (postero-superior part)
- Drug of choice: Mebendazole
- Casoni's test: Immediate hypersensitivity skin test

LEISHMANIASIS
- Kala azar is known as 'Black Sickness'
- Causative agent of Leishmaniasis:

<table>
<thead>
<tr>
<th>Types of Leishmaniasis</th>
<th>Causative agent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visceral Leishmaniasis (Kala Azar)</td>
<td>Leishmania donovani</td>
</tr>
<tr>
<td>Cutaneous Leishmaniasis (Oriental Sore)</td>
<td>Leishmania tropica</td>
</tr>
<tr>
<td>Muco-Cutaneous Leishmaniasis</td>
<td>Leishmania braziliensis</td>
</tr>
</tbody>
</table>

- Reservoir of infection: Dogs, jackals, foxes, rodents & other mammals
  - Indian Kala Azar is a non-zoonotic infection: Man as reservoir
- Peak age of Kala Azar in India: 5 - 9 years
- Vectors: Female phlebotamine sandflies

<table>
<thead>
<tr>
<th>Types of Leishmaniasis</th>
<th>Vector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visceral Leishmaniasis (Kala Azar)</td>
<td>Phlebotamus argentipes</td>
</tr>
<tr>
<td>Cutaneous Leishmaniasis (Oriental Sore)</td>
<td>Phlebotamus papatasi</td>
</tr>
<tr>
<td></td>
<td>Phlebotamus sergenti</td>
</tr>
</tbody>
</table>

- Habitat of Sandfly: Cracks & crevices of walls, tree holes caves
- Insecticide of choice for sandfly: DDT (sprayed only up to a height of 6 feet from floor)
  1 - 2 gm/sq. metre
- IP: 10 days to 2 years (average 1 - 4 months)
- Aldehyde Test of Napier: Useful Test for surveillance (but not for diagnosis)
- Serological tests:
  - ELISA: for diagnosis as well as epidemiological field survey
  - rk 39 dipstick test
  - Indirect Fluorescent Antibody Test (IFAT)
  - Direct Agglutination Test (DAT)
- Leishmanin (Montenegro) test: Useful Test for immunity status
- Treatment of Leishmaniasis:
  - 1st line of drugs: Sodium stibogluconate (Pentavalent antimonial compounds) 20 mg/kg i.v. or i.m. X 20 days
  - 2nd line of drugs: Miltefosine (2.5 mg/kg x 4 weeks, oral)
  - Other drugs: Ketoconazole, Allopurinol, Paramomycin, Pentamidine, Amphotericin B
Classification: Henapivirus genus (paramyxovirus)

Description: Is an emerging zoonotic infection transmissible to man from animals' which causes encephalitis/respiratory infections

Incubation period: 4-45 days

Transmission:
- Outside India: Direct contact with pigs or their tissues
- Within India: Consumption of fruits contaminated with bats secretions (urine/saliva) [RECENTLY reported from Siliguri (Bengal)]

Case fatality rate: 40-75%

Diagnosis: ELISA, PCR, Immunofluorescence, Viral isolation by cell culture

Treatment: NONE available; only symptomatic treatment done
5E. SURFACE INFECTIONS

TRACHOMA
- Is a chronic infectious disease of conjunctiva and cornea, caused by Chlamydia trachomatis
  - **Incubation period for Trachoma**: 5 - 12 days
  - **Treatment of trachoma**: Single dose Oral Azithromycin 20 mg/kg
  - **Mass (Blanket) treatment of trachoma**:
    - Treatment consists of 1% tetracycline (for 5 consecutive days each month or once daily for 10 days each month for 6 consecutive months, or for 60 days) or alternatively erythromycin
  - WHO has recommended the **SAFE Strategy** for global elimination of blinding trachoma in the remaining countries
    - Surgery
    - Antibiotic use
    - Facial cleanliness
    - Environmental improvement

TETANUS
- **Causative agent**: Clostridium tetani (Gram +ve, anaerobic, drumstick appearance)
- **Reservoir**: Natural habitat is soil & dust
- **Period of communicability**: NONE (no person to person transmission)
- **Mode of transmission**: Contamination of Wounds with spores
- **IP**: 6-10 days (1 day to several months)
- **Tetanus is best prevented by**: Active immunisation with Tetanus toxoid (TT)
- **Tetanus toxin**: Second most lethal toxin (Most lethal toxin is Botulinum toxin)
- **Herd Immunity in Tetanus**: Does not protect the individual

WOUNDS AND TETANUS IMMUNIZATION
- **Prevention of tetanus in the wounded**:

<table>
<thead>
<tr>
<th>Immunity Category</th>
<th>Treatment by type of wound</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Wounds &lt; 6hrs old, clean, non-penetrating, with negligible tissue damage</strong></td>
</tr>
<tr>
<td>A</td>
<td>Nothing more required</td>
</tr>
<tr>
<td>B</td>
<td>Toxoid 1 dose</td>
</tr>
<tr>
<td>C</td>
<td>Toxoid 1 dose</td>
</tr>
<tr>
<td>D</td>
<td>Toxoid complete course</td>
</tr>
</tbody>
</table>

Where,

- **A**: Complete course of toxoid or booster dose in previous 5 years
- **B**: Complete course of toxoid or booster dose in previous 5-10 years
- **C**: Complete course of toxoid or booster dose in >10 years ago
- **D**: Has not had a complete course of toxoid or status is unknown

NEONATAL TETANUS (NNT)
- Also known as ‘8th DAY DISEASE’
- **Cleans for safe delivery for prevention of NNT**:
LEPROSY (HANSEN'S DISEASE)

- Chronic infectious disease caused by Mycobacterium leprae & affecting mainly peripheral nerves

Elimination level of Leprosy: < 1/10000 (less than 1 case per 10000 population)
- India achieved level of elimination of Leprosy by 31st Dec 2005

Classification of leprosy:

Ridley Jopling classification:
- TT (Tuberculoid)
- BT (Borderline Tuberculoid)
- BB (Borderline borderline)
- BL (Borderline lepromatous)
- LL (Lepromatous Leprosy)

Operational Classification of Leprosy (according to skin smear positivity) to serve as a basis for Chemotherapy:
- Paucibacillary Leprosy (PBL) BI < 2
- Multibacillary Leprosy (MBL) BI > 2

Included types
- Indeterminate
- Polar tuberculoid (TT)
- Border tuberculoid (BT)
- Polar lepromatous (LL)
- Borderline lepromatous (BL)
- Mid-borderline (BB)

Multidrug therapy (MDT) in NLEP (Drugs)
- Rifampicin 600mg OAMS
- Dapsone 100mg daily
- Rifampicin 600mg OAMS
- Dapsone 100mg daily
- Clofazimine 300mg OAMS

Treatment duration
- 6 months
- 12 months

Follow up (after treatment) [clinical surveillance]
- Annually for 2 yrs
- Annually for 5 yrs

(BI: Bacteriological Index; OAMS: Once a month supervised)

Leprosy is often known as a 'Social disease'
- Is probably the oldest disease known to mankind

Mode of transmission of Leprosy:
- Droplet infection
- Contact transmission (Direct skin to skin or indirect with soil/fomites)
- Other routes:
  1) Breast milk from lepromatous mothers
  2) Insect vectors
  3) Tattooing needles
Diagnosis of leprosy under NLEP: is currently based on clinical grounds

- PBL: 1 - 5 skin lesions
- MBL: > 5 skin lesions

LEPROMIN TEST

- Test of CMI in Leprosy
- Test: 0.1 ml Lepromin intradermal on inner aspect of forearm
- Antigens used in Lepromin test:
  1) Dhamendra antigen (extensively used in India)
  2) Mitsuda antigen
- Readings: After 48 hours and after 21 days
- Reactions in Lepromin test:
  1) Early Reaction (FERNANDEZ REACTION)
  2) Late Reaction (LATE MITSUDA REACTION)
- Value of Lepromin test:
  1) IS NOT A DIAGNOSTIC TEST
  2) USES OF LEPROMIN TEST:
     i. Evaluation of CMI status of patients
     ii. Aid to confirm the classification of Leprosy
     iii. Estimation of prognosis of cases

SCABIES

- Is a transmissible ectoparasite skin infection characterized by superficial burrows, intense pruritus (itching) and secondary infection
- Scabies is caused by the mite Sarcoptes scabiei, variety 'hominis' (known as 'Itch mite')
- Drug of Choice for scabies: 5% Permethrin
- Scabies was the first disease of man with known cause
- Other treatment modalities for Scabies:
  25% Benzyl benzOate (2 applications).
  1% HCH (Gammaxene; lindane) (2 applications)
  5% Tetramis solution (3 daily applications)
  10% Sulphur ointment (4 daily applications)
  Crotamiton lotion (3 applications)
  Malathion (1. application)
  Ivermectin (Single dose)
  Neem oil (for persistent ca'ees)

In scabies, the impregnated female 'tunnels into the stratum corneum of the skin' and deposits eggs in the 'burrows'...

Scabies is sometimes classed as a sexually transmitted disease (STD): transmitted readily by skin-to-skin contact with an infected person...

- Scabies transmission cannot be prevented by using condoms
SEXUALLY TRANSMITTED INFECTIONS (STIS)

- Sexual disease is known as 'Venereal Disease'.
- Common sexually transmitted infections (STIs):

<table>
<thead>
<tr>
<th>STI</th>
<th>Causative agent</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 Classical STDs</td>
<td></td>
</tr>
<tr>
<td>Syphilis</td>
<td>Treponema pallidum</td>
</tr>
<tr>
<td>Gonorrhoea</td>
<td>Neisseria gonorrhoeae</td>
</tr>
<tr>
<td>Chancroid</td>
<td>Hemophilus ducreyi</td>
</tr>
<tr>
<td>LGV</td>
<td>Chlamydia trachomatis</td>
</tr>
<tr>
<td>Donovanosis</td>
<td>Calymmatobacterium granulomatis</td>
</tr>
<tr>
<td>HIV/AIDS</td>
<td>Human immunodeficiency virus</td>
</tr>
<tr>
<td>Hepatitis A</td>
<td>Enterovirus 72 (Picornavirus)</td>
</tr>
<tr>
<td>Hepatitis B</td>
<td>Hepadnavirus (Dane’s particle)</td>
</tr>
<tr>
<td>Hepatitis C</td>
<td>Hepacivirus</td>
</tr>
<tr>
<td>Hepatitis D</td>
<td>HDV</td>
</tr>
<tr>
<td>Genital and anal warts</td>
<td>Human Papilloma Virus</td>
</tr>
<tr>
<td>Scabies</td>
<td>Sarcoptes scabei</td>
</tr>
<tr>
<td>Pubic louse</td>
<td>Phthirus pubis</td>
</tr>
<tr>
<td>Trichomoniasis</td>
<td>Trichomonas vaginalis</td>
</tr>
</tbody>
</table>

- Other sexually transmitted agents include:
  - Streptococcus group B
  - Candida albicans
  - Campylobacter
  - Molluscum contagiosum
  - Ureaplasma urealyticum
  - Mycoplasma hominis
  - Entamoeba histolytica
  - Giardia lambia
  - Shigella
  - Human (alpha) herpes virus 1, 2
  - Human (beta) herpes virus 5

- The 1st effective treatment for a STD: Salvarsan (a treatment for syphilis)

- MC STI globally: Trichomoniasis

- Usual methods of case detection in a STD control programme:
  - Screening:
  - Contact tracing: Sexual partners of diagnosed patients are identified, located, investigated & treated
  - Cluster testing: Screening of all persons of either sex, who move in the same socio-sexual environment of the patient

SYNDROMIC APPROACH (Simplified STD Treatment)
The traditional method of diagnosing STDs is by laboratory tests. However, such tests are very often unavailable or too expensive. For this reason, Syndromic Management of STDs has been recommended by WHO since 1990 which is ‘based on symptoms and clinical signs’

- Importance of Syndromic Approach: Through this approach, a health worker at the most peripheral level without using laboratory support, can diagnose reproductive infections and accordingly prescribe treatment or advise referral of the patient

- Syndromes in Syndromic Approach:
Urethral discharge: Is usually due to gonococcal or non-gonococcal (chlamydial) urethritis.

Vaginal discharge: Is usually due to gonococcal or non-gonococcal cervicitis or vaginitis (trichomoniasis, candidiasis or bacterial vaginosis). Speculum examination for establishing diagnosis.

Genital ulcer: Due to syphilis, chancroid, LGV, granuloma inguinale or herpes infection.

Inguinal swelling (Bubo): Usually due to LGV

Lower abdominal pain/PID

ENDEMIC TREPONEMATOSES

<table>
<thead>
<tr>
<th>Treponemal Disease</th>
<th>Causative agent</th>
<th>Mode of transmission</th>
<th>Treatment of choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pinta</td>
<td>Treponema carateum</td>
<td>Non venereal (direct contact with infectious lesions)</td>
<td>Benzathine Penicillin G</td>
</tr>
<tr>
<td>Yaws</td>
<td>Treponema pertanue</td>
<td>Non venereal (direct contact with secretions from infectious lesions, fomites, insect vectors)</td>
<td></td>
</tr>
<tr>
<td>Endemic syphilis</td>
<td>Treponema pallidum</td>
<td>Non venereal</td>
<td></td>
</tr>
<tr>
<td>Syphilis</td>
<td>Treponema pallidum</td>
<td>Venereal</td>
<td></td>
</tr>
</tbody>
</table>

YAWS

- Also known as Pian, Bubas, Framboesia
- Causative agent: Treponema pertanue
- Yaws has been declared eliminated from India in 2007
- Man is the only known reservoir of Yaws (but no natural immunity)
- Yaws provide partial immunity to venereal syphilis (just like sickle cell trait provide partial immunity to Falciparum Malaria & Dengue provide partial immunity to yellow fever)
- IP: 3-5 days

HIV/AIDS

- Causative organism: Human immunodeficiency virus (HIV) [Human T-Lymphotropic virus - III (HTLV - III); Lymphadenopathy virus (LAP)]
- Chances of HIV transmission in presence of STDs: Increases 8 - 10 times
- AIDS (Acquired Immunodeficiency Syndrome) is also known as 'Slim Disease'
- MC Opportunistic Infection (01) in AIDS
  - World: Pneumocystis carinii pneumonia (PCP)
  - India: Tuberculosis (> Candida > PCP)
- HIV transmission in India:

<table>
<thead>
<tr>
<th>Route of transmission</th>
<th>Percentage of total cases</th>
<th>Efficiency of route</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sexual</td>
<td>87</td>
<td>0.01 - 1%</td>
</tr>
<tr>
<td>Blood and blood products</td>
<td>1</td>
<td>&gt; 90%</td>
</tr>
<tr>
<td>Sharing needles/ syringes</td>
<td>2</td>
<td>3%</td>
</tr>
<tr>
<td>Mother to child transmission</td>
<td>4</td>
<td>3%</td>
</tr>
</tbody>
</table>

- HIV/AIDS statistics in India [2012]:
  - Total no. of HIV cases: 2.39 million
  - Prevalence of HIV: 0.31%
  - Tamil Nadu in India has the largest number of HIV/ AIDS cases
MC age group having AIDS cases: 30 - 49 years (Specially 30-34y)
First case of HIV/AIDS: 1986 (Chennai, Tamil Nadu)

Mother to Child Transmission (MTCT) of HIV:
- MTCT in developing countries (India): 30%
- MTCT in developed countries: 20%
- Prevention of MTCT in India:

<table>
<thead>
<tr>
<th>Modality</th>
<th>jDose/ type</th>
<th>Reduction in MTCT by</th>
<th>Post-modality MTCT in India</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zidovudine</td>
<td>Mother: 300 mg BD from 36 wks POG + 300 mg 3h during delivery Child: 2mg/kg 6h X 6 wks</td>
<td>66%</td>
<td>10%</td>
</tr>
<tr>
<td></td>
<td>Nevirapine: Mother: 200 mg at labor onset Child: 2mg/kg within 72 hrs of birth</td>
<td>50%</td>
<td>15%</td>
</tr>
<tr>
<td>Caesarean section</td>
<td>Elective CS</td>
<td>50%</td>
<td>15%</td>
</tr>
</tbody>
</table>

- Risk of HIV transmission with prolonged breast feeding: 12 - 15%

National AIDS Control Programme, India:
- National AIDS Control Programme (NACP) launched: 1987
- Screening tests used: ELISA/ RAPID/ SIMPLE (ERS)
- Confirmatory diagnostic test used: Western Blot Assay (WBA)

5F. CHRONIC NON-COMMUNICABLE DISEASES

PREVENTION AND CONTROL OF NON-COMMUNICABLE DISEASES (NCDs)
- Population strategy:
  - Focus on control of underlying causes (risk factors) in whole populations, 'not merely by individuals'
  - Principle: Small changes in risk factor levels in total populations can achieve the biggest reduction in mortality, thus aim should be 'to shift the whole curve or risk factors towards biological normality'

- Specific interventions:
  1) Dietary changes: PRUDENT DIET- DIETARY GOALS
  2) Primordial prevention

- High risk strategy:
  - Identifying risk: by using simple tests for blood pressure, serum cholesterol measurement
- Specific advice: those identified at 'high' risk

- Secondary prevention:
  - Aim: to prevent recurrence and progression of NCDs
  - Most promising results have come from beta-blockers

^CORONARY HEART DISEASE (CHD)
- Coronary Heart Disease (CHD) or Ischemic Heart Disease (mhf):
  Impairment of heart function due to inadequate flow to heart as compared to its needs, caused by obstructive changes in coronary circulation to heart. CHD manifests as:
  - Angina pectoris
• Myocardial infarction
• Irregularities of the heart
• Cardiac failure
• Sudden death

○ CHD causes 25-30% of deaths in most industrialized countries

6 WHO has drawn attention to 'CHD as our modern epidemic'

○ Risk factors for CHD:

<table>
<thead>
<tr>
<th>Non-modifiable risk factors</th>
<th>Modifiable risk factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>Cigarette smoking</td>
</tr>
<tr>
<td>Sex</td>
<td>High blood pressure</td>
</tr>
<tr>
<td>Family history</td>
<td>Elevated serum cholesterol</td>
</tr>
<tr>
<td>Genetic factors</td>
<td>Diabetes</td>
</tr>
<tr>
<td>Personality Type A</td>
<td>Obesity</td>
</tr>
<tr>
<td></td>
<td>Lack of exercise</td>
</tr>
<tr>
<td></td>
<td>Sedentary habits</td>
</tr>
<tr>
<td></td>
<td>Stress and anger</td>
</tr>
<tr>
<td></td>
<td>High alcohol intake</td>
</tr>
<tr>
<td></td>
<td>OCPs and hyperoestrogenemia</td>
</tr>
</tbody>
</table>

Single most useful test for identifying high risk for CHD: Blood Pressure
Mean serum cholesterol level associated with high risk of CHD: >200 mg/dl
High alcohol intake level as independent risk factor for CHD: > 75 gm per day

PRUDENT DIET (DIETARY GOALS): Dietary modification is the principal preventive strategy in the prevention of CHD. WHO recommended changes: [Main goal cholesterol: HDL ratio < 3.5]

• Reduction of fat intake to < 20-30% of total energy intake
• Consumption of saturated fats <10% of total energy intake
• Reduction in dietary cholesterol to <100 mg/1000 kcal/day
• Increase in complex carbohydrate consumption
• Reduction of salt intake to < 5 gms per day
• Avoidance of alcohol consumption

HYPERTENSION

○ RULE OF HALVES: Hypertension is an 'Iceberg disease'

• Only about half of hypertensive subjects in general population of most of the developed countries are aware of condition, only half of those aware of the problem were being treated & only half of those treated were considered adequately treated

○ Hypertension (HT) is the MC cardiovascular disorder

○ Tracking of Blood Pressure: If BP of individuals were followed up over a period of years from early childhood into adult life, those having high BP would continue into same 'track' as adults

• Low BP tends to remain low & high BP tends to become higher as individuals grow older

○ Recommended salt intake to prevent HT: < 5 gm per day

STROKE (APOPLEXY)

○ WHO definition: Rapidly developing clinical signs of local (or global) cerebral dysfunction, lasting more than, 24 hours or leading to death, with no apparent cause other than vascular origin

• 24 hour threshold EXCLUDES transient ischemic attacks (TIA)

○ MCC of stroke or apoplexy: Cerebral thrombosis
RHEUMATIC FEVER (RF)

- **Causative agent:** Group A beta hemolytic streptococci: (Serotype M type 5)
- RF is a disease of childhood & adolescence (5 - 15yrs) affecting both sexes equally
- **Diagnosis of RF is by employing Revised Jones criteria:** 2 Major OR 1 Major + 2 minor PLUS evidence of preceding group A Streptococcal infection

<table>
<thead>
<tr>
<th>Diagnostic categories</th>
<th>Criteria</th>
</tr>
</thead>
</table>
| **Major manifestations (M)** *(Mnemonic: JONES)* | Joints: Migratory polyarthritis  
O shape of heart: Carditis  
Nodules (Subcutaneous)  
Erythema marginatum  
Sydenham's Chorea |
| **Minor manifestations (m)** | Clinical: Fever, polyarthralgia  
Laboratory: elevated acute phase reactants (ESR, CRP, TLC) |
| **Supporting evidence of a preceding streptococcal within the last 45 days** | ECG: Prolonged PR interval  
Elevated or rising ASO  
Positive throat culture  
Rapid antigen test for Grp A Streptococci  
Recent Scarlet fever |

- **Prevention of RF with Benzathine benzyl penicillin:**
  - **Type of prevention**  
    - **Primary**  
      - Adults: 1.2 million units  
      - Children: 600,000 units  
      - Remarks: Single dose intramuscular  
    - **Secondary**  
      - Adults: 1.2 million units  
      - Children: 600,000 units  
      - Remarks: 3 weekly intervals for 5 yrs or till 18 yrs age (whichever is later)  

- MC cardiac lesion seen in RF:  
  - In children: Mitral stenosis  
  - In adults: Mitral regurgitation

- RF is not a communicable disease, but it results from a communicable disease (streptococcal pharyngitis)
- Prevalence of RHD in India: 5 - 7 per 1000 in 5 - 15 yrs age group

**CANCERS**

- The total cancer burden (in decreasing order) globally:  
  - Lung cancer  
  - Colo-rectal cancer  
  - Breast cancer  
  - Prostate cancer

- **Most common cancers in Males and Females:**
  - **Most common cancer**  
    - **India**  
      - Males: Oro-pharyngeal CA  
      - Females: Breast CA  
    - **World**  
      - Males: Lung CA  
      - Females: Breast CA

<table>
<thead>
<tr>
<th></th>
<th>Most common cancer</th>
<th>Most common cancer related cause of death</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>India</strong></td>
<td>World</td>
<td>India</td>
</tr>
<tr>
<td>Males</td>
<td>Oro-pharyngeal CA (Aero-digestive CA)</td>
<td>Lung CA</td>
</tr>
<tr>
<td>Females</td>
<td>Breast CA</td>
<td>Breast CA</td>
</tr>
</tbody>
</table>

Most common cancer among females in India is Breast CA followed by cervical CA
o Global Incidence and mortality of cancers (in decreasing order).

<table>
<thead>
<tr>
<th>Incidence</th>
<th>Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Males</strong></td>
<td><strong>Females</strong></td>
</tr>
<tr>
<td>Lung cancer</td>
<td>Breast cancer</td>
</tr>
<tr>
<td>Stomach cancer</td>
<td>Cervix-uteri cancer</td>
</tr>
<tr>
<td>Prostate cancer</td>
<td>Colo-rectal cancer</td>
</tr>
<tr>
<td>Colo-rectal cancer</td>
<td>Lung cancer</td>
</tr>
</tbody>
</table>

o Most common cancers in India:

<table>
<thead>
<tr>
<th>Incidence</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Males</strong></td>
</tr>
<tr>
<td>Oro-pharyngeal cancer</td>
</tr>
<tr>
<td>Oesophageal cancer</td>
</tr>
<tr>
<td>Stomach cancer</td>
</tr>
<tr>
<td>Lower respiratory tract cancer</td>
</tr>
</tbody>
</table>

O Beer consumption is associated with: rectal cancer

**OBESITY**

**CRITERIA FOR ASSESSMENT OF OBESITY:**

o **Body Mass Index (Quetelet’s Index):**

\[
\text{BMI} = \frac{\text{Weight (Kg)}}{\text{Height}^2 (m^2)}
\]

- Classification of adults according to BMI:

<table>
<thead>
<tr>
<th>Classification</th>
<th>BMI for Global population</th>
<th>BMI for Asian population*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>&lt;18.5</td>
<td>&lt;18.5</td>
</tr>
<tr>
<td>Normal BMI</td>
<td>18.5-24.99</td>
<td>18.5-24.99</td>
</tr>
<tr>
<td>Overweight</td>
<td>25.0-29.99</td>
<td>23.0-26.99</td>
</tr>
<tr>
<td>Obesity</td>
<td>&gt;30.0</td>
<td>&gt;27.0</td>
</tr>
</tbody>
</table>

- Classification of obesity based on BMI:

<table>
<thead>
<tr>
<th>Classification</th>
<th>BMI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-obese (overweight)</td>
<td>25.0-29.99</td>
</tr>
<tr>
<td>Obesity Grade I</td>
<td>30.0-34.99</td>
</tr>
<tr>
<td>Obesity Grade II</td>
<td>35.0-39.99</td>
</tr>
<tr>
<td>Obesity Grade III</td>
<td>&gt;40.0</td>
</tr>
</tbody>
</table>

o Pondera I index
o Broca index
o Lorentz formula
o Corpulence index:
Skin fold thickness (SET):
- "Herpenden skin callipers" are good for estimation of SFT
- Measurement at 4 sites: Mid-triceps, biceps, sub-scapular, supra-iliac regions
  1) Sum > 50 mm in girls indicate obesity
  2) Sum > 40 mm in boys indicate obesity
- Single best measurement site of -skin fold thickness: Mid; triceps
  1) > 18 mm in boys indicate obesity
  2) > 32 mm in girls indicate obesity

Waist circumference (WC) & waist: hip ratio (WHR)
- Good predictor of risk of cardiovascular diseases
- High WHR indicates abdominal fat accumulation
  1) WHR > 1.0 in men indicate obesity
  2) WHR > 0.85 in women indicate obesity;

Most prevalent form of malnutrition: Obesity

NEW GUIDELINES FOR OBESITY IN INDIA (2009)

<table>
<thead>
<tr>
<th>Classification</th>
<th>BMI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal weight</td>
<td>18.5-22.99</td>
</tr>
<tr>
<td>Overweight</td>
<td>23.0-24.99</td>
</tr>
<tr>
<td>Obesity</td>
<td>&gt;25.0</td>
</tr>
<tr>
<td>Require bariatric surgery</td>
<td>&gt;32.5</td>
</tr>
</tbody>
</table>

Cut-offs for waist circumference:

<table>
<thead>
<tr>
<th>Populations</th>
<th>Cut-off for WC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indian</td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>90 cms</td>
</tr>
<tr>
<td>Females</td>
<td>80 cms</td>
</tr>
<tr>
<td>Global</td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>102 cms</td>
</tr>
<tr>
<td>Females</td>
<td>88 cms</td>
</tr>
</tbody>
</table>

BLINDNESS

WHO defines Blindness as 'visual acuity of <3/60 in better eye with best possible correction'

National Programme for Control of Blindness (NPCB), India defines Blindness as 'visual acuity of <6/60 in better eye with best possible correction'

Comparison of WHO and NPCB definitions:

<table>
<thead>
<tr>
<th>WHO - ICD</th>
<th>Visual Acuity</th>
<th>NPCB, India</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Vision</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Category 1</td>
<td>&lt;6/18 - 6/60</td>
<td>Low Vision</td>
</tr>
<tr>
<td>Category 2</td>
<td>&lt;6/60-3/60</td>
<td>Economic Blindness</td>
</tr>
<tr>
<td>Blindness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Category 3</td>
<td>&lt;3/60-1/60</td>
<td>Social Blindness</td>
</tr>
<tr>
<td>Category 4</td>
<td>&lt;1/60 - PL+</td>
<td>Manifest Blindness</td>
</tr>
<tr>
<td>Category 5</td>
<td>PL-</td>
<td>Absolute Blindness</td>
</tr>
</tbody>
</table>

(PL+: Perception of Light; PL-: No perception of light)
**Prevalence of Blindness (World):** 0.6% (Visual acuity <3/60) [2002]

**Causes of Blindness in World:**
- Cataract (MCC)
- Glaucoma (2nd MCC)

**Prevalence of Blindness (India):** 1.05% (Visual acuity <6/60) [2012]

**Causes of Blindness in India:**
- Cataract (63%) - MCC of Blindness in India
- Refractive Error (2nd MCC)

**VISION 2020 - THE RIGHT TO SIGHT**

**Vision 2020 - The Right To Sight:** A global initiative by WHO and International NGOs to reduce avoidable (preventable and curable) blindness by 2020

<table>
<thead>
<tr>
<th>Global Vision 2020 (5 diseases)</th>
<th>Indian Vision 2020 (7 diseases)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cataract</td>
<td>Cataract</td>
</tr>
<tr>
<td>Refractive errors and low vision</td>
<td>Refractive errors and low vision</td>
</tr>
<tr>
<td>Childhood blindness</td>
<td>Childhood blindness</td>
</tr>
<tr>
<td>Trachoma</td>
<td>Trachoma (Focal)</td>
</tr>
<tr>
<td>Onchocerciasis</td>
<td>Glaucoma</td>
</tr>
<tr>
<td></td>
<td>Diabetic retinopathy</td>
</tr>
<tr>
<td></td>
<td>Corneal blindness</td>
</tr>
</tbody>
</table>

**WHO STRATEGIES TO COMBAT DISEASES**

- **Catch up - Keep up - Follow up strategy:** WHO Measles elimination strategy comprises a 3-Part Vaccination strategy:
  - *Catch up:* One time nationwide, vaccination campaign targeting all children 9 months to 14 years of age, irrespective of history of Measles disease or vaccination status
  - *Intensive PULSE strategy:* Is for prevention & control of Poliomyelitis
  - *Roll Back Initiative:* Malaria
- **SAFE Strategy:** Recommended by WHO for global elimination of blinding trachoma
  - Surgery
  - Antibiotic use
  - Facial cleanliness
  - Environmental improvement
  - Malaria
CHAPTER 8

NATIONAL HEALTH PROGRAMMES, POLICIES AND LEGISLATIONS IN INDIA

8A. NATIONAL HEALTH PROGRAMMES

Some Important Health Programmes of India

- National Rural Health Mission (NRHM), 2005-12
- National Tuberculosis Programme (NTP), 1962
- Revised National Tuberculosis Control Programme (RNTCP), 1992
- National Family Planning Programme: 1951
- National AIDS Control Programme (NACP): 1987
- National Malaria Control Programme (NMCP): 1953
- National Malaria Eradication Programme (NMEP): 1958
- Modified Plan of Operation (MPO): 1977
- National Vector Borne Disease Control Programme (NVBDCP): 2003-04
- National Leprosy Control Programme: 1955
- Integrated Child Development Services (ICDS) Scheme: 1975
- National Programme for Control of Blindness (NPCB): 1976


- National Rural Health Mission (NRHM) 2005-12: One of the key components of the is.to provide every village in the country with a trained female community health activist - ASHA (Accredited Social Health Activist)

- Proposed population norm: 1 ASHA worker per 1000 population

- ASHA is expected to act as,
  - Interface between: Community and Health care system
  - Bridge between: ANM and village
  - Accountable to: Panchayat

- Selection criteria of ASHA:
  - Woman resident of local community
  - Preferably 25 - 45 years age
  - Literate with formal education upto VIII class

- Responsibilities of ASHA:
  - create awareness on health and its social determinants and mobilize the community towards local health planning and increased utilization and accountability of the existing health services
  - Promote good health practices and provide a minimum package of curative care as appropriate and feasible and make timely referrals
  - Provide information on determinants of health, on existing health services and the need for timely utilization of services
  - Counsel women on aspects of reproductive and child health
  - Mobilise the community and facilitate them in accessing health and health related services provided by the government
  - Act as a depot older for essential provisions like ORS, IFA tablets, chloroquine, disposable delivery kits, oral pills & condoms
  - Provide primary medical care and act as DOTS provider
  - Help develop a comprehensive village health plan
• arrange escort/accompany pregnant women and children requiring treatment/admission to nearest health facility
• Be a part of JSY (Janani Suraksha Yojana) and help reduce MMR
  o Core unit of planning, budgeting and implementation: District

8A2. National Leprosy Elimination Programme (NLEP)
  o Infrastructure norms under ‘programme:
    • SET Centre: one per 20,000 - 25,000 population
    • Urban Leprosy Centre (ULC): one per 50,000 population
    • Leprosy Control Unit (LCU): one per 4.5 Lac population
  o Accompanied MDT: If patient is unable to come to collect his/her MDT from clinic, any responsible person from family or village can collect it

Lepra Reactions
  o Lepra Reactions: Is an inflammation that can affect skin patches, nerves, eyes and in'few case, internal organs. They can occur anytime in a leprosy patient
  o Types of Lepra Reactions:
    | Type I Lepra reactions | Type II Lepra reactions |
    | - Reversal reactions  |  Erythema Nodosum Leprosum (ENL) |
    | More common in Borderline leprosy | More common in LL and BL leprosy |
    | DOC is Prednisolone (steroid) | DOC is |
      | Mild cases: Analgesics or anti-pyretics | |
      | Severe cases: Prednisolone (steroid) | |
      | During steroid withdrawal: Clofazimine | |

Multi-drug Therapy (MDT)
  o Treatment of Single Skin Lesion (SSL) of Leprosy:
    • PREVIOUSLY: ROM therapy [NOW NOT USED]
      1) Rifampicin 600 mg
      2) Ofloxacin 400 mg
      3) Minocycline 100 mg
    • CURRENTLY: 6 month treatment as for Paucibacillary (PBL) Leprosy (Rifampicin and dapsone one for 6 months)
  o MDT in Leprosy: Paucibacillary (PBL)
    | Day 1: Supervised monthly |
    | Rifampicin 600 mg |
    | Dapsone 100 mg |
    | Day 2 - 28: Daily |
    | Dapsone 100 mg |
    | Duration of treatment: 6 months. |

Multibacillary Leprosy (MBL)
    | Day 1: Supervised monthly |
    | Rifampicin 600 mg |
    | Clofazimine 300 mg |
    | Dapsone 100 mg |
    | Day 2 - 28: Daily |
    | Clofazimine 50 mg |
    | Dapsone 100 mg |
    | Duration of follow-up: 2 years |

Duration of treatment: 12 months
Duration of follow-up: 5 years
8A3. National AIDS Control Programme (NACP)

HIV Testing in India
Under National AIDS Control Programme (India):
• Screening of HIV: E/R/S
  1) ELISA (E) Test
  2) RAPID (R) Test
  3) SIMPLE (S) Test
• Confirmatory diagnosis of HIV: Western Blot Assay

Screening of HIV:
- Strategy I: One out of three screening tests (E/R/S) are used
  1) Done for screening every blood Unit before transfusion
  2) Does not recommend its use for diagnosis of HIV in a person
- Strategy II: Two out of three screening tests (E/R/S) are used
  1) Done for screening person who is symptomatic with any one of AIDS defining illness (NACO guidelines)
- Strategy III: All three screening tests (E/R/S) are used
  1) Done for screening person who is asymptomatic

Western Blot Assay (Immunoblot): Is a method to detect a specific protein in a given sample of tissue homogenate or extract
- Used as a confirmatory test for HIV (NACP, India)
- Based on detecting: Viral core protein (p24) and envelope glycoprotein (gp 41)

8A4. National Polio Elimination Programme (NPEP)

Acute Flaccid Paralysis (AFP) Surveillance
- Acute Flaccid Paralysis (AFP): Any child less than 15 years age who has sudden onset of flaccid paralysis or paralytic illness in a person of any age when polio is suspected.
- Acute Flaccid Paralysis (AFP) Surveillance is used to identify reservoirs of wild poliovirus transmission in National Polio Surveillance Project
  - Acute: rapid progression from onset to maximum paralysis
  - Flaccid: loss of muscle tone, floppy as opposed to spastic, or rigid.
  - Paralysis: weakness, loss of voluntary movement
- Differential diagnosis of AFP: Descending asymmetric flaccid LMN paralysis
  - Guillain Barre Syndrome (Cytologico-albuminic dissociation)
  - Transverse myelitis (Normal CSF, sensory loss bladder dysfunction)
  - Traumatic neuritis (any age, only one leg involved)
  - Other Non-polio enteric viruses: Coxsackie-B, ECHO, Enterovirus type 70 and 71, Mumps
- AFP case investigation: Is done within 48 hours of notification
- Stool sample collection: From every case of AFP, stool samples are collected for diagnosis of cases of poliomyelitis
  - 2 stool samples
  - 24 - 48 hours apart
  - Within 14 days of onset of paralysis (or maximum 8 weeks)
  - Each 8 grams (adult thumb size) weight
  - Transport to laboratory in 'Reverse cold chain'. (+2° to +8° C)
- 2 critical WHO indicators of AFP surveillance and lab performance
  - Non-polio AFP rate in children < 15 years of age > 1/100,000
• Reported AFP cases with 2 stool specimens collected < 14 days since paralysis onset (Target > 80%)

  o Outbreak Response Immunization (ORI): Following stool specimen collection, ORI is organized in community where all 0 - 59 months (0 - 5 years) aged children are given OPV (irrespective of their previous immunization status); Atleast 500 children are vaccinated

  o Follow-up examination: Is done 60 days after the onset of paralysis to confirm the presence or absence of residual weakness (activity completed before 70th day)

**Pulse Polio Immunization (PPI) Programme in India**

  o Launched in India: 1995-96 (1st round on 9th Dec 1995 and 20th Jan 1996)
    • First PPI targeted children < 3 years age
    • Later on, WHO recommended age group be 0-5 years (1996-97)

  o Meaning of 'Pulse': Sudden, simultaneous mass administration of Oral Polio Vaccine (OPV) on a single day to 'all children 0-5 years age', irrespective of their previous immunization status
    • PPI replaces wild virus with vaccine virus from the community
    • PPI is overknnd above routine immunization

  o Intensive Pulse Polio Immunization (IPP): Intensification of PPI has been done by adding additional rounds at .fixed booths followed by 'house-to-house search-and-vaccinate' component

  o Success of PPI (India) i 35000 cases annually in 1995-96 to <500 cases annually after year 2000 [1 CASE IN 2012]

**8A5. RCH Programme**

Components of Reproductive and Child Health Programme

  • Community Needs Assessment Approach (CNAA)
  • Integrated packages of services for mother and child
  • MTP services at PHC and safe abortion
  • Control and prevention of RTI/ STI
  • Adolescent health
  • Services in urban slums
  • Improving quality of services
  • Unmet needs and sub-centre action plans
  • Communication strategy
  • Gender sensitivity
  • Greater involvement of Panchayati Raj Institutions (PRIs), NGOs and community

Iron Folic Acid (IFA) tablets

  • Iron and Folic Acid content per IFA tablet:
    1. Adult tablet: 100 mg elemental iron and 500 meg folic acid
    2. Pediatric tablet: 20 mg elemental iron and 100 meg folic acid
Prevalence of Iron Deficiency Anemia (IDA) in India [NFHS - 3, 2005 - 06]

<table>
<thead>
<tr>
<th>Group</th>
<th>Anemia cut off level</th>
<th>Anemia type</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children (6-59 months)</td>
<td>&lt;11.0 gm/dl</td>
<td>Any</td>
<td>70%</td>
</tr>
<tr>
<td></td>
<td>10.0 - 10.9 gm/dl</td>
<td>Mild</td>
<td>27%</td>
</tr>
<tr>
<td></td>
<td>7.0 - 9.9 gm/dl</td>
<td>Moderate</td>
<td>40%</td>
</tr>
<tr>
<td></td>
<td>&lt;7.0 gm/dl</td>
<td>Severe</td>
<td>03%</td>
</tr>
<tr>
<td>Women (15 - 49 years)</td>
<td>&lt;12.0 gm/dl</td>
<td>Any</td>
<td>55%</td>
</tr>
<tr>
<td></td>
<td>10.0 - 11.9 gm/dl</td>
<td>Mild</td>
<td>38%</td>
</tr>
<tr>
<td></td>
<td>7.0 - 9.9 gm/dl</td>
<td>Moderate</td>
<td>15%</td>
</tr>
<tr>
<td></td>
<td>&lt;7.0 gm/dl</td>
<td>Severe</td>
<td>02%</td>
</tr>
<tr>
<td>Men (15 - 49 years)</td>
<td>&lt;13.0 gm/dl</td>
<td>Any</td>
<td>24%</td>
</tr>
<tr>
<td></td>
<td>12.0 - 12.9 gm/dl</td>
<td>Mild</td>
<td>13%</td>
</tr>
<tr>
<td></td>
<td>9.0 - 11.9 gm/dl</td>
<td>Moderate</td>
<td>10%</td>
</tr>
<tr>
<td></td>
<td>&lt;9.0 gm/dl</td>
<td>Severe</td>
<td>01%</td>
</tr>
</tbody>
</table>

8A6. Revised National Tuberculosis Control Programme (RNTCP)

**Objectives of RNTCP**
- To achieve a cure rate of atleast 85% through administration of short course chemotherapy (SCC) and
- To achieve a case detection,rate of 70% (only after having achieved the desired cure rate)

**National Tuberculosis Programme (NTP) vs RNTCP**

<table>
<thead>
<tr>
<th>Objective</th>
<th>NTP, 1962</th>
<th>RNTCP, 1992</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operational targets</td>
<td>Early diagnosis &amp; treatment</td>
<td>Breaking chain of transmission</td>
</tr>
<tr>
<td>Diagnosis</td>
<td>1. More emphasis on X-rays 2. 2 sputum smears 3. 1 SS +ve considered a case</td>
<td>1. Mainly sputum microscopy 2. 3 sputum smears 3. 1 SS +ve not a case</td>
</tr>
</tbody>
</table>

- Under RNTCP, active case finding is not pursued: Case finding is passive.

**Some Important Working Definitions in RNTCP**
- **NEW CASE:** A person suffering from TB who has *never taken treatment or took treatment for <4 weeks (1 month)*
- **CURED:** Sputum smear positive (SS +ve) who has completed treatment, and had *sputum smear negative (SS -ve) on atleast 2 separate occasions with one at the end* (completion of treatment)
- **RELAPSE:** A person *declared cured returns back as SS +ve*
- **FAILURE:** A person on treatment who is SS +ve at or after 5 nmonths of treatment
- **DEFAULTER:** A person who, at any time after registration, *has not taken afai-TB.drugs for 2 months or more consecutively*
Categorization and Treatment Regimens in RNTCP

<table>
<thead>
<tr>
<th>Category</th>
<th>Type of patient</th>
<th>Regimens</th>
<th>Duration (months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cat I</td>
<td>New SS +ve Serious ill SS -ve Seriously ill extra-pulmonary</td>
<td>2(HRZE)_3, 4(HR)_3</td>
<td>6</td>
</tr>
<tr>
<td>Cat II</td>
<td>SS +ve relapse SS +ve failure - ; ; SS +ve treatment; after default</td>
<td>2(HRZES)_3</td>
<td></td>
</tr>
<tr>
<td>Cat III</td>
<td>SS -ve Non-seriously ill extrapulmonary</td>
<td>2(HRZ)_3, 4(HR)_3</td>
<td>6</td>
</tr>
<tr>
<td>Cat IV*</td>
<td>MDR - TB</td>
<td>4(KOCZEEt), 12-18 (OCEEt)</td>
<td>18-24</td>
</tr>
</tbody>
</table>

(* Category IV (DOTS PL US): For MDR cases; pilot projects undertaken in Gujarat)

- Daily self-administered Noh-DOTS regime: ONLY if there are adverse reactions to drugs or patients compliance is not possible

<table>
<thead>
<tr>
<th>Non-DOTS regime 1 (ND1)</th>
<th>Non-DOTS regime 2 (ND2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulmonary (SS+ve) seriously ill Extra-pulmonary Seriously ill</td>
<td>Pulmonary (SS-ve) not seriously ill Extra-pulmonary not seriously ill</td>
</tr>
<tr>
<td>2 (SHE) + 10 (FIE)</td>
<td>12 (HE)</td>
</tr>
</tbody>
</table>

- Letters: R - Rifampicin, E - Ethambutol, H - Isoniazid, S - Streptomycin, Z - Pyrazinamide, K - Kanamycin, O - Ofloxacin, Et - Ethionamide, C - Cycloserine
- Numbers: The numbers before letters refer to months of treatment (2 imply two months of treatment). The numbers after letters refer to frequency of administration per week (3 imply thrice per week)
- Seriously ill extra-pulmonary TB: Meningitis, disseminated TB, tuberculous pericarditis, peritonitis, bilateral or extensive pleurisy, spinal disease with neurological complaints, SS -ve TB with extensive perenchymal involvement, and intestinal and genito-urinary TB

Kindly note: Now category III has been merged in category I

NEW TUBERCULOSIS DIAGNOSIS (RNTCP) GUIDELINES IN INDIA

(w.e.f. 01 April 2009 onwards)

- **Tuberculosis Suspect:** Any person with cough 2 weeks or more
- **Number of specimen(s) required for diagnosis of smear positive pulmonary Tuberculosis:** TWO
  - Spot sputum specimen (Day 1)
  - Morning sputum specimen (Day 2)
- **Diagnosis of Tuberculosis:**
  - None sputum positive: Doubtful
  - One sputum positive: Sputum positive pulmonary tuberculosis
  - Two sputum positive: Sputum positive pulmonary tuberculosis
- **Management of clients:**
  - None sputum positive: Give antibiotics for 10 - 14 days
    - Cough relieved: Non-tuberculosis person
• Cough persists: REPEAT two sputum smear examinations
  1) None sputum positive: X-ray chest
     i) Findings suggestive of TB: Sputum negative tuberculosis; Start ATT
     ii) No findings suggestive of TB: Non-tuberculosis person
  2) One sputum positive: Sputum positive pulmonary tuberculosis; Start ATT
  3) Two sputum positive: Sputum positive pulmonary tuberculosis; Start ATT

  o One sputum positive: Start ATT
  o Two sputum positive: Start ATT

AFB sputum smears for follow-up during treatment
  o '2 sputum smears' over 2 days period

8A7. National Vector Borne Diseases Control Programme (NVBDCP)

Goals for Malaria
  o Goal under National Health Policy 2002: Reduction of mortality on account of malaria and other vector borne diseases (VBDs) by 50% by 2010 and efficient morbidity control
  o Millennium Development Goal 6: Combat HIV/AIDS, malaria and other diseases (by 2015)

Diagnosis of Malaria
  o Diagnosis of malaria in NVBDCP (malaria component): Peripheral blood smear
    • Two types of smear,
      1) Thick smear (SENSITIVITY): Presence of malaria
      2) Thin smear (SPECIFICITY): Species identification
    • Stain used: JSB (Jaswant Singh Bhattacharaya) Stain
  o Dipstick Test’ is used for the rapid diagnosis of Plasmodium falciparum (Pf)
    • Is a ‘rapid whole blood immuno-chromatographic test’
    • Uses 2 antibodies specific for Pf Histidine Rich Protein II Antigen

Modified Plan of Operation (MPO)
  o Modified Plan of Operation (MPO): In 1977, attempts at malaria eradication were given up and under review policy MPO was launched
  o Under MPO, areas were divided on the basis of API
    • Areas with API > 2: Regular insecticide spray (interval 6 weeks)
    • Areas with API < 2: Focal spray of DDT (or BHC or Malathion) if a case of Pf occurs in the area
  o Fever Treatment Depots (FTDs) and Drug Distribution Centers (DDCs)

<table>
<thead>
<tr>
<th>Fever Treatment Depots</th>
<th>Drug Distribution Centers</th>
</tr>
</thead>
<tbody>
<tr>
<td>FTD holder given training at PHC</td>
<td>DDC established (if no FTD)</td>
</tr>
<tr>
<td>2. Giving presumptive treatment</td>
<td>2. Impregnation of bed nets</td>
</tr>
<tr>
<td>3. Impregnation of bed nets</td>
<td>3. Promotion of larvivorous fishes</td>
</tr>
<tr>
<td>4. Promotion of larvivorous fishes</td>
<td></td>
</tr>
</tbody>
</table>

Insecticide treated Bed nets (ITBN)
  o Chemicals used in ITBN Program: Synthetic pyretheroids
    • Deltamethrin: 2.5 % in dosage of 25 mg/m²
• Cyfluthrin: 5% in dosage of 50 mg/m²
• Other insecticides used: Permethrin, Lambda-cyhalothrin, Etofenprox, a-cypermethrin

- Effectiveness of pyrethroids: for 6 - 12 months (Retreatment every 6 months)
- Household bed nets used for mosquito control:
  - No. of holes per square inch >150
  - Diameter of each hole < 0.0475 inch

8A8. National Iodine Deficiency Disorders Control Programme (NIDDCP)
- National Goitre Control Programme (NGCP) launched in 1962 (100% centrally sponsored)
- National Iodine Deficiency Disorders Control Programme (NIDDCP) was launched in 1992
- Indicators for epidemiological assessment of iodine deficiency:
  - Prevalence of goitre
  - Prevalence of cretinism
  - Urinary iodine excretion (BEST indicator)
  - Measurement of thyroid function (T₄, TSH)
  - Prevalence of neonatal hypothyroidism
- Daily requirement of iodine: 150 mg (<1 teaspoon over lifetime)
- Most widely used prophylactic public health measure against endemic goiter: Iodised salt
- Standards of iodised salt (Level of iodization in salt):
  - At production level: 30 ppm
  - At consumer level: 15 ppm

8A9. National Programme For Control Of Blindness (NPCB)
- NPCB was launched in 1976 as a '100% Centrally sponsored programme'
- India was the first country to launch a national level programme for blindness'
- Apex institute: National Institute of Ophthalmology (Dr. Rajendra Prasad Centre for Ophthalmic Sciences, AIIMS, New Delhi)
- NPCB cut-off for blindness: <6/60 in better eye
- Prevalence of blindness in general population: 1.05% (MCC: Cataract 62.6%)
- Cataract surgery rate required to clear the backlog of blindness: 400 operations per lac population
- IOL implantations in cataract surgeries: 83%

8A10. National Programme For Prophylaxis Against Blindness
- National Programme for prophylaxis against blindness in children caused due to Vitamin - A deficiency:
  Oral 5 doses (Total 17 lac IU) of Vitamin - A starting at 9 months age along with measles vaccine (1 lac IU), and then at 15 months age (2 lac IU) followed by a dose (2 lac IU) every 6 months till the age of 5 years
- Vitamin A solution contains 1 lac IU per ml solution
- Vitamin A is given in NIS of India till 5 years age (Recent guidelines)
  - At 9 months age: 1 lac IU (1 ml)
  - Every 6 months, till 5 years age: 2 lac IU (2 ml) each
  - Total dose given: 17 lac IU (9 doses)

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Night blindness</td>
<td>&gt; 1.0%</td>
</tr>
<tr>
<td>Bitot spots</td>
<td>&gt;0.5%</td>
</tr>
</tbody>
</table>

- Age group to determine Xerophthalmia problem: 6 months - 6 years
8A11. Integrated Management Of Neonatal And Childhood Illness (IMNCI)

- IMNCI is a strategy for reducing morbidity and mortality associated with major causes of childhood illness.
  - **Curative component** includes management of:
    1. Diarrhoea
    2. Measles
    3. Pneumonia
    4. Malaria
    5. Severe malnutrition and nutritional counseling
  - **Health promotive and preventive component**:  
    1. Breast feeding
    2. Nutritional counseling
    3. Vitamin A and iron supplementation
    4. Immunization
    5. Treatment of helminthic infestation

- **Target**: Children < 5 years age
- **Case management process**: Is presented in a series of charts (Mnemonic: A Case- Is Treated & Care Given)
  - Assess the young infant or child
  - Classify the illness
  - Identify the treatment
  - Treat the infant or child
  - Counsel the mother
  - Give follow-up care

8A12. School Eye Screening (SES) Programme

- Focus on middle school (V - VIII class) covering 10 - 14 years age
- One trained, teacher to handle 150 students
- 1 - day training for teacher at nearest PHC
- **Teacher Kit**: Vision screening cards, referral cards, tape/rope to measure 20 feet
- 150,000 children to be screened per block
- **Visual cut-off for referral to nearest PHC**: <6/9 in either eye

8A13. Others

**Stains commonly used in Public Health Programmes in India**

<table>
<thead>
<tr>
<th>Disease (organism)</th>
<th>Stain(s) used</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TB</strong> (Mycobacterium tuberculosis)</td>
<td>Zeihl Neelson (ZN) stain (RNTCP)</td>
</tr>
<tr>
<td></td>
<td>Auramine Rhodamine stain</td>
</tr>
<tr>
<td><strong>Leprosy</strong> (Mycobacterium leprae)</td>
<td>Modified Zeihl Neelson (Modified ZN) stain</td>
</tr>
<tr>
<td><strong>Malaria</strong> (Plasmodium)</td>
<td>Jaswant Singh Bhattacharya (JSB) stain</td>
</tr>
<tr>
<td><strong>Plague</strong> (Yersinia pestis)</td>
<td>Way son's stain</td>
</tr>
<tr>
<td></td>
<td>Giemsa stain</td>
</tr>
<tr>
<td><strong>Diphtheria</strong> (Corynebacterium diphtheriae)</td>
<td>Albert's stain.</td>
</tr>
<tr>
<td></td>
<td>Neisscr's stain</td>
</tr>
<tr>
<td></td>
<td>Ponder's stain</td>
</tr>
</tbody>
</table>
8B. HEALTH POLICIES AND LEGISLATIONS

Key Health Related Legislations passed in India
- The Quarantine Act, 1870
- The Vaccination Act, 1880
- The Child Marriage Restraint (SARDA) Act, 1929
- The Employees State Insurance (ESI) Act, 1948
- The Factories Act, 1948
- The Prevention of Food Adulteration (PFA) Act, 1954
- The Indian Medical Council (Prof. Conduct and Ethics) Act, 1956
- The Dowry Prohibition Act, 1961
- The Maternity Benefit Act, 1961
- The Registration of Births and Deaths Act, 1969
- The Medical Termination of Pregnancy (MTP) Act, 1971
- The Consumer Protection Act (COPRA), 1986
- The Environmental Protection Act (EPA), 1986
- The Infant Milk Substitutes, Feeding Bottles and Infant Food (Regulation of production, supply and distribution) Act, 1992
- The Pre-conception and Pre-natal Diagnostic Techniques (Prohibition of Sex Selection) [PNDT] Act, 1994
- The Transplantation of Human Organs Act, 1994
- The Biomedical Waste (Management and Handling) Rules, 1998
- The National Rural Employment Guarantee Act (NREGA), 2005
- The Protection of Women from Domestic Violence Act, 2005
- The Right to Information (RTI) Act, 2005

- Immediate objective: To address the unmet needs for contraception, health care infrastructure, and health personnel, and to provide integrated service delivery for basic reproductive and child health care
- Mid-term objective: To bring the TFR to replacement levels (TFR = 2.1) by 2010
- Long term objective: To achieve a stable population by 2045
- National Socio-demographic goals for 2010:
  - Address the unmet needs for basic reproductive and child health services, supplies and infrastructure
  - Make school education up to age 14 free and compulsory, and reduce drop outs at primary and secondary school levels to <20% for both boys and girls
  - Reduce IMR to <30 per 1000 live births
  - Reduce MMR to <100 per 100,000 live births
  - Achieve universal immunization of children against all VPDs
  - Promote delayed marriage for girls (not <18y and preferably >20y)
  - Achieve 80% institutional deliveries and 100% by trained persons
  - Achieve universal access to information/counseling, and services for fertility regulation and contraception with a wide basket of choices
  - Achieve 100% registration of births,' deaths, marriage & pregnancy
  - Contain the spread of AIDS, and promote greater integration between the management of RTI and STI: and the NACO
  - Prevent and control Communicable diseases
  - Integrate Indian Systems of Medicine (ISM) in RCH services
  - Promote vigorously the small family norm to achieve replacement levels of TFR (i.e., TFR = 2.1)
8B2. National Health Policy (NHP) 2002

- **Goals for 2005**
  - Eradicate Polio and Yaws
  - Eliminate Leprosy
  - Establish integrated system of Surveillance, National Health Accounts and Health Statistics
  - Increase state sector health spending from 5.5% to 7% of budget

- **Goals for 2007**
  - Achieve zero level of growth of HIV/AIDS

- **Goals for 2010**
  - Eliminate Kala Azar
  - Reduce mortality by 50% due to TB, malaria, Vector borne diseases and Water borne diseases
  - Reduce prevalence of blindness to 0.5%
  - Reduce IMR to 30/1000 and MMR to 100/Lac
  - Increase health expenditure as % of GDP from 0.9% to 2.0%
  - Increase share of central grants to constitute >25% of total health spending
  - Further increase state sector health spending to 8% of budget

- **Goals for 2015**
  - Eliminate Lymphatic Filariasis


- The NREGA Act 2005 has been passed by the Parliament to provide for **100 days of guaranteed wage employment in every year** to every household whose adult members volunteer to do ‘unskilled manual work’. Salient features:
  - A household is entitled for **100 days of work in a year**
  - Rural Households to register to local gram panchayat. ‘Job card’ to be given to every registered household (valid for 5 years)
  - Registered adult must submit an application to gram panchayat (for at least 14 days of continuous work)
  - One-third of persons who are given employment will be women.
  - Allotment for work: ‘within 15 days’, else he/she shall be provided unemployment allowance
  - The statutory minimum wage applicable to agricultural workers in the state is to be paid
  - Work will be provided ‘within 5 km’ of applicant's residence, else he/she is entitled to 10 per cent additional wages towards transport and living expenses
  - Implementation of the Act: Thq. ‘gram sabha’ will identify works to be taken up. The ‘panchayats’ have the principal responsibility for planning, implementation and monitoring
  - All agencies implementing NREGA will be accountable to the public for their work. Social audit and Right to Information will apply to each aspect of implementation

8B4. Others

**Legal age cut-offs in India**

- **Legal age of marriage in India**: 18 years for girls and 21 years for boys
- **Legal age for voting in India**: 18 years for both boys and girls
- **Legal age for employment in India**: > 14 years
- **Legal age of consent by a girl for sexual intercourse in India**: 18 years [NEW GUIDELINE]
- **Juvenile in India**: Boy less than 18 years and girl less than 18 years [NEW GUIDELINE]
- **Major in India**: 18 years and above
- **Tobacco products cannot be sold in India**: To age below 18 years
- **Alcohol cannot be sold in India**: To age below 25 years
Age groups in Public health

- **Ovum**: 0 - 2 weeks
- **Embryo**: 2 - 9 weeks
- **Fetus**: 9 weeks - delivery
- **Period of viability**: POG > 28 weeks
- **Perinatal period**: 28 weeks POG - 7 days post-delivery
- **Neonatal period**: 0 - 2.8 days after birth (0 - 4 weeks post-delivery)
  - Early neonatal period: 0 - 7 days after birth (1st week)
  - Late neonatal period: 8 - 28 days after birth (2 - 4 week)
- **Post neonatal period**: 29 days - 365 days after birth (1 month - 1 year)
- **Infancy**: Birth - 365 days (1st year of life)
- **Toddler**: 1 - 3 years age
- **Preschool child**: 3 - 6 years age
- **Adolescent**: 10 - 19 years age (WHO definition)
  - Early adolescence: - 13 years
  - Mid adolescence: 14 - 16 years
  - Late adolescence: 17 - 19 years
- **Youth**: 15 - 24 years age group (UN definition)
- **Reproductive age group**: 15 — 44 years or 15 - 49 years age
- **Geriatric age (India)**: > 60 years

Demography

- **Demography**: Is the scientific study of human population; It focuses attention on,
  - Changes in population size
  - Composition of population
  - Distribution of population in space

- **Demographic Processes**: 5 processes continuously on work in a population, thus determining its' size, composition and distribution
  - Fertility
  - Marriage
  - Mortality
  - Migration
  - Social mobility

Demographic cycle

- **Demographic cycle is closely related** to: Socio-economic progress of a country
- **Demographic cycle is based on**: Demographic gap (DG = Crude Birth Rate - Crude Death Rate)
- **There are 5 stages (phases) of demographic- Cycle** through which a nation passes

<table>
<thead>
<tr>
<th>Demographic cycle</th>
<th>Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stages</strong></td>
<td><strong>Phases</strong></td>
</tr>
<tr>
<td><strong>Stage I</strong></td>
<td>High stationary</td>
</tr>
<tr>
<td><strong>Stage II</strong></td>
<td>Early expanding</td>
</tr>
<tr>
<td><strong>Stage III</strong></td>
<td>Late expanding</td>
</tr>
<tr>
<td><strong>Stage IV</strong></td>
<td>Low stationary</td>
</tr>
<tr>
<td><strong>Stage V</strong></td>
<td>Declining</td>
</tr>
</tbody>
</table>
**Jlity related rates**

Total Fertility Rate (TFR): Average no. of children a woman would bear in her reproductive life span

Also known as 'Period Total Fertility Rate'...

- Gives magnitude of approximately 'completed family size' - no. of alive children in a family
- Obtained by summing single-year age-specific rates at a given time
- TFR (India): 2.68 [NFHS - 3, 2005 - 06]; 2.58 [2012]
- Replacement level of fertility (TFR = 2.1): TFR at which newborn girls would have an average of exactly 1 daughter over their lifetimes (women have just enough babies to replace themselves)

General marital fertility rate (GMFR): Annual number of live births per 1000 married women of childbearing age (15-49 years old, or 15-44 years old) mid year population

Gross Reproduction Rate (GRR): Measures the no. of daughters a woman would have in her lifetime if she experiences prevailing age-specific fertility, 'assuming no mortality'

- GRR or NRR = \( \frac{1}{2} \) TFR (approximately)
- To achieve NRR = 1: Couple Protection Rate (CPR) should be >60%

Net Reproduction Rate (NRR): Measures the no. of daughters a woman would have in her lifetime if she experiences prevailing age-specific fertility and mortality rates

- NRR = 1: Each generation of women is exactly reproducing itself
- To achieve NRR = 1: Couple Protection Rate (CPR) should be >60%

Crude birth rate (CBR): is the childbirths per 1,000 mid-year population

- CBR (India): 22.1 per 1000 population [2012]
- Relationship between Crude birth rate (CBR) and Total fertility rate (TFR):

\[
CBR = (8 \times TFR) + 1 \quad [\text{approx}] 
\]

Growth rate

- Growth rate (GR): Is the change in population over time, and can be quantified as the 'change in the number of individuals in a population per unit time' 

  - Annual growth rate (AGR): Crude birth rate (BR) minus crude death rate (DR)
  - Decadal growth rate (DGR): Change in population over a decade

- Growth rate (India): [Census 2011]
  - Annual growth rate (AGR): 1.64%
  - Decadal growth rate (DGR): 17.64%
    1) Highest DGR (2001-2011): Daman & Diu (53%),
    2) Lowest DGR (2001-2011): Nagaland (-0.47%),


- Growth rates of countries: [UN World's Population Prospects Report 2006]
  - Rank 1: Liberia (4.5%) Highest growth rate.
  - Rank 230: Cook's Islands (-2.23%) Lowest growth rate

- Relation between annual growth rate (AGR) and population: Since India's AGR is 1.64%, it is in very rapid growth phase and population of India will double in 35 - 47 years'

Sex ratio

- Sex Ratio: Is defined as number of females per thousand males

  - Interpretation of sex ratio:
    - Ideal Sex Ratio: Sex ratio of 1000 (equal no. of males & females)
    - Favourable Sex Ratio: Sex ratio > 1000 (Females > Males)
    - Unfavourable Sex Ratio: Sex ratio < 1000 (Females < Males)

- Sex Ratio (India): [Census 2011]
  - Sex ratio (India): 940 (Highly unfavourable)
  - Favourable sex ratio in India:
    1) Kerala: 1084
    2) Pondicherry: 1038
Census 2001 data for sex ratio (India).

<table>
<thead>
<tr>
<th>State with Highest Sex Ratio</th>
<th>Kerala</th>
<th>1084</th>
</tr>
</thead>
<tbody>
<tr>
<td>State with Lowest Sex Ratio</td>
<td>Haryana</td>
<td>877</td>
</tr>
<tr>
<td>UT with Highest Sex Ratio</td>
<td>Pondicherry</td>
<td>1038</td>
</tr>
<tr>
<td>UT with Lowest Sex Ratio</td>
<td>Daman &amp; Diu</td>
<td>618</td>
</tr>
</tbody>
</table>

- **Child Sex Ratio**: Is defined as number of female children 0 - 6 years age per thousand male children 0 - 6 years age.
  - **Child Sex Ratio (India)**: 914 [Census 2011] (Highly unfavourable)

**Dependency Ratio (DR)**

- **Dependency Ratio (DR)**: The proportion of persons above 65 years of age and children below 15 years of age are considered to be dependent on economically productive age group (15 - 64 years).

  \[
  \text{DR} = \frac{\text{Proportion of persons, < 15 years age} \text{and} \geq 65 \text{years age}}{\text{Proportion of persons 15 - 64 years age}}
  \]

- **DR (India) (per 100)**:

<table>
<thead>
<tr>
<th>Year</th>
<th>Total dependency</th>
<th>Child dependency</th>
<th>Old-age dependency</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>64</td>
<td>56</td>
<td>8</td>
</tr>
<tr>
<td>2010*</td>
<td>54</td>
<td>45</td>
<td>9</td>
</tr>
</tbody>
</table>

  (* projected)

- **DR (India) is 62 per 100 or 0.62**: It implies 62 non-earning people in India are dependent on 100 earning population.

**Literacy**

- **Literate (India)**: Any person who can read AND write, WITH understanding, IN ANY ONE language of India AND who is > 7 years of age (definition used in 1991 & 2001 Censuses)

- **Literacy Rate (India)**: 74% [Census 2011]
  - **Literacy rate by sex**: Males - 82% & Females - 65%
  - **Literacy rate by state**: Maximum 94% (Kerala) & Least 63% (Bihar)

- **International Literacy Day**: 8th September (every year)

**KEY FACTS OF CENSUS (INDIA) 2011**

- Frequency of census in India: Every 10 years (decadal)
- Legal basis of conducting census: The Census Act, 1948
- The census organization set up and working under: Ministry of Home Affairs
- Head of census organization: Registrar General and Census Commissioner
- Population enumeration: 9th - 28th February 2011
- Revisional round: 1st - 5th March 2011
- Houseless population enumeration: Night of 28th February 2011
- Districts covered: 640
- **Census Stop (Census Movement)**: 00.00 hrs 01 March 2011 (The referral time and date at which snapshot of the population is taken)
o FIRST TIME ACTIVITIES EVER DONE: BIOMETRY
  • Finger prints - 10
  • Iris scan
  • National population register
  • UID - Unique identification number

KEY FINDINGS OF CENSUS OF INDIA 2011
o 35 States & UTs; 640 districts; 6.41 lac villages
  o Total population 1210.1 million (M : F = 51.4 : 48.6)
    • Highest population Uttar Pradesh (199 million)
    • Lowest population Lakshadweep (64000)
  o Sex ratio 940
    • Highest sex ratio Kerala (1084); Puducherry (1038)
    • Lowest sex ratio Daman & Diu (618); Dadra & Nagar Ha. veli (775)
      Chandigarh (818); Delhi (866); Haryana (877)
  o Child Sex Ratio (0-6 y) 914
    • Highest CSR Mizoram (971)
    • Lowest CSR Haryana (830)
  o Literacy rate 74.04%
    • LR Males 82.14%
    • LR Females 65.46%
    • LR Highest Kerala (93.9%)
    • LR Lowest Bihar (63.8%)
  o Density of population 382
    • Highest density Delhi (11,297)
    • Lowest density Arunachal Pradesh (17)
  o Growth rate annual 1.64%
  o Growth rate decadal 17.64%
    • Highest DGR Dadra & Nagar Haveli (55.5%)
    • Lowest DGR Nagaland (-0.47%)

National Family Health Survey (NFHS)
  o Is a large-scale, multi-round survey conducted in a representative sample of households throughout India
  o 3 rounds of the survey have been conducted till date.
    • NFHS-1: 1992-93
    • NFHS-2: 1998-99
    • NFHS-3: 2005-06
  o" Main objective of NFHS survey: To provide state and national information for India on fertility, infant and child mortality, the practice of family planning, maternal and child health, reproductive health, nutrition, anaemia, utilization and quality of health and family planning services
  o Nodal agency for NFHS: International Institute for Population Sciences (IIPS), Mumbai
  o Few key findings of NFHS 3, India (2005-06):
    • Literacy rate: Male - 83%, Female - 59%
    • IMR: 57 per 1000 live births
    • TFR: 2.6
    • Contraceptive prevalence: 56% (Sterilization: 37%)
    • 3 AN check ups: 51%
    • Institutional deliveries: 41%
    • Delivery assisted by health professionals: 48%
    • Anemia - children: 79%
      Anemia - pregnancy: 58%
      Women experienced domestic violence: 37%
Sample Registration System (SRS)
- Sample Registration System (SRS) was initiated in 1964-65 to provide national as well as state level reliable estimates of fertility and mortality.
- SRS is a dual record system:
  - Field Investigation: continuous enumeration of births and deaths by an enumerator
  - Independent retrospective survey: every 6 months by an investigator-supervisor
- Main objective of SRS: To provide reliable estimates of BR, DR and IMR at the natural division level for rural areas and at the state level for urban areas
- Sample design adopted for SRS: A uni-stage stratified simple random sample
- SRS now covers the entire country
- Findings of SRS Bulletin: [2012]:
  - Crude Birth Rate (CBR): 22.1 per 1000 mid-year population
  - Crude Death Rate (CDR): 7.2 per 1000 mid-year population
  - Natural Growth Rate: 14.9 per 1000 mid-year population
  - Infant Mortality Rate (IMR): 47 per 1000 live births

Civil Registration System (CRS)
- Civil Registration System (CRS): Birth and death registration system is technically known as CRS
- Registration of births and deaths (Birth and Death Registration Act, 1969) and marriages is compulsory at their place of occurrence, with local registrar in India
  - Births must be registered within: 21 days
  - Deaths must be registered within: 21 days
  - Marriages must be registered within: 30 days
- Sin. cases of delayed registration for birth/ death:
  - After 21 days till 30 days: Late fee
  - After 30 days till J year: Late fee + Written permission from district registrar (vide an affidavit)
  - After J year: Late fee + Order of executive magistrate
- Registration of name of the child:
  - Within J2 months of birth, registration: Free of charge
  - After 12 months of birth registration till 15 years: Rupees 5.00
- Coverage of registration of births and deaths in India:
  - Coverage of births registration in India: 55%
  - Coverage of deaths registration in India: 46%

Population Pyramid
- Population pyramid: (age-sex pyramid or age-structure diagram) Is a graphical illustration that shows the distribution of various age groups in a population which normally forms the shape of a pyramid
  - Double Histogram: 2 back-to-back histogram graphs
    1) one showing the number of males and
    2) one showing females in a particular population.
    (Males are conventionally shown on left and females on right)
  - The population (%) is plotted on the X-axis and age on the Y-axis (in 5-year age group intervals)
- Utility of Population pyramid:
  - Shape of population pyramid indicates fertility pattern
    1) Broad base, Narrow top (upright triangle): High proportion of younger population (developing countries)
    2) Bulge in Middle, Spindle shape: High proportion of adults (developed countries)
  - Span (height) of population pyramid indicates life expectancy
    1) Taller pyramid: Higher life expectancy (developed countries)
    2) Shorter pyramid: Lower life expectancy (developing countries)
• Symmetry of population pyramid indicates sex ratio
  1) Symmetric pyramid: ideal sex ratio, (developed countries)
  2) Asymmetric pyramid: unfavourable sex ratio <1000 (developing countries)

UN Classification of urban agglomerations

<table>
<thead>
<tr>
<th>Classification</th>
<th>Population count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mega city</td>
<td>&gt; 10 millions</td>
</tr>
<tr>
<td>Million-plus city</td>
<td>1 - 10 millions</td>
</tr>
<tr>
<td>Major city</td>
<td>0.1 - 1 million (1—10 Lac)</td>
</tr>
<tr>
<td>Town</td>
<td>&lt;0.1 million (&lt;1 Lac)</td>
</tr>
</tbody>
</table>

o Megacity: Is defined as a metropolitan area with
  • Total population: in excess of 10 million people
  • In World (2005), there were 25 megacities
  • In India, 3 cities (Delhi, Mumbai, Kolkata) are included in the list of ‘Mega Cities’ (population > 10 millions)
    1) Population projections indicate that by 2015, Hyderabad will also become a Mega City
  • Urban area with maximum population the world: Tokyo
  • Largest mega city in the world: Tokyo

Poverty

p Poverty: Deprivation of those things that determine the quality of life
  • Absolute poverty: a set standard which is consistent over time and between countries
  • Relative poverty: as being below some relative poverty threshold

o Poverty threshold (poverty line): Is the minimum level of income deemed necessary to achieve an adequate standard of living

o Definitions of Below Poverty Line (BPL):
  • Based on per capita calorific intake per day:
    1) Rural areas: per capita daily calorific intake < 2400 Kcal
    2) Urban areas: per capita daily calorific intake < 2100 Kcal
  • Based on per capita expenditure per month:
    1) Rural areas: Per capita expenditure per day INR < 29/-
    2) Urban areas: Per capita expenditure per day INR < 32/-
  • Based on criteria for International comparisons (World Bank):
    1) Extreme poverty: Living on <1.25 $ per person per day
    2) Moderate poverty: Living on <2 $ per person per day

o Poverty in India:
  • Most obvious problem of India
  • Population living BPL in India: 29% [2012]

o 3 primary diseases of poverty: AIDS, Malaria, and Tuberculosis

o Human Poverty Index (HPI): Is an indication of the standard of living in a country, developed by the United Nations (UN)
  • For highly developed countries, the UN considers that it can better reflect the extent of deprivation compared to Human Development Index (HDI)

Key definitions

o Crude birth rate (CBR): Annual number of live births per 1000 mid-year population

o General fertility rate (GFR): Annual number of live births per 1000 women of childbearing age (15-49 years old, or 15-44 years old) mid year population (MYP)

o General marital fertility rate (GMFR): Annual number of live births per 1000 married women of childbearing age (15-49 years old, or 15-44 years old) (MYP)

o Age-specific fertility rates (ASFR): Annual number of live births per 000 women in particular age groups (usually age 15-19 years, 20-24 years etc) (MYP)
- **Crude death rate (CDR):** Annual number of deaths per 1000 mid-year population
- **Infant mortality rate (IMR):** Annual number of deaths of children less than 1 year old per 1000 live births
- **Expectation of life (Life expectancy):** The number of years which an individual at a given age could expect to live at present mortality levels
- **Total fertility rate (TFR):** Number of live births per woman completing her reproductive life, if her childbearing at each age reflected current ASFRs
- **Gross reproduction rate (GRR):** Number of daughters who would be born to a woman completing her reproductive life at current ASFRs
- **Net reproduction rate (NRR):** Expected number of daughters, per newborn prospective mother, who may or may not survive to and through the ages of childbearing
CHAPTER 10
FAMILY PLANNING AND CONTRACEPTION

Concept of family planning
- **Birth control (contraception):** Is a regimen of one or more actions, devices, or medications followed in order to deliberately prevent or reduce the likelihood of pregnancy or childbirth. It is commonly used as part of family planning,
- **Family planning:** A couple plans when to have children, using birth control and other techniques (sexuality education, prevention and management of STIs, preconceptional counseling & management, and infertility management),
- **Modern concept of family planning:** Family planning is not synonymous with birth control only. A WHO Expert Committee (1970) recommends that family planning includes in its' purview:
  - Proper spacing and limitation of births
  - Advice on sterility
  - Education for parenthood
  - Sex education
  - Screening for pathological conditions related to reproductive system (eg. Cervical cancer)
  - Genetic counseling
  - Marriage counseling
  - Premarital consultation and examination
  - Carrying out pregnancy tests
  - Preparation of couples for arrival of their 1st child
  - Providing services for unmarried mothers
  - Teaching home economics and nutrition
  - Providing adoption services

Eligible couples
- **Eligible couples (ECs):** A currently married couple with wife in reproductive age group (15-45 years age)
  - ECs are in need of family planning services
  - There are 150-180 ECs per 1000 population in India
  - EC register, a basic document for organizing family planning work, is maintained at Sub-centre (multipurpose worker)

Couple Protection rate (CPR)
- **Couple Protection rate (CPR):**
  - CPR is percent of eligible couples (ECs) protected against one or the other approved methods of family planning, viz. condoms, OCPs, IUDs, sterilization
  - \( NRR = 1 \) can be achieved if CPR >60%
  - CPR (India): 46.5% [2009-10]
  - CPR is an indicator of prevalence of contraceptive practice in a community

\[
\text{CPR} = \frac{\text{Total no. of ECs protected by any of 4 approved methods}}{\text{Total no. of ECs in the community}}
\]

10A. NATURAL FAMILY PLANNING METHODS

**Basal Body Temperature (BBT) Method**
- **Depends on:** Rise of temperature (0.3° - 0.5° C) at ovulation
- **Occurs due to:** Increased progesterone production
 Measurement: Before getting out of bed in morning (preferably)
 Drawback: Abstinence necessary for entire pre-ovulatory period

Cervical Mucus Method
 Also known as 'Billing's Method', or 'Ovulation Method'
 Based on: Changes in characteristics of cervical mucus
 At ovulation: Watery, clear, smooth, slippery, profuse (like Egg white)
 After ovulation: Thickens and lessens in quantity
 Method: Tissue paper to wipe off inside of vagina
 Drawback: Requires high degree of motivation

Symptothermic Method
 Combines temperature, cervical mucus and calendar techniques
 More effective than Billing's method

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Male condoms</th>
<th>Female condoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material commonly used</td>
<td>Latex</td>
<td>Polyurethane*</td>
</tr>
<tr>
<td>Pearl Index (failure rate)</td>
<td>2-14 per HWY</td>
<td>5-21 per HWY</td>
</tr>
<tr>
<td>No. of rings</td>
<td>1</td>
<td>2 (outer &amp; inner)</td>
</tr>
<tr>
<td>Reusable</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Covering skin around external genitals</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Compatible with oil based lubricants</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Insertion requires male erection</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Prevention of pregnancy</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Prevention of STIs</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

(*) Now also made of nitrile polymers, known as FC2

Diaphragm
 Is a cervical barrier type of birth control
 Mechanism of action: It is a soft latex or silicone dome with a spring molded into the rim. The spring creates a seal against the walls of the vagina and blocks sperm from entering the female reproductive tract.
   - One teaspoon (5ml) of spermicide may be placed in the dome of the diaphragm before insertion, or with an applicator after insertion
   - It must be inserted sometime before sexual intercourse, and remain in the vagina for 6 - 8 hours after a man's last ejaculation
 Protection against: PID and Human Papilloma Virus (HPV)
 Disadvantages:
   - Increased risk of UTI, yeast infection & bacterial vaginosis
   - Toxic Shock Syndrome (if left in-situ > 24 hours)

Vaginal Sponge
 Is also known as TODAY (brand name)
 Sponge a barrier method of contraception: It actually combines barrier and spermicidal methods to prevent conception
   - Is a small polyurethane sponge 5 cms X 2.5 cms
   - Saturated with 1000 mg of spermicide "Non-oxynol-9"
   - Today must be run under water till thoroughly wet before insertion
Sponges is 'inserted vaginally' prior to intercourse and must be 'placed over the cervix to be effective'.

Sponge must be left in place for 6 hours after ejaculation. All sponges must be removed within the time limits specified by the manufacturer (24 hours for Today).

Disadvantages of sponge:
- Sponge provide no protection from STIs
- Can lead to Toxic Shock Syndrome
- Increased risk of yeast infection and UTI

Failure rate (Pearl Index):
- Parous women: 20 - 40 per HWY
- Nulliparous women: 9 - 20 per HWY

10C. INTRAUTERINE DEVICES (IUDs)

<table>
<thead>
<tr>
<th>1st Generation IUDs</th>
<th>2nd Generation IUDs</th>
<th>3rd Generation IUDs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-medicating IUDs</td>
<td>Medicating IUDs</td>
<td>Bio-active IUDs</td>
</tr>
<tr>
<td>Inert IUDs</td>
<td>Copper ions added</td>
<td>Hormones added</td>
</tr>
<tr>
<td>No medication added</td>
<td>are added to IUD</td>
<td>to IUD</td>
</tr>
<tr>
<td>to the IUD</td>
<td>CuT 7, CuT 220 B</td>
<td>Progestasert</td>
</tr>
<tr>
<td>Lippes Loop</td>
<td>CuT 380 A or Ag</td>
<td>LNG - IUD</td>
</tr>
<tr>
<td>Grafenberg's Ring</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In CuT 7, CuT 220 B and CuT 380 A or Ag, 'Numbers (7, 220, 380) represent: Surface area of copper (in sq. mm) on the device
- B in CuT 220 B represent: Size of IUD (IUDs were earlier available in different sizes - A, B, C and D. D was the largest size).
- A or Ag in CuT 380 A represent: Silver or Gold (with copper)

Mechanisms of Action of Intratueterine Devices (IUDs):
- 'Foreign body reaction'
  1) cellular/biochemical changes in endometrium/uterine fluids
  2) impair viability of gamete
  3) reduces chances of fertilization, rather than implantation
- Copper in IUD:
  1) enhances cellular response in endometrium
  2) affects enzymes in uterus
  3) alter cervical mucus thus affecting sperm motility, capacitation & survival
- Hormones in IUD:
  1) increase viscosity of cervical mucus
  2) prevent sperm from entering cervix
  3) make endometrium unfavorable to implantation (high progesterone & low estrogen)

IUDs are world's most widely used method of reversible birth control

Change of IUD: (Shelf life of copper IUDs)

<table>
<thead>
<tr>
<th>IUD</th>
<th>Approved years of use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper IUDs</td>
<td>3 - 5</td>
</tr>
<tr>
<td>Progestasert</td>
<td>1</td>
</tr>
<tr>
<td>CuT 200</td>
<td>4</td>
</tr>
<tr>
<td>NOVA T</td>
<td>5</td>
</tr>
<tr>
<td>LNG IUD</td>
<td>7 - 10</td>
</tr>
<tr>
<td>CuT 380 A</td>
<td>10</td>
</tr>
</tbody>
</table>
Non-hormonal (copper) IUDs are considered safe to use while breastfeeding.

**Ideal IUD woman candidate (Planned Parenthood Federation of America PPFA):**

- Who has borne at least one child
- Has no history of pelvic disease
- Has normal menstrual periods
- Is willing to check the IUD tail
- Has access to follow-up and treatment of potential problems
- Is in a monogamous relationship

**The WHO Medical Eligibility Criteria for Contraceptive Use**

**Category 3 (CuT NOT RECOMMENDED):**

- Postpartum between 48 hours and 4 weeks
- Benign gestational trophoblastic disease
- Ovarian cancer
- High likelihood of exposure to gonorrhea/chlamydial STIs
- AIDS (unless clinically well on anti-retroviral therapy)

**Category 4 (CuT CONTRAINDICATED):**

- Pregnancy
- Postpartum puerperal sepsis
- Immediately post-septic abortion
- Before evaluation of unexplained vaginal bleeding suspected of being a serious condition
- Malignant gestational trophoblastic disease
- Cervical cancer (awaiting treatment)
- Endometrial cancer
- Distortions of the uterine cavity by uterine fibroids or anatomical abnormalities
- Current PID
- Current purulent cervicitis, chlamydial infection, or gonorrheal STIs
- Known pelvic tuberculosis

### Contraindications for IUDs use:

<table>
<thead>
<tr>
<th>Absolute contraindications</th>
<th>Relative contraindications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suspected pregnancy</td>
<td>Anemia</td>
</tr>
<tr>
<td>PID</td>
<td>Menorrhagia</td>
</tr>
<tr>
<td>Vaginal bleeding of undiagnosed etiology</td>
<td>History of PID since last pregnancy</td>
</tr>
<tr>
<td>Cancer of cervix, uterus or adnexa and other pelvic tumors</td>
<td>Purulent cervical discharge</td>
</tr>
<tr>
<td>Previous ectopic pregnancy</td>
<td>Distortions of uterine cavity due to congenital malformations, fibroids</td>
</tr>
<tr>
<td></td>
<td>Unmotivated persons</td>
</tr>
</tbody>
</table>

**IUDs as Emergency Contraceptives:** IUDs can be used as emergency contraception to prevent pregnancy 'up to 5 days after' unprotected sexual intercourse, or sexual intercourse during which the primary contraception is believed to have failed:

- Insertion of a CuT as emergency contraception is ‘more than 99% effective’ (more effective than emergency contraceptive pills)

**Side effects of IUD (Intrauterine device) insertion**

- **Bleeding:**
  - *MC side effect of woman with IUD:* Increased vaginal bleeding
  - Usually disappear by 1 - 2 months
  - Leads to 10 - 20% of all IUD removals (MCC removal: Pain)
  - Greater bleeding, with Non-medicated (Inert) IUDs
  - Can lead to Iron deficiency anemia (IDA)
• Management of bleeding:
  1) Re-assure the female (DO NOT REMOVE IUD)
  2) Ferrous sulphate 200 mg TDS X 1 - 2 months
  3) If bleeding is heavy or persistent: REMOVE IUD

• Pain
  • Second major side effect of IUD insertion.
  • MCC requiring removal of IUDs: Pain (15 - 40% removals)
  • Usually disappear by 3 months.
  • Pain is more common in:
    1) Nullipara
    2) Those who have not had child for many years
  • Management of Pain:
    1) Slight pain: Analgesics like Aspirin or Codeine
    2) Intolerable pain: Remove the IUD, insert a copper based device or advise other contraceptives.

• Pelvic infection (Pelvic Inflammatory Disease — PID):
  • PID include: Acute, subacute and chronic infection of tubes, ovaries, uterus, connective tissue and pelvic peritoneum.
  • IUD increases risk of PID in a woman: 2-8 times.
  • Higher risk of PID with IUD insertion:
    1) Women with greater no. of sexual partners
    2) In first few months after insertion
  • Organism involved:
    1) Gardenella
    2) Anaerobic streptococci
    3) Bacteroides
    4) Coliform bacilli
    5) Actinomyces
  • Management of PID:
    1) Prompt treatment with broad spectrum antibiotics
    2) If no response to antibiotics in 24 - 48 hours: Remove IUD

• Uterine perforation:
  • Conclusive diagnosis: Pelvic X-ray
  • Management: Removal of IUD

• Pregnancy with IUD-in-situ:
  • Outcomes: 50% spontaneous abortion, 25% only successful
  • Management:
    1) If woman requests: Legally induced abortion
    2) If woman wants to continue pregnancy and threads are visible: Remove IUD gently by pulling the threads
    3) If woman wants to continue pregnancy and threads are NOT visible: Carefully examine for possible complications. If any sign of intrauterine infection - evacuation of uterus under broad spectrum antibiotic cover

• Ectopic pregnancy with IUD-in-situ

• Spontaneous expulsion:
  • Expulsion rate: 12 - 20%
  • Higher risk of expulsion:
    1) Young women
    2) Nullipara women
    3) Women who have had a postpartum insertion
    4) Inert (Non-medicated IUDs)

• Mortality associated with IUD use: Very low:

• IUDs associated with side effects or complications:
Grafenberg's Ring
- Is a 1st Generation (Non-medicated/Inert) IUD
- A flexible ring of 'silver wire' used as a birth control device
- It was a precursor to the IUD (inserted into the woman's uterus)

Progestasert
- Progestasert is a 3rd Generation IUD (Medicated/Bio-active IUD)
- Progestasert was the first hormonal uterine device, developed in 1976
- T-shaped device filled with 3.8 mg progesterone
- Reservoir: Silicon oil (in vertical stem)
- Rate of hormone release: 65 μg per day
- Shelf life: 1 - 1 years
- Mechanism of action:
  - Direct local effect on uterine lining
  - Effect on cervical mucus
  - Effect on sperms
- Advantages of Progestasert:
  - IUD with 'Lowest expulsion rate'
  - IUD with 'Lowest removal rate'
  - Lesser chances of dysmenorrhea and menorrhagia
- Disadvantages of Progestasert:
  - Expensive
  - Requires yearly replacement
  - Highest rate of ectopic pregnancy; 9-fold higher:
- Failure rate of Progestasert: 2%-per year

10D. ORAL CONTRACEPTIVE PILLS (OCPs)
- Combined OCPs are of 3 types:
  - Monophasic OCPs deliver the same amount of estrogen and progestin every day
  - Biphasic OCPs deliver the same amount of estrogen every day for the first 21 days of the cycle
  - Triphasic OCPs have constant, or changing estrogen concentrations and varying progestin concentrations throughout the cycle
- Composition of Combined OCP: (MALA-NV MALA-D)
  - Ethinyl estradiol: 0.03 mg (30 μg)
  - Norgestrel/Desogestrel: 0.15 mg (150 μg)
- Adverse effects of Combined Oral Contraceptive Pills (OCPs)
  - Cardiovascular effects (due to oestrogenic component)
    1) Myocardial infarction
    2) Cerebral, thrombosis
3) Venous thrombosis (with or without pulmonary embolus)
4) Hypertension

Carcinogenesis:
1) Cervical cancer (increased risk)
2) Breast Cancer

Metabolic Effects: (due to progesterone component)
1) Elevated blood pressure (hypertension)
2) Altered lipid profile (reduced HDL)
3) Blood clotting
4) Hyperglycemia and increased plasma insulin

Hepatocellular adenoma
Gall bladder disease
Cholestatic jaundice
Mononial vaginitis (candidiasis)
Decline milk volume during lactation
Slight delay in return of fertility (upon discontinuation)
Depression
Fetal birth defects (?)

General effects:
1) Breast tenderness
2) Weight gain (due to water retention)
3) Headache & migraine
4) Bleeding disturbances

Beneficial effects of Combined Oral Contraceptive Pills (OCPs):
- Benign breast disorders (Fibrocystic disease, Fibroadenoma)
- Benign ovarian disease (Ovarian cysts)
- Malignant ovarian disease (Ovarian cancer)
- Pelvic Inflammatory Disease (PID)
- Ectopic pregnancy
- Iron deficiency anemia
- Endometrial cancer

Non-contraceptive benefits, of combined OCPs:
- polycystic ovary syndrome (PCOS)
- endometriosis
- adenomyosis
- anemia related to menstruation
- painful menstruation (dysmenorrhea)
- mild or moderate acne
- irregular menstrual cycles
- dysfunctional uterine bleeding

Contraindications for use of oral contraceptive pills (OCPs):

<table>
<thead>
<tr>
<th>Absolute contraindications</th>
<th>Relative contraindications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breast Cancer</td>
<td>Age &gt; 40 years</td>
</tr>
<tr>
<td>Genital Cancer</td>
<td>Smoking and age &gt;35 years</td>
</tr>
<tr>
<td>Liver disease</td>
<td>Mild hypertension</td>
</tr>
<tr>
<td>History of thromboembolism (past or present)</td>
<td>Chronic renal disease</td>
</tr>
<tr>
<td>Cardiac abnormalities</td>
<td>Epilepsy</td>
</tr>
<tr>
<td>Congenital hyperlipidemia</td>
<td>Migraine</td>
</tr>
<tr>
<td>Undiagnosed abnormal uterine bleeding</td>
<td>Nursing mothers. (0 - 6 months)</td>
</tr>
<tr>
<td></td>
<td>Diabetes mellitus</td>
</tr>
<tr>
<td></td>
<td>Gall bladder disease</td>
</tr>
<tr>
<td></td>
<td>History of infrequent bleeding</td>
</tr>
<tr>
<td></td>
<td>Amenorrhoea</td>
</tr>
</tbody>
</table>
Centchroman

- Synthetic NON-STEROIDAL oral contraceptive
  - Centchroman is also known as 'once-a-week pill'
  - Centchroman is the 'only anti-implantation agent approved for clinical use' globally
  - Centchroman has also been found effective as an anti-breast cancer agent
- Brand name: Saheli
- Chemical in Centchroman: ORMELOXIFENE
- Mechanism of Action: Selective estrogen receptor, modulators (SERMs) a class of medication which acts on the estrogen receptor
  - Works through a unique combination of weak estrogenic and potent anti-estrogenic properties
- Developed by: Central Drug Research Institute (CDRI), Lucknow, India
- Dosage & frequency: 1 tablet (30 mg) twice a week X 3 months, then 1 tablet per week
- Failure rate (Pearl Index): 1.83 - 2.84 per HWY
- Uses of Centchroman:
  - As a contraceptive
  - Treatment of dysfunctional uterine bleeding
- Contraindications of Centchroman:
  - PCOD (Stein Leventhal Syndrome).
  - Cervical hyperplasia
  - Recent history of jaundice
  - Severe allergic disease

Vasectomy

- Sterilization is the most cost-effective contraceptive measure
  - Cost wise ratio is 5 vasectomies to 1 tubectomy
- Procedure of Vasectomy:
  - Remove 'minimum 1 cm of vas deferens'
  - Ends are hgated and folded back to themselves
  - Person is NOT sterile UNTIL after 30 ejaculations post-vasectomy
- Post-operative advice:
  - Patient need 30 ejaculations after vasectomy, before turning sterile
  - Use of barriers methods till aspermia
  - Avoid bath for 24 hours after operation
  - T-bandage for support, for 15 days, keep site dry
  - Avoid cycling, lifting heavy weights for 15 days
  - Stitch removal on o? day
- Complications of vasectomy:
  - Operative: Pain, scrotal hematoma, local infection
  - Sperm granules:
    1) 7 mm painful mass
    2) appears 10-14 days after vasectomy
    3) can provide a medium for re-anastomosis of vas
    4) using metal clips reduce this problem
  - Spontaneous recanalization: seen in 0-6 % cases; require regular follow-up for 3 years
  - Autoimmune response: seen in 54% of vasectomised persons; require regular follow-up for 3 years
  - Psychological: diminution of sex vigour, impotence, fatigue
  - Post-Vasectomy Pain Syndrome
- Failure of vasectomy:
  - MCC in India: Mistaken identification of vas deferens
  - Failure rate (Pearl Index): 0.15 per HWY
Confirmation of successful vasectomy.
1) Histological confirmation
2) Smear of squeeze of vas by Wright’s stain

- No Scalpel Vasectomy (NSV): vas is brought out through a tiny puncture which does not require any stitches
  - Also known as ‘Key hole vasectomy’
  - Surgical hook (not scalpel) is used to enter the scrotum
  - New safer, convenient technique acceptable to males
  - Nearly painless, less invasive and faster

Guidelines for sterilization (Government of India):
- Age of husband: 25 - 50 years
- Age of wife: 20 - 45 years
- Couple must have ‘2 living children at the time of operation’
- If couple has > 3 living children, lower limit for age of husband/wife may be relaxed at the discretion of operating surgeon
- It is sufficient if;
  1) acceptor declares having obtained consent of spouse
  2) acceptor knows that procedure is practically irreversible
  3) spouse has not been sterilized earlier

10F. SUB-DERMAL IMPLANTS

Norplant
- Is a type of Subdermal implant (Depot formulation)
- 6’silastic capsules containing 35 mg LNG each
  - Norplant R2: 2 capsules containing 75 mg LNG each
- Mechanism of action: Capsules or rods are inserted beneath skin of forearm; prevents ovulation
- Effectiveness: 5 years
- Disadvantages:
  - Irregularities of menstrual bleeding
  - Surgical procedures required for insertion and removal

10G. DEPOT FORMULATIONS

Depot Medroxy Progesterone Acetate (DMPA)
- Is a Progestogen only Injectable contraceptive (Depot formulation)
- Dose: 150 mg i/m every 3 months
- Advantages:
  - Highly effective
  - Long lasting and reversible
  - Does not affect lactation
- Side effects:
  Disruptions of normal menstrual cycles (most common)
  Amenorrhoea

Nor-ethisterone enanthate (NET-EN)
- Is Norethisterone Enanthate, a Progestogen only Injectable contraceptive (Depot formulation)
- Dose: 200 mg i/m every 2 months
- Advantages:
  - Highly effective
  - Long lasting and reversible
- Side effects:
  Disruptions of normal menstrual cycles (most common)
  Amenorrhoea
Other Important Topics

Emergency Contraception (EC)
Emergency postcoital contraception include the contraceptive measures that, if taken after sex, may prevent pregnancy.

- **Yuzpe and Lancée Method**: Combined oral pills are generally accepted as the preparation of choice for post-coital (emergency) contraception, as it is less likely to cause adverse side effects.
  - **Regimens**:
    1. **Current recommendation (pills with 30 mg oestrogen)**: 4 pills immediately followed by 4 pills 12 hours later.
    2. **Standard method (pills with 50 mg oestrogen)**: 2 pills immediately followed by 2 pills 12 hours later.
  - Regimens have to be completed within 72 hours of coitus.
  - A pregnancy test should be carried out if the period is >3 days late.
  - The Regimen does not protect against STDs.
  - MC side effect reported by users of emergency contraceptive pills: Nausea.

- **Mini Pills (POP)**: Progesterone only Pill (POP) 75 mg.
  - Pill has to be used within 72 hours of intercourse.
  - Reduces risk of pregnancy by 89%.
  - Use in first 24 hours prevent 95% of expected pregnancies.
  - POP as an Emergency Contraceptive has showed greater efficacy with reduced side effects and has therefore superseded Yuzpee & Lancée method (WHO).
  - A single dose of 100 mg mifepristone is also more effective than the Yuzpe regime.

- **IUD Insertion**: Must be inserted within 5 days of coitus.
  - Insertion of an IUD is more effective than use of Emergency Contraceptive Pills.

- **High dose estrogens**: Estrogen 5mg OD X 5 days.

- **Antiprogestogen (Mifepristone RU 486)**: 600 mg stat within 72 hours of coitus.

Conventional Contraceptives

- **Conventional Contraceptives**: Methods that require action at the time of coitus.
  - Condoms
  - Spermicides

Contraceptive Efficacy

- **Contraceptive Efficacy**: Is assessed by measuring the number of unplanned pregnancies that occur during a specified period of exposure and use of a contraceptive method. Two methods used are:
  - Pearl Index
  - Life table analysis

Pearl Index (PI) as Measure of Contraceptive Efficacy

- **PI or Pearl rate**: MC technique used in clinical trials for measuring the effectiveness of a birth control method.
  - PI is no. of failures per 100 woman years (HWY) of exposure.

\[
\text{Pearl Index (PI)} = \frac{\text{Total accidental pregnancies} \times 1200}{\text{Total months of exposure}}
\]

- Pearl Indices for few contraceptive methods:
**Contraceptive Method**  
<table>
<thead>
<tr>
<th>Method</th>
<th>Pearl Index (per HWY)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No method used</td>
<td>80</td>
</tr>
<tr>
<td>Rhythm (calendar) Method</td>
<td>•• 24</td>
</tr>
<tr>
<td>Coitus interruptus</td>
<td>18</td>
</tr>
<tr>
<td>Male condoms</td>
<td>•• 2 - 14</td>
</tr>
<tr>
<td>Female condoms</td>
<td>•• 5 - 21</td>
</tr>
<tr>
<td>Diaphragm</td>
<td>12</td>
</tr>
<tr>
<td>Vaginal sponge</td>
<td>20 - 40</td>
</tr>
<tr>
<td>Parous women</td>
<td></td>
</tr>
<tr>
<td>Nulliparous women</td>
<td>9 - 20</td>
</tr>
<tr>
<td>IUD</td>
<td>0.5 - 2.0</td>
</tr>
<tr>
<td>Oral pill</td>
<td>0.1 - 0.5</td>
</tr>
<tr>
<td>Centchroman (Saheli)</td>
<td>1.83 - 2.84</td>
</tr>
</tbody>
</table>

**Non-contraceptive benefits of contraceptives**

- **Non-contraceptive benefits of OCPs:** Reduced incidence or improvements in:
  - Regularization of irregular menstrual cycles esp. in Stein Levinthal Syndrome (Polycystic Ovarian Disease - PCOD)
  - Dysmenorrhea
  - Anemia
  - Acne
  - Hirsutism
  - Ectopic pregnancy
  - Benign breast disease
  - Endometrial cancer
  - Ovarian cysts
  - Ovarian cancer
  - Colorectal cancer
  - Pelvic inflammatory disease (PID)
  - Osteopenia, osteoporosis,

- **Non-contraceptive benefit of IUDs:**
  - Synechiolysis (breaking of synechiae) and prevent further adhesion formation in uterine cavity (Asherman's Syndrome)
  - Reduction of risk of Endometrial cancer
  - Treatment of anemia
  - Treatment of menorrhagia (LNG IUD)
  - Hormone replacement therapy - HRT (LNG IUD)
  - Adjuvant therapy to tamoxifen (LNG IUD)

- **Non-contraceptive benefit of Barrier methods:**
  - Prevention of STIs and HIV transmission

- **Non-contraceptive benefit of Centchroman:**
  - Treatment of dysfunctional uterine bleeding (DUB)
Maternal and Child Health (MCH) indicators

- Infant mortality rate (IMR): Is the ratio of infant deaths registered in a given year to the total number of live births registered in the same year; IMR is usually expressed as a rate per 1000 live births (LB)
  \[
  \text{IMR} = \frac{\text{No. of infant deaths in a given year}}{\text{Total no. of live births in the same year}} \times 1000
  \]

- Neonatal mortality rate (NNMR): Is the number of neonatal deaths (deaths within completed 28 days after birth) per 1000 live births in that year
  \[
  \text{NNMR} = \frac{\text{No. of neonatal deaths in a given year}}{\text{Total no. of live births in the same year}} \times 1000
  \]

  - Early neonatal mortality (ENNM): Neonatal mortality in first week (1 - 7 days) of life
  - Late neonatal mortality (LNNM): Neonatal mortality in first to fourth week (8 - 28 days) of life

- Perinatal mortality rate (PNMR): Includes both late fetal deaths (stillbirths) and early neonatal deaths
  \[
  \text{PNMR} = \frac{\text{Late fetal deaths and early neonatal deaths in a given year}}{\text{Total no. of live births in the same year}} \times 1000
  \]

  - Perinatal period is from 28 weeks period of gestation to 7th completed days of life (But the WHO definition of perinatal period is from 22 completed weeks gestation to 7th completed days of life).

Infant Mortality Rate (IMR)

- Infant Mortality Rate (IMR) is a rate
- Is the single best indicator of socio-economic development of a country
- Is most important indicator of health status of a community, level of living and effectiveness of MCH services in general

- MCC of IMR in India: Low birth rate and prematurity (57%)
- MCC of IMR in World: Pneumonia
- IMR (India): 47 per 1000 LB [MP : 62 ; Goa 10] [2012]
- Goal in National Population Policy 2000: 10 per 1000 LB by 2010
- Goal in National Health Policy 2002: 10 per 1000 LB by 2010
- Factors affecting Infant Mortality Rate (IMR):
  - Biological factors:
    1) Birth weight (BW): IMR greater in BW < 2.5 kg and > 4.0 kg
    2) Age of mother: IMR is greater in age < 19 and >35 years
    3) Birth order: Infant mortality is greatest for birth order 1 and least for 2; It increases from birth order 3 onwards
    4) Birth spacing: IMR reduces with wider birth spacing
    5) Multiple births: IMR increases in multiple births
    6) Family size: IMR increases as family size increases
7) **High fertility:** IMR increases with high fertility.

- **Economic factors:**
  
  1) **Socio-economic status (SES):** IMR higher in lower SES.
  
  2) **Breastfeeding:** IMR higher in early weaning and bottle-fed infants living in poor hygienic conditions.
  
  3) **Religion and caste:** IMR is affected by patterns, habits, customs, child care, etc.
  
  4) **Early marriages:** IMR higher in teen age pregnancy.
  
  5) **Sex of the child:** IMR higher.
  
  6) **Quality of mothering:** IMR low in good quality of mothering.
  
  7) **Quality of health care:** IMR high in improper obstetric and pediatric care.
  
  8) **Maternal education:** IMR low in mothers with high literacy rate.
  
  9) **Broken family:** IMR higher.
  
  10) **Illegitimacy:** IMR higher.
  
  11) **Brutal habits and customs:** IMR high (not feeding colostrum, applying cow-dung to umbilical-stump, faulty feeding practices).
  
  12) **Untrained dai:** High IMR.
  
Neonatal mortality rate (NNMR)

- **Neonatal mortality** is the most difficult part of IMR to alter.
- **NNMR (India):** 29 per 1000 LB [SRS 2007].
- **MCC of NNMR in India:** Preterm birth.
- **Causes of Neonatal mortality (0-4 weeks):**
  
  - Low birth weight and prematurity.
  - Birth injury and difficult labour.
  - Sepsis.
  - Congenital anomalies.
  - Hemolytic diseases of newborn.
  - Conditions of placenta and cord.
  - Diarrhoeal diseases.
  - Acute respiratory infections.
  - Tetanus.

- **NNMR is directly related with birth weight and gestational age.**
- **MCC of ENNMR:** Prematurity and congenital anomalies.
- **MCC of LNNMR:** Infections (diarrhea and tetanus).

- **NNMR** = NNMR<sub>boys</sub> < NNMR<sub>girls</sub>.

Maternal Mortality rate (MMR)

- **Maternal Mortality rate - (MMR):** Maternal deaths expressed as per 100,000 live births, where a 'maternal death' is defined as 'death of a woman while pregnant or during delivery, or within 42 days (6 weeks) of termination of pregnancy, irrespective of duration or site of pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes.'

\[ \text{MMR} = \frac{\text{No. of maternal deaths in a given year}}{\text{Total no. of live births in the same year}} \times 100,000 \]

- **Maternal deaths expressed as per 100,000 live births** (earlier it was expressed per 1000 live births but that yielded fractions like 4.08 maternal deaths per 1000 LB; so denominator was extrapolated to 100,000 to make MMR value more sensible).

- **MMR is a ratio** (Maternal mortality rate is a misnomer; MMR is not a rate).
Maternal mortality is 'a sentinel event to assess the quality of a health care system' 

- MMR India: 212 per 100,000 live births (Uttar Pradesh: 359; Kerala: 81) [2011]
  - MCC of MMR in India: Obstetric hemorrhage (38%)
- MMR World: 400 per 100,000 live births
  - MCC of MMR in World: Obstetric hemorrhage (25%)
- Millennium Development Goal (MDG) 5: Reduce maternal mortality by three-fourths by 2015

**Child mortality rate, CMR (Under 5 mortality rate, U5MR)**

\[
CMR = \frac{\text{No. of deaths of children less than 5 years age in a year}}{\text{No. of live births in a year}} \times 1000
\]

- U5MR (India): 64 per 1000 LB [2011]
- Single MCC of U5MR or CMR is Pneumonia (19%) [diarrhoea - 17%; malaria - 8%]
- Millennium Development Goal (MDG) 4: Reduce child mortality by two-thirds by 2015
- UNICEF considers U5MR or CMR as 'single best indicator of socio-economic development and well being'

**Child death rate, CDR (1-4 year mortality rate)**

\[
CDR = \frac{\text{No. of deaths of children aged 1 - 4 years in a year}}{\text{Mid year population of children aged 1 - 4 years}} \times 1000
\]

- CDR (India): 16 per 1000 under five children; .5.2% of total deaths [2007]

**Most common causes**

- MCC of MMR in India: Obstetric hemorrhage (38%)
- MCC of Maternal Mortality Rate (MMR in World): Obstetric hemorrhage (25%)
- MCC of NNMR in India is preterm birth (low birth weight and prematurity)
- MCC of ENNMR in World: Prematurity and congenital anomalies
- MCC of LNNMR in World: Infections (diarrhea and tetanus)
- MCC of IMR in India: Low birth rate and prematurity (57%)
- MCC of IMR in World: Pneumonia
- MCC of Child. (1 - 4 yr) death rate in developing countries: Diarrhoeal diseases and respiratory infections
- MCC of Child (1 - 4 yr) death rate in developed countries: Accidents
- MCC of Under 5 Mortality Rate (Child Mortality Rate): Pneumonia (19%)

**Neonatal screening**

- Phenylketonuria (PKU)
  - PKU is an autosomal recessive trait with a frequency of 1 in 10,000 births
  - Enzyme deficient in PKU: Phenylalanine hydroxylase
  - Guthrie Test: Is done in neonates for mass screening of Phenylketonuria (PKU)
    - 1) Guthrie test was the first screening test used in neonates
    - 2) Blood sample is collected by heel prick of the baby 7-10 days after birth
    - 3) Guthrie Test is negative in first 2 - 3 days of life
    - 4) Guthrie test can detect PKU, Galactosemia and Maple syrup urine disease
    - 5) Chemicals detected: Phenylalanine, Phenylpyruvate and Phenyllactate
    - 6) It is a semi-quantitative test
    - 7) Currently, Guthrie test has been replaced by Tandem mass Spectrometry
  - Treatment of PKU: restricting or eliminating foods high in phenylalanine, such as breast milk, meat, chicken, fish, nuts, cheese, legumes and other dairy products

- Neonatal Hypothyroidism
  - MC neonatal disorder to be screened: Neonatal hypothyroidism (NNH)
MCC of congenital hypothyroidism is iodine deficiency
Blood sample is collected from Cord’s Blood
Test involves measurement of T₄ or TSH both simultaneously
Treatment-. Daily dose of thyroid hormone (thyroxine) by mouth

Weight of newborn
- Average birth weight in India: 2.8 kg (2.7 - 2.9 kg)
- Low Birth Weight (LBW): BW < 2.5 kg
  - LBW in India: 26%
  - LBW is regardless of gestational age
  - Goal for LBW in National Health Policy 1983: Reduce LBW to <10% by 2000
- BW doubles at 5 months, triples by 1 year and quadruples by 2 years age
  - So BW of 3 kg will become 6 kg, 9 kg and 12 leg at 5 months, 1 year and 2 years age respectively
- Minimum expected weight, gain per month: 500 grams
- Weight gain pattern in children:

<table>
<thead>
<tr>
<th>Age</th>
<th>Weight increments</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-3 months</td>
<td>200 grams per wWk</td>
</tr>
<tr>
<td>4-6 months</td>
<td>150 grams per week</td>
</tr>
<tr>
<td>7-9 months</td>
<td>100 grams per week</td>
</tr>
<tr>
<td>10-12 months</td>
<td>50 - 75 grams per week</td>
</tr>
<tr>
<td>0-1 year</td>
<td>7.0 kg per year</td>
</tr>
<tr>
<td>1-2 year</td>
<td>2.5 kg per year</td>
</tr>
<tr>
<td>3-5 year</td>
<td>2.0 kg per year</td>
</tr>
</tbody>
</table>

Height of newborn
- Weight reflects only present status of the child, whereas height indicates events in the past also
- Height increase pattern in children:

<table>
<thead>
<tr>
<th>Age</th>
<th>Height increments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st year</td>
<td>25 cms</td>
</tr>
<tr>
<td>2 year</td>
<td>12 cms</td>
</tr>
<tr>
<td>3rd year</td>
<td>9 cms</td>
</tr>
<tr>
<td>4th year</td>
<td>7 cms</td>
</tr>
<tr>
<td>5th year</td>
<td>6 cms</td>
</tr>
</tbody>
</table>

- Near-final height attainment:
  - Indian boys attain 98% of final height by 17.75 years
  - Indian girls attain 98% of final height by 16.5 years

Nutritional growth & development
- Low weight for age: Is known as 'Underweight' (Acute+chronic Malnutrition)
- Low weight for height: Is known as 'Nutritional wasting' or 'Emaciation'.(Acute Malnutrition)
- Low height for age: Is known as 'Nutritional stunting' or 'Dwarfing' (Chronic malnutrition)
- Single best parameter for assessment of physical growth: Weight (and rate of weight gain)
- Single most sensitive measure of growth: Weight
- Single most reliable criterion of assessment of health and nutritional status: Weight
- Weight for height is considered more important than weight alone, for the measurement of physical growth
- Height is a stable measurement of growth as opposed to body weight
• **Weight**: reflects only present health status
• **Height**: indicates events in past also

o **Gomez Classification of malnutrition**: Is based on ‘weight for age’

<table>
<thead>
<tr>
<th>Weight for age*</th>
<th>Grade of malnutrition</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 80%</td>
<td>Normal</td>
</tr>
<tr>
<td>71 - 80%</td>
<td>Grade I</td>
</tr>
<tr>
<td>61 - 70%</td>
<td>Grade II</td>
</tr>
<tr>
<td>51 - 60%</td>
<td>Grade III</td>
</tr>
<tr>
<td>&lt;50%</td>
<td>Grade IV</td>
</tr>
</tbody>
</table>

**Milestones of development**

o **Milestones of development**.

<table>
<thead>
<tr>
<th>Age</th>
<th>Motor development</th>
<th>Language development</th>
<th>Adaptive development</th>
<th>Socio-personal development</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-8 wks</td>
<td></td>
<td></td>
<td></td>
<td>look at mother and smiles</td>
</tr>
<tr>
<td>3 m</td>
<td>holds head erect</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4-5 m</td>
<td></td>
<td>listening</td>
<td>begins to reach</td>
<td>recognizes mother</td>
</tr>
<tr>
<td>6-8 m</td>
<td>sits without</td>
<td>experiment with</td>
<td>transfers objects</td>
<td>enjoys hide and seek</td>
</tr>
<tr>
<td></td>
<td>support</td>
<td>noises</td>
<td>hand to hand</td>
<td></td>
</tr>
<tr>
<td>9-10 m</td>
<td>crawls</td>
<td>increasing range</td>
<td>releases objects</td>
<td>suspicious of strangers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>of sounds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.0-11 m</td>
<td>stands with</td>
<td>first words</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>support</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12-14 m</td>
<td>walks wide base</td>
<td></td>
<td>builds</td>
<td></td>
</tr>
<tr>
<td>18-21 m</td>
<td>walks narrow base</td>
<td>joining words</td>
<td>beginning to</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>explore</td>
<td></td>
</tr>
<tr>
<td>24 m</td>
<td>runs</td>
<td>short sentences</td>
<td></td>
<td>dry by day</td>
</tr>
<tr>
<td></td>
<td>• • K. V</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

o **Behavioral development of children are assessed in 4 fields**. Developmental milestones

• Motor-development
• Language development
• Adaptive development
• Socio-personal development

**Growth monitoring of children**

o **Growth chart was first designed by 'David Morley' (and later modified by WHO)**

o **Growth chart is the 'passport to child's health care'**

o **Best available standards of growth**: NCHS standards

o **Direction of growth in a growth chart is more important than the position of dots**

o **Uses of growth chart**:
  • Diagnostic tool for identifying high risk children
  • Planning and policy making
  • Educational, tool
  • Tool for action
  • Evaluation of corrective measures and impact of a programme
Tool for teaching

Growth Charts

- Growth Chart (Road-to-health chart): Is a visible display of child's physical growth and development
- Growth chart is designed for: Longitudinal follow-up (growth monitoring) of a child
- Growth chart is generally plotted between: Weight and Age
- Growth chart provides information on:
  - Identification and registration
  - Birth date and birth weight
  - Chronological age
  - Weight-for-age
  - Developmental milestones
  - History of sibling health
  - Immunization procedures
  - Introduction of supplementary foods
  - Episodes of sickness
  - Child spacing (Contraceptive/family planning methods used)
  - Reasons for special care

WHO HOME BASED GROWTH CHART

- WHO growth chart has 2 reference curves:
  - Upper Reference Curve (URC): 50th percentile for boys
  - Lower Reference Curve (LRC): 3rd percentile for girls

Road to Health: Is the space between two growth-curves (weight, channel). It includes zone of normality for most populations, i.e., 95% of healthy normal children used as a reference fall in this area.

WHO reference curves are based on: NCHS Standards (National-Centre for Health Statistics; USA)

- The 3rd percentile (LRC) corresponds to approximately 2 SD below the median of weight-for-age reference value (i.e., URC)

GOVERNMENT OF INDIA (GOD RECOMMENDED GROWTH CHART)

- GOI recommended growth chart has 4 reference curves:
  - 80% of median (50th percentile or URC) of WHO reference standard
  - 70% of median (50th percentile or URC) of WHO reference standard
  - 60% of median (50th percentile or URC) of WHO reference standard
  - 50% of median (50th percentile or URC) of WHO reference standard

Interpretation of plot of weight on GOI recommended growth chart:

- Between 80% and 70% lines: 1st degree or Mild malnutrition
- Between 70% and 60% lines: 2nd degree or Moderate malnutrition
- Between 60% and 50% lines: 3rd degree or Severe malnutrition
- Below 50% line: 4th degree or IV grade malnutrition

ICDS GROWTH CHART

- ICDS Growth chart has 3 reference curves:
  - Reference standard f=URC of WHO Growth chart — 50th percentile for boys
    - -2 SD
School Health

- School health committee (1,961) in India recommended medical examination of children 'at the time of entry and thereafter every 4 years' [Recent recommendation: Once every 6 months]

- **School Eye Screening Programme:**
  - Focus on middle schools (V - VIII classes: 10 - 14 years age group)
  - Teachers to do screening: 1 teacher per 150 students
  - Visual acuity, cutoff for referral to PHC: <6/9

- **Healthy school environment:** Suggested minimum standards for sanitation of schools & its environs in India include,
  - **Location:** Away from noisy surroundings; kept fenced
  - **Site:** 5 acres for primary schools; 10 acres for higher elementary schools
  - **Structure:** Exterior walls 10 inch thick and heat resistant
  - **Class room:** 1 class room per 40 students maximum; Per capita space > 10 sq. feet
  - **Furniture:** Single/desks of 'minuS(-) type'
  - **Doors and windows:** Doors and windows area > 25% of floor area
  - **Color:** Inside color of walls should be white
  - **Lighting:** Natural light from left side
  - **Water supply:** Safe and potable and continuous supply through taps
  - **Lavatory:** 1 urinal per 60 students and 1 latrine per 100 students

**Integrated Child Development Services (ICDS)**

- **Integrated Child Development Services (ICDS), 1975:** ICDS aims at providing services to pre-school children in an integrated manner so as to ensure proper growth and development of children in rural, tribal and Slum areas.

  - ICDS is a centrally sponsored scheme /
  - ICDS provides an integrated package of services:
    - Supplementary nutrition
    - Immunization
    - Health check-up
    - Medical referral, services
    - Nutrition and health education for women
    - Non-formal education for children aged 3 - 6 years, and pregnant and nursing mothers in rural, urban and tribal areas

- **ICDS Beneficiaries** (Irrespective of income of family):
  - Children 0 - 6 years age
  - Pregnant and lactating mothers
  - Women in reproductive age group
  - Adolescent girls 11 - 18 years

- **Heart of ICDS system:** Anganwadi

  - Focal point for ICDS services delivery is Anganwadi Worker. Each Anganwadi has 1 Anganwadi worker and 1 helper
  - 1 Anganwadi centre per 400-800 population in rural and urban projects [1 mini AWC/150]
  - 1 Anganwadi centre per 300-800 population in tribal projects

- **Supplemental nutrition given through ICDS:** 300 feeding days in a year

<table>
<thead>
<tr>
<th>Beneficiary group</th>
<th>Calories</th>
<th>Proteins</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child 0-1 year</td>
<td>200 Cal</td>
<td>6 - 8 grams</td>
</tr>
<tr>
<td>Child 1 - 6 year</td>
<td>300 Cal</td>
<td>8 - 10 grams</td>
</tr>
<tr>
<td>Malnourished child*</td>
<td>600 Cal</td>
<td>16 — 20 grams</td>
</tr>
<tr>
<td>Pregnant &amp; Lactating mother</td>
<td>500 Cal*</td>
<td>20 - 25 grams</td>
</tr>
<tr>
<td>Adolescent girls</td>
<td>500 Cal</td>
<td>20 - 25 grams</td>
</tr>
</tbody>
</table>

(* In case of a malnourished child, double the daily supplement)
(# = 125-150 grams cereals)
• Human milk vitamins and minerals: Human milk is rich in Vitamin A, C and K; richer in copper, cobalt and selenium; richer in iron and higher bioavailability; high calcium/phosphorus ratio; Human milk has lesser sodium

Colostrum:
• Is the most suitable food immediately after birth of the baby; Regular milk comes 3 - 6 days after birth
• Also known as 'Beestings', 'First milk' or 'Immune Milk'
• High in carbohydrates, protein, and antibodies and low in fat
• Contains all five immunoglobulins found in all mammals, IgA, IgD, IgE, IgG and IgM

Safe Delivery and Tetanus Toxoid (TT) during pregnancy
Refer to Chapter 7

Neonatal Tetanus in India
Refer to Chapter 7

Anemia

o Cut-off points for diagnosis of anemia (WHO):

<table>
<thead>
<tr>
<th>Group</th>
<th>Hb (g/dl)</th>
<th>MCHC (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult males</td>
<td>13</td>
<td>34</td>
</tr>
<tr>
<td>Adult females, non-pregnant</td>
<td>12</td>
<td>34</td>
</tr>
<tr>
<td>Adult females, pregnant</td>
<td>11</td>
<td>34</td>
</tr>
<tr>
<td>Children, 6 m - 6 y</td>
<td>11</td>
<td>34</td>
</tr>
<tr>
<td>Children, 6 - 14 y</td>
<td>12</td>
<td>34</td>
</tr>
</tbody>
</table>

• 12 by 12 Initiative: The initiative was launched by MoHFW, GOI; FOGSI and UNICEF on April 24, 2007
  • Main Objective: To ensure that every child have a healthy hemoglobin of 12 gm% by the age of 12 years

Iron - Folic acid tablets

o An adult tablet of IFA contains: 100 mg elemental Iron and 500 meg Folic acid (to be given for 100 days minimum in pregnancy)

o A pediatric tablet of IFA contains: 20 mg elemental Iron and 100 meg Folic acid (to be given for 100 days minimum every year till 5 years age of child)

Semen analysis

o World Health Organization (WHO) values for normal semen analysis:
  • Total volume: > 2 ml
  • Concentration: > 20 million sperm per ml
  • Morphology: > 15% normal sperm
  • Motility: > 50% sperm with forward movement, or 25% with rapid movement within 1 hour of ejaculation
  • White blood cells: < 1 million per mL
  • Further analysis (sperm mixed antiglobulin reaction [MAR] test) shows adherent particles in: < 10% of sperm

o Grading of sperm motility:
  • Grade I: Immotile (no movement at all)
  • Grade II: Non-progressive motility (no movement but tails move)
  • Grade III: Nqn-linear motility, curved/ crooked motility (type b)
  • Grade IV: Linear progressive motility (type a)

o Aspermia: Absence of semen

o Azoospermia: Absence of sperms
**Oligospermia**: Low no. of sperms

**Asthenozoospermia**: Poor sperm motility

**Teratozoospermia**: Sperms carry more morphological defects than usual

---

**Baby Friendly Hospital Initiative (BFHI)**

- 10 steps to successful breast feeding (WHO-UNICEF and BFHI-Baby Friendly Hospital Initiative): Every facility providing maternity services and care to the newborn infants should, (MNEMONIC: SERENDIPITY)
  - Have a written breast feeding Policy that is routinely communicated to all health care staff
  - Train all health care staff in skills-necessary to implement this policy
  - Inform all pregnant women about benefits and management of breast feeding
  - Help mother Initiate breast feeding 'within half hour of birth'
  - Show mothers how to breast-feed, and how to maintain lactation even if they are separated from their infants
  - Give newborn infants no food or drink other than breast milk, unless medically indicated
  - Practice Rooming-in: Allow mothers and infants to remain together 24 hours a day
  - Encourage ‘breast feeding on Demand’
  - Give NO artificial teats, pacifiers (dummies/soothers) to breast feeding infants
  - Foster Establishment of breast feeding support groups and refer mothers to them on discharge from the hospital or clinic
    - Eliminate any support by the manufacturers of infant-formula/infant-food or feeding bottles
    - Prohibit distribution of free and low-cost supplies of breast milk supplies
    - Provide additional lactation assistance to mothers of special cases, i.e., low birth weight, caesarean section
    - Assure a safe and healthy and positive birthing experience for mother and infant

---

**Health programmes to combat malnutrition**

<table>
<thead>
<tr>
<th>Programme</th>
<th>Ministry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin A prophylaxis programme</td>
<td>Ministry of Health &amp; Family Welfare</td>
</tr>
<tr>
<td>Prophylaxis against nutritional anemia</td>
<td>Ministry of Health &amp; Family Welfare</td>
</tr>
<tr>
<td>Iodine deficiency disorders control programme</td>
<td>Ministry of Health &amp; Family Welfare</td>
</tr>
<tr>
<td>Special nutrition programme</td>
<td>Ministry of Social Welfare</td>
</tr>
<tr>
<td>Balwadi nutrition programme</td>
<td>Ministry of Social Welfare</td>
</tr>
<tr>
<td>ICDS programme</td>
<td>Ministry of Social Welfare</td>
</tr>
<tr>
<td>Midday meal programme</td>
<td>Ministry of Education</td>
</tr>
</tbody>
</table>

---

**Mother to Child Transmission (MTCT)**

- **Rubella**: Any trimester; MC and most serious in I trimester
- **Varicella**: Any trimester; MC and most serious in I trimester
- **Syphilis**: Any trimester; More common in Late II trimester or III trimester
- **Toxoplasmosis**: Any trimester; MC in III trimester; Most serious in I trimester
- **Herpes simplex**: During delivery (from infected genital secretions)
- **HIV**: during delivery (30% chance in developing countries, 20% in developed countries), breast feeding (16%)
- **Hepatitis B**: 90% (in presence of HBeAg); 20% (in presence of HBsAg); MC in III trimester and through breast feeding
- **Cytomegalovirus**: Any trimester (MC third trimester)

---

**GERIATRICS**

- **Geriatric age group in India**: > 60 years
- **% Indian population comprised of Geriatric age group**: 8.1%
- **MC health disorder in Geriatric age group in India**: Visual impairment (Cataract)
The recommended daily energy intake

<table>
<thead>
<tr>
<th>Group</th>
<th>Energy allowance per day (Kcal)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Infancy</strong></td>
<td></td>
</tr>
<tr>
<td>0-6 months</td>
<td>500 Kcal/day</td>
</tr>
<tr>
<td>6-12 months</td>
<td>670 Kcal/day</td>
</tr>
<tr>
<td><strong>Adult Reference Male</strong></td>
<td></td>
</tr>
<tr>
<td>(Wt: 60 Kg)</td>
<td></td>
</tr>
<tr>
<td>Sedentary/Light work</td>
<td>2320</td>
</tr>
<tr>
<td>Moderate work</td>
<td>2730</td>
</tr>
<tr>
<td>Heavy Work</td>
<td>3490</td>
</tr>
<tr>
<td><strong>Adult Reference Female</strong></td>
<td></td>
</tr>
<tr>
<td>(Wt: 55 kg)</td>
<td></td>
</tr>
<tr>
<td>Sedentary/Light work</td>
<td>1900</td>
</tr>
<tr>
<td>Moderate work</td>
<td>2230</td>
</tr>
<tr>
<td>Heavy Work</td>
<td>2850</td>
</tr>
<tr>
<td><strong>Pregnancy</strong></td>
<td>+ 350 •</td>
</tr>
<tr>
<td><strong>Lactation</strong></td>
<td></td>
</tr>
<tr>
<td>First 6 months</td>
<td>+ 600</td>
</tr>
<tr>
<td>6-12 months</td>
<td>+ 520 .</td>
</tr>
</tbody>
</table>

(+ indicates 'over and above the daily requirement')

- Reference Man requires daily energy intake of 45 Kcal/kg
- Reference Woman requires daily energy intake of 40 Kcal/kg
- WHO recommends reduction in energy intake after age of 40 years
  - 5% per each decade till age 60 years and
  - 10% per each decade thereafter

Macro-nutrients

- Carbohydrates, fats and proteins form the main bulk of food; thus they are known as 'Macronutrients' or 'Proximate principles'
- Energy yield of macro-nutrients (Proximate principles): •

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Energy yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbohydrates</td>
<td>4 Kcal per gram (17 KJ)</td>
</tr>
<tr>
<td>Proteins</td>
<td>4 Kcal per gram (17 KJ)</td>
</tr>
<tr>
<td>Fats</td>
<td>9 Kcal per gram (37 KJ)</td>
</tr>
</tbody>
</table>

- Alcohol yields 7 kcal per gram

- In 'Balanced Diet', •...*"***•
  - Proteins should constitute 10 - 15 % of total daily energy intake
  - Fats should constitute 15 - 30 % of total daily energy intake
  - Carbohydrates, rich in fibre, should constitute the remaining of energy
Proteins
- *Protein requirement of an adult:* 0.83 gm per kg per day
- **Assessing Protein Quantity:**
  - *Protein Energy Ratio:*
    \[ PE \text{ ratio} = \frac{\text{Energy from protein}}{\text{Total energy in diet}} \times 100 \]
- **Assessing Protein Quality:**
  - Amino Acid Score (AAS)
  - Protein Efficiency Ratio (PER)
  - Biological Value (BV)
  - Net Protein Utilization (NPU): *BEST INDICATOR*

**Net Protein Utilization (NPU)**
- *Net Protein Utilization (NPU):* Provides a complete expression of *protein quality*
  \[ \text{NPU} = \frac{\text{Nitrogen retained by body}}{\text{Nitrogen intake}} \times 100 \]
  \[ \text{NPU} = \text{Biological value} \times \text{Digestibility coefficient} \]

- **NPU of selected food items:**

<table>
<thead>
<tr>
<th>Food Item</th>
<th>Net Protein Utilization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Egg (hen)</td>
<td>96*</td>
</tr>
<tr>
<td>Milk (cow)</td>
<td>81</td>
</tr>
<tr>
<td>Meat</td>
<td>79</td>
</tr>
<tr>
<td>Fish</td>
<td>77</td>
</tr>
<tr>
<td>Rice</td>
<td>65</td>
</tr>
<tr>
<td>Soyabean</td>
<td>55</td>
</tr>
<tr>
<td>Wheat</td>
<td>51</td>
</tr>
<tr>
<td>Grams (pulses)</td>
<td>45-50</td>
</tr>
<tr>
<td>Groundnut</td>
<td>50</td>
</tr>
</tbody>
</table>

(* NPU of egg is 96. Since egg is *reference protein*, its NPU is taken as 100 for comparison)

**Amino Acids**
- Limiting Amino Acids: Amino acids most deficient in proteins of a food item are *'Limiting amino acids'*

<table>
<thead>
<tr>
<th>Food Item</th>
<th>Limiting Amino Acid(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cereals</td>
<td>Threonine (&amp; Lysine)</td>
</tr>
<tr>
<td>Pulses</td>
<td>Methionine (&amp; Cysteine)</td>
</tr>
<tr>
<td>Maize</td>
<td>Tryptophan (&amp; Lysine)</td>
</tr>
</tbody>
</table>

- Deficiency develops due to only consumption of a particular type of food item with limiting amino acids (for e.g. wheat); Thus two or more food items are eaten together so that their proteins supplement one another; this is known as *Supplementary Action of Proteins'*
- **Essential Amino Acids (EAA):** Amino acids which are not synthesized in adequate amounts in the human body; so they have to be supplemented in diet from outside to prevent deficiency
  - *There are 10 EAA,* namely, Phenylalanine, Valine, Threonine, Tryptophan, Isoleucine, Methionine, Histidine, Arginine, Leucine, Lysine [**Mnemonic:** PVT TIM HALL or *Any Help In Learning 7These Little Molecules Proves Truly Valuable*]  
  - Histidine and Arginine are semi-essential amino acids
Fats

Fat content of different oils (%):

<table>
<thead>
<tr>
<th>Fats</th>
<th>SFA*</th>
<th>'MUFA*</th>
<th>PUFA*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safflower oil</td>
<td>10</td>
<td>15</td>
<td>75</td>
</tr>
<tr>
<td>Sunflower seed oil</td>
<td>8</td>
<td>27</td>
<td>65</td>
</tr>
<tr>
<td>Soya bean oil</td>
<td>14</td>
<td>24</td>
<td>62</td>
</tr>
<tr>
<td>Margarine</td>
<td>25</td>
<td>25</td>
<td>50</td>
</tr>
<tr>
<td>Groundnut oil</td>
<td>19</td>
<td>50</td>
<td>31</td>
</tr>
<tr>
<td>Palm oil</td>
<td>46</td>
<td>44</td>
<td>10</td>
</tr>
<tr>
<td>Butter</td>
<td>60</td>
<td>37</td>
<td>3</td>
</tr>
</tbody>
</table>

(* SFA: Saturated Fatty Acids; MUFA: Mono-unsaturated Fatty Acids; PUFA: Poly-unsaturated Fatty Acids)

Essential fatty acids (EFA)

- Essential Fatty Acids (EFA): Are those that cannot be synthesized in human body; they can only be derived from the food.
- The most important EFA is Linoleic Acid, which serves as a basis for production of other EFA.
- Dietary sources of EFA:

<table>
<thead>
<tr>
<th>EFA</th>
<th>Dietary source</th>
<th>% content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linoleic Acid</td>
<td>Safflower Oil</td>
<td>73</td>
</tr>
<tr>
<td></td>
<td>Corn Oil</td>
<td>57</td>
</tr>
<tr>
<td></td>
<td>Sunflower Oil</td>
<td>56</td>
</tr>
<tr>
<td></td>
<td>Soyabean oil</td>
<td>51</td>
</tr>
<tr>
<td>Arachidonic Acid</td>
<td>Meat, Eggs</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>Milk (fat)</td>
<td>0.5</td>
</tr>
<tr>
<td>Linolenic Acid</td>
<td>Soyabean oil</td>
<td>7</td>
</tr>
<tr>
<td>Eicosapentanoic Acid</td>
<td>Fish oil</td>
<td>10</td>
</tr>
</tbody>
</table>

EFA deficiency lead to 'Phrenoderma' (Toad Skin): It is characterized by rough rash like eruptions on the back and sides of arms and legs, the back, and the buttocks. It can be cured by giving 'linseed of safflower oil' which are rich in EFAs.

- Essential fatty Acids (EFA) chains:

<table>
<thead>
<tr>
<th>Type of fatty acids</th>
<th>Type of chain</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>co-3 Fatty Acids</td>
<td>Short chain</td>
<td>a-Linolenic acid</td>
</tr>
<tr>
<td></td>
<td>Long chain</td>
<td>Eicosapentaenoic acid</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Docosahexaenoic acid</td>
</tr>
<tr>
<td>co-6 Fatty Acids</td>
<td>Short chain</td>
<td>Linoleic Acid</td>
</tr>
<tr>
<td></td>
<td>Long chain</td>
<td>Arachidonic acid</td>
</tr>
<tr>
<td></td>
<td></td>
<td>y-Linolenicacid</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dihomo-y-Linolenic acid</td>
</tr>
</tbody>
</table>

- co-3 Fatty Acids have been shown to reduce the incidence of Coronary Heart Disease
- co-6: co-3 Fatty Acids ratio in diet is ideally recommended to be 1:1 to 4:1 (IDEAL FAT)
- Richest source of EFAs:
  - Safflower oil is the richest source of Linoleic acid, most important Essential fatty Acid
  - Flaxseed Oil is the richest source of Linolenic Acid
  - Fish is the richest source of Eicosapentaenoic acid
Milk

- Nutritive values of milk (per 100 gms):

<table>
<thead>
<tr>
<th></th>
<th>Cow's milk</th>
<th>Human milk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lactose (g)</td>
<td>4.4</td>
<td>7.4</td>
</tr>
<tr>
<td>Proteins (g)</td>
<td>3.2</td>
<td>1.1</td>
</tr>
<tr>
<td>Fat (g)</td>
<td>4.1</td>
<td>3.4</td>
</tr>
<tr>
<td>Calcium (mg)</td>
<td>120</td>
<td>28</td>
</tr>
<tr>
<td>Iron (mg)</td>
<td>0.2</td>
<td>1.0</td>
</tr>
<tr>
<td>Water (g)</td>
<td>87</td>
<td>88</td>
</tr>
<tr>
<td>Energy (Kcal)</td>
<td>67</td>
<td>65</td>
</tr>
</tbody>
</table>

- Milk is a poor source of Iron and Vitamin C
- Fat content of milk: Buffalo > Goat > Cow > Human
- Protein content of milk: Buffalo > Goat > Cow > Human
- Lactose content of milk: Human > Buffalo > Goat > Cow
- Energy content of milk: Buffalo > Goat > Cow > Human
- Types of commercially available milk in India:

<table>
<thead>
<tr>
<th>Milk Type</th>
<th>Fat content</th>
<th>SNF (Solid-not-fat) content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full cream</td>
<td>6.0 %</td>
<td>9.0 %</td>
</tr>
<tr>
<td>Standardised</td>
<td>4.5 %</td>
<td>8.5 %</td>
</tr>
<tr>
<td>Toned</td>
<td>3.0 %</td>
<td>8.5 %</td>
</tr>
<tr>
<td>Double toned</td>
<td>1.5 %</td>
<td>9.0 %</td>
</tr>
<tr>
<td>Skimmed</td>
<td>0.5 %</td>
<td>8.7 %</td>
</tr>
</tbody>
</table>

- Human Milk is richer in Carbohydrate (lactose), Iron and Water content WHILE Cow's milk is richer in Fat, Protein, Calcium and energy content
- Human milk proteins: More cystine and taurine; less methionine; better digested than cow's milk proteins
- Human milk fats: Higher levels of PUFAs, esp., linoleic acid and -linoleic acid; better digested and absorbed; low calcium content but better absorbed than cow's milk
- Human milk carbohydrates: Higher lactose inhibits growth of harmful bacteria
- Human milk vitamins and minerals: Human milk is richer in Vitamin A, C and K; richer in copper, cobalt and selenium; richer in iron and higher bioavailability; high calcium/phosphorus ratio; Human milk has lesser sodium

Pasteurization of Milk

- Test of contamination of milk:
  - Methylene Blue Reduction Test’ (MBRT): Is an indirect method for detection of microorganisms in milk; MBRT test is ‘carried out on milk accepted for pasteurization’
- Methods of Pasteurization:

<table>
<thead>
<tr>
<th>Method</th>
<th>Temp</th>
<th>Time</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holder/Vat Method</td>
<td>63-66°C</td>
<td>&gt;30 min</td>
<td>For small and rural communities</td>
</tr>
<tr>
<td>HTST Method</td>
<td>72° C</td>
<td>&gt;15 sec</td>
<td>Most widely used; for large quantities; Flash Rasterization'</td>
</tr>
<tr>
<td>HHST Method</td>
<td>68° C</td>
<td>30 min</td>
<td>'Batch Pasteurization'</td>
</tr>
<tr>
<td>UHT Method</td>
<td>125° C</td>
<td>Few sec</td>
<td>Heating in 2 stages; 2nd stage under pressure</td>
</tr>
</tbody>
</table>

- Tests of Pasteurized Milk (for adequacy/sufficiency of pasteurization):
  - Phosphatase Test: Widely used test
  - Standard Plate Count: Enforced limit is 30,000 bacterial count per ml of pasteurized milk
  - Coliform Count: Standard is coliforms be absent in 1 ml of milk
Dietary fibre

Dietary fibre is a non-starch polysaccharide and a physiologically important component of diet. There are two types of dietary fibres:

- **Insoluble fibres**: Cellulose, hemi-cellulose and lignin
- **Soluble fibres**: Pectins, gums and mucilages

A daily intake of about 40 grams of fibre is desirable. Indian diets provide about 50-100 grams of fibre per day.

Cereals and pulses are good sources of fibre (>10 gm fibre per 100 gms).

**Functions/uses of dietary fibre:**

- Forms bulk of stool; reduces tendency of constipation
- By reducing intestinal transit time of stools, it reduces toxicity
- Inhibits fecal mutagen synthesis
- Reduces incidence of colonic polyps, and invasive, colon cancer
- Reduces incidence of stomach, breast and prostate Cancers
- Reduces incidence of coronary heart disease
- Reduces blood levels of glucose and cholesterol
- Used in the management of irritable bowel syndrome and recurrent diverticulitis

**Recommended daily requirements (RDA) of Vitamins**

<table>
<thead>
<tr>
<th>Vitamin</th>
<th>Recommended daily requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin A</td>
<td>600 meg retinol</td>
</tr>
<tr>
<td>Vitamin B1 (Thiamine)</td>
<td>0.5 mg per 1000 Kcal of energy intake</td>
</tr>
<tr>
<td>Vitamin B2 (Riboflavin)</td>
<td>0.5 mg per 1000 Kcal of energy intake</td>
</tr>
<tr>
<td>Vitamin B3 (Niacin)</td>
<td>6.6 mg per 1000 Kcal of energy intake</td>
</tr>
<tr>
<td>Vitamin B5 (Pantothenic Acid)</td>
<td>10 mg</td>
</tr>
<tr>
<td>Vitamin B6 (Pyridoxine)</td>
<td>2 mg</td>
</tr>
<tr>
<td>Vitamin B7 (Folic Acid)</td>
<td>200 meg</td>
</tr>
<tr>
<td>Vitamin B9 (Folic Acid)</td>
<td>200 meg</td>
</tr>
<tr>
<td>Vitamin B12 (Cobalamin)</td>
<td>1 meg</td>
</tr>
<tr>
<td>Vitamin D</td>
<td>100 IU (2.5 meg calciferol)</td>
</tr>
<tr>
<td>Vitamin E (Tocopherol)</td>
<td>0.8 mg per gm of essential fatty acids</td>
</tr>
<tr>
<td>Vitamin K</td>
<td>0.03 mg per kg</td>
</tr>
</tbody>
</table>

**Vitamins and Vitamin deficiencies**

<table>
<thead>
<tr>
<th>Vitamins</th>
<th>Chemical Name(s)</th>
<th>Deficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin A</td>
<td>Retinol, Retinoid, Carotenoid</td>
<td>Xerophthalmia</td>
</tr>
<tr>
<td>Vitamin B1</td>
<td>Thiamine</td>
<td>Beri-beri, Wernicke's Korsakoff Psychosis</td>
</tr>
<tr>
<td>Vitamin B2</td>
<td>Riboflavin</td>
<td>Ariboflavinosis</td>
</tr>
<tr>
<td>Vitamin B3</td>
<td>Niacin, Niacinamide</td>
<td>Pellagra</td>
</tr>
<tr>
<td>Vitamin B5</td>
<td>Pyridoxine, Pyridoxamine, Pyridoxal</td>
<td>Anemia</td>
</tr>
<tr>
<td>Vitamin B7</td>
<td>Biotin</td>
<td>Dermatitis, Enteritis</td>
</tr>
<tr>
<td>Vitamin B9</td>
<td>Folic Acid, Folinic Acid</td>
<td>Megaloblastic Anemia, Neural tube defects</td>
</tr>
<tr>
<td>Vitamin B12</td>
<td>Cyanocobalamin, Hydroxycobalamin, Methylcobalamin</td>
<td>Megaloblastic Anemia</td>
</tr>
<tr>
<td>Vitamin C</td>
<td>Ascorbic Acid</td>
<td>Scurvy</td>
</tr>
<tr>
<td>Vitamin D</td>
<td>Ergocalciferol, Cholecalciferol</td>
<td>Rickets, Osteomalacia</td>
</tr>
<tr>
<td>Vitamin E</td>
<td>Tocopherols, Tocotrienols</td>
<td>Hemolytic anemia in newborn</td>
</tr>
<tr>
<td>Vitamin K</td>
<td>Phylloquinone, Menadione</td>
<td>Hemorrhagic disease of newborn</td>
</tr>
</tbody>
</table>
Xerophthalmia

- All the ocular manifestations of Vitamin-A deficiency are collectively known as 'Xerophthalmia' (Dry Eye)
  - Xerophthalmia is most common in children aged 1 - 3 years
  - 'First clinical sign' of Vitamin-A deficiency: Conjunctival xerosis
  - 'First clinical symptom' of Vitamin-A deficiency: Night blindness

- Recommended daily requirement of Vitamin-A:

<table>
<thead>
<tr>
<th>Group</th>
<th>Retinol (meg) OR p-carotene (meg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adults</td>
<td></td>
</tr>
<tr>
<td>Man</td>
<td>600</td>
</tr>
<tr>
<td>Woman</td>
<td>600</td>
</tr>
<tr>
<td>Pregnancy</td>
<td>800</td>
</tr>
<tr>
<td>Lactation</td>
<td>950</td>
</tr>
<tr>
<td>Infants</td>
<td>0 - 12 months</td>
</tr>
<tr>
<td>350</td>
<td></td>
</tr>
<tr>
<td>2800</td>
<td></td>
</tr>
<tr>
<td>Children</td>
<td></td>
</tr>
<tr>
<td>1 - 6 years</td>
<td>400</td>
</tr>
<tr>
<td>7 - 12 years</td>
<td>600</td>
</tr>
<tr>
<td>Adolescents</td>
<td>13 - 19 years</td>
</tr>
<tr>
<td>600</td>
<td></td>
</tr>
<tr>
<td>4800</td>
<td></td>
</tr>
</tbody>
</table>

- Prevalence criteria for determining the Xerophthalmia problem in a community:

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Night blindness</td>
<td>&gt;1.0%</td>
</tr>
<tr>
<td>Bitot's spots</td>
<td>&gt;0.5%</td>
</tr>
</tbody>
</table>

- Prevalence is measured in population, at risk, i.e., pre-school children 6 months - 6 years

- Clinical presentation of Xerophthalmia
  - Conjunctival xerosis in Xerophthalmia has a characteristic appearance of 'emerging like sand banks at receding tide'
  - 'Bitot's Spots' are triangular, pearly-white or yellowish, foamy spots on bulbar conjunctiva, on either side of cornea; in young children they indicate Vitamin-A deficiency, whereas in adults they are often inactive sequelae of earlier disease
  - Corneal xerosis
  - Keratomalacia (liquefaction of cornea) is a 'grave medical emergency'

Vitamin-A under National Immunization Schedule (NIS)

- Vitamin-A is administered by a '2 ml spoon'
- Strength of Vitamin-A solution: 1 lac IU per ml
- Under National Immunisation Schedule (NIS), Vitamin-A is given:
  - 1 lac IU at 9 months age (along with measles vaccine),
  - 2 lac IU every six months thereafter, till the age of 3 years (at 18, 24, 30 and 36 months of age)
  - A total of 9 lac IU is given
- UNDER THE NEW RECENT GUIDELINES IN NIS, VITAMIN-A IS GIVEN:
  - 1 lac IU at 9 months age (along with measles vaccine),
  - 2 lac IU every six months thereafter, till the age of 5 years (at 18, 24, 30, 36, 42, 48, 54 and 60 months of age)
  - A total of 17 lac IU is given

Vitamin B, (Niacin)

- Four D’s of Niacin deficiency (Pellagra): Diarrhoea, Dermatitis, Dementia and Death.
  - Pellagra also manifests glossitis and stomatitis
  - Casals Necklace: Scaly pigmented rash around neck seen in severe cases of pellagra
Pellagra is seen commonly in maize/sorghum eating populations: Maize is deficient in tryptophan (limiting amino acid), so maize eaters develop deficiency of Niacin, thus leading to Pellagra.

- Excess leucine is responsible for interfering the conversion
- Conversion ratio is 60 : 1
- 60 mg Tryptophan is converted to 1 mg of niacin in the body

**Vitamin B^ (Pantothenic acid)**

- Pantothenic acid is required by adrenal cortex
- Pantothenic acid deficiency was thought to be cause of 'Burning Feet/Sole Syndrome' among prisoners of World War II

**Vitamin D**

- Vitamin D is 'Kidney Hormone'
- Three major forms of Vitamin D are D_3 (Calciferol), D_2 (Ergocalciferol) and D_3 (Cholecalciferol)
- There is no plant source for Vitamin D (and Vitamin B_12)
- Vitamin D deficiency leads to rickets, osteomalacia, osteoporosis and colon cancer
- Vitamin D synthesis in sunlight:
  - Vitamin D can be synthesized in the body in adequate amounts by simple exposure to sunlight even for 5 minutes per day
  - Vitamin D is synthesized in sunlight when 7-dehydrocholesterol (present in abundance in skin) is converted to cholecalciferol
  - 'UV-B rays' (wavelength 270 - 300 nm) play an important role in Vitamin D synthesis

**Iron**

- Iron absorption from habitual Indian diets is less than 5%
- Iron absorption is low in Indian diets due to presence of inhibitors (phytates, tannates, oxalates, calcium)
- Vitamin C (Ascorbic acid) is a facilitator of iron absorption

**Evaluation of iron status in the body can be done by:**
- Hemoglobin concentration
- Serum ferritin: 'Most sensitive tool for evaluation of iron status'

**Iodine**

- Iodine deficiency as a major public health problem: Goitre prevalence > 10%
- Daily requirement of iodine: 150 meg (<1 teaspoon over lifetime) supplied normally by well balanced diets and drinking water
- Most widely used prophylactic public health measure against endemic goiter: Iodised salt
- Two-in-one salt: National Institute of Nutrition (Hyderabad) developed 'Twin Fortified Salt' also known as 'Double Fortified Salt' (DFS).
  - DFS contains Iron and Iodine
Iodisation of salt is the 'most widely used prophylactic measure against prevention of goiter'.

Iodised salt is most convenient, effective and economical method of mass prophylaxis in endemic areas.

According to Prevention of Food Adulteration (PFA) Act 1954:

- Level of iodisation: Minimum 30 ppm at production level and 15 ppm at consumer level.
- Moisture content: < 6.0 % by weight.
- Sodium chloride: > 96.0 % by weight.

Fluorine

Major source of fluorine to man: Drinking water.

Optimum level of fluorine in drinking water: 0.5 - 0.8 ppm (0.5 - 0.8 mg/litre).

- Level > 1.5 ppm: Dental fluorosis (mottling; seen best on incisors of upper jaw).
- Level 3.0 - 6.0 ppm: Skeletal fluorosis.
- Level > 10.0 ppm: Crippling fluorosis.

In temperate countries, where water intake is low, the optimum level of fluorine intake is accepted to be 1 - 2 ppm.

Defluoridation of water:

- 'Nalgonda Technique' has been developed by National Environmental Engineering Research Institute (NEERI), Nagpur for defluoridation of water. It involves addition of lime, alum and bleaching powder followed by flocculation, sedimentation and alteration. In Nalgonda technique, aluminium is major de-fluoridating agent.
- Household level de-fluoridation can be done by:
  1) Nalgonda Technique
  2) Alumina
  3) Phosphates

Food items as source of nutrients

Food Items as Poor Sources of nutrients:

- Milk is a poor source of Vitamin C and Iron.
- Meat is a poor source of Calcium.
- Fish is a poor source of Carbohydrates & Iodine.
- Egg is a poor source of Vitamin C and Carbohydrates.
- Rice is a poor source of Thiamine, Calcium, Iron and Vitamins A, D, C.

Food Items as Rich Sources of nutrients:

- Etlibbit Liver Oil is richest source of Vitamin A and Vitamin D.
- Indian Gooseberry (amla), is richest source of Vitamin C.
- Gingelly/seeds are richest source of Vitamin B1 (Thiamine).
- Sheep liver is richest source of Vitamin B2 (Riboflavin).
- Ragi (millet) is a rich source of calcium.
- Pistachio is the richest source of iron.

Soyabean

Soya bean is richest among pulses:

- It contains 43.2% proteins; 20% fats and 4% of minerals.
- Proteins of soya bean are of high nutritive value.
- Soya bean is also relatively richer in Calcium, Iron and Vitamin B as compared to other pulses.
- Limiting amino acid in soya bean is Methionine.
- NPU of Soya bean is 55.

Recommended Dietary Allowance (RDA)

Recommended Dietary Allowance (RDA): Is a level of intake corresponding to Mean ± 2 Standard Deviation, which covers requirement of 97.5 % of population.
RDA 'safe level approach' is NOT USED FOR ENERGY since excess energy intake is undesirable; For energy only mean or average requirement is defined as RDA.

Energy intake recommendations are formulated for a reference man and reference woman:

- Indian Reference Man: 18-29 years age; Weight 60 kg
- Indian Reference Woman: 18-29 years age; Weight 55 kg

### Food Adulteration Diseases

<table>
<thead>
<tr>
<th>Disease</th>
<th>Toxin</th>
<th>Adulterant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lathyrism</td>
<td>BOAA</td>
<td>Khesari Dal (Lathyrus sativus)</td>
</tr>
<tr>
<td>Epidemic Dropsy</td>
<td>Sanguinarine</td>
<td>Argemone maxicana (oil)</td>
</tr>
<tr>
<td>Endemic Ascites</td>
<td>Pyrrolizidine alkaloids</td>
<td>Crotolaria seeds (Jhunjhunia)</td>
</tr>
<tr>
<td>Aflatoxicosis</td>
<td>Aflatoxin</td>
<td>Aspergillus flavus/parasiticus</td>
</tr>
<tr>
<td>Ergotism</td>
<td>Clavine alkaloids</td>
<td>Claviceps fusiformis</td>
</tr>
</tbody>
</table>

### Lathyrism

- Lathyrism is a food adulteration disease
- Lathyrism is of two types:
  - Neurolathyris: In human beings
  - Osteolathyris (Odoratism): In animals Neurolathyris is caused by eating the pulse 'Khesari Dal (Lathyrus sativus)'. Diets containing over 30% of this dal consumed over a period of 2 - 6 months result in neurolathyrism
  - Toxin present in lathyrus seeds is 'Beta oxalyl amino alanine (BOAA)'.
- Lathyrism affects 15 - 45 years of age; It manifests as following stages:
  - Latent stage
  - No-stick stage
  - One-stick stage
  - Two-stick stage
  - Crawler stage
- Interventions for prevention and control of lathyrism:
  - Vitamin C prophylaxis
  - Banning the crop
  - Removal of toxin: Steeping method and Parboiling
  - Education
  - Genetic approach
  - Socio-economic changes

### Epidemic Dropsy

- Is caused by contamination of mustard oil with 'Argemone oil'
- 'Sanguinarine' is the toxin contained in argemone oil.
  - Sanguinarine interferes with oxidation of 'pyruvic'og which 'accumulates in blood/Tt may lead to sudden non-inflammatory edema of bilateral kWer limbs, diarrhea, dyspnoea, cardiac failure and death; It can also lead to glaucoma; It may Sometimes manifest as 'Sarcoïds' (dilatation of skin capillaries).
- Argemone oil may be detected by following tests:
  - Nitric acid test
  - Paper chromatography test: Most sensitive test
- Epidemic dropsy may occur in all ages except breast-fed infants

### Mid-day r^gal programme

- Mid-day meal programme (MDMP): Also known as 'School Lunch Programme' it has been in operation since 1961
• The major objective of MDMP: To attract more children for admission to schools and retain them so that literacy improvement of children could be brought about
• The meal is a supplement and not a substitute to the home diet
• The meal should supply 1/3 of the total energy requirement and 1/2 of the total protein requirement
• MDMP is being operationahsed under the Ministry of Education

Indian reference man & Woman

- Energy intake recommendations are formulated for a 'reference man' and a 'reference woman'

<table>
<thead>
<tr>
<th>Reference Indian Man</th>
<th>Reference Indian Woman</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>18-29 years</td>
</tr>
<tr>
<td>Weight</td>
<td>&gt; 60 kg</td>
</tr>
<tr>
<td>Height</td>
<td>&gt; 1.73 metres</td>
</tr>
<tr>
<td>BMI</td>
<td>20.3</td>
</tr>
<tr>
<td>Others</td>
<td>Free from disease, fit for active work; engaged in 8 hours of occupation (usually moderate activity), 8 hours in bed, 4-6 hours in sitting &amp; moving about and 2 hours in walking and in active recreation or household duties</td>
</tr>
<tr>
<td>Calculation</td>
<td>Average of values of age category 18-19 years, 20-24 years and 25-29 years.</td>
</tr>
</tbody>
</table>

Food Standards

- Codex Alimentarius: Joint FAO/WHO standards for international markets; Food standards in India are based on Codex Alimentarius
- PFA standards: Laid under 'Prevention of Food Adulteration Act 1954'; to obtain a minimum level of quality of food stuffs attainable under Indian conditions
- Bureau of Indian Standards (BIS): purely voluntary; express degree of excellence above PFA standards
- Agmark standards: Purely voluntary; express degree of excellence above PFA standards
CHAPTER 13
SOCIAL SCIENCES AND HEALTH

Family
- **Nuclear Family (Elementary/Unitary Family):** Consists of a married couple and their children while they are still regarded as dependents.
- **Joint Family:** Consists of no. of married couples and their children who live together in the same household.
  - All males are related by blood while females are wives, daughters, sisters and widows.
  - Property is held in common; there is a common family purse.
  - All authority is vested in the senior male member of the family.
- **3-Generation Family:** Consists of a household with representatives of three generations.
- **New Family:** A family of <10 years duration and consists of parents and children.

Family cycle
- A **normal family cycle** is conceived as having 6 phases:

<table>
<thead>
<tr>
<th>Phases of family life cycle</th>
<th>Events characterising</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>Description</td>
</tr>
<tr>
<td>I</td>
<td>Formation</td>
</tr>
<tr>
<td>II</td>
<td>Extension</td>
</tr>
<tr>
<td>III</td>
<td>Complete extension</td>
</tr>
<tr>
<td>IV</td>
<td>Contraction</td>
</tr>
<tr>
<td>V</td>
<td>Completed contraction</td>
</tr>
<tr>
<td>n</td>
<td>Dissolution</td>
</tr>
</tbody>
</table>

Intelligence quotient
- **Intelligence Quotient (IQ):** Is a score derived from one of several different standardized tests attempting to measure intelligence.
  - **Stern’s IQ Test:**
    \[
    \text{IQ} = \frac{\text{Mental age}}{\text{Chronological age}} \times 100
    \]
- "Levels of Intelligence based on IQ levels:

<table>
<thead>
<tr>
<th>Levels of Intelligence</th>
<th>IQ range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Idiot</td>
<td>0 – 24</td>
</tr>
<tr>
<td>Imbecile</td>
<td>25 – 49</td>
</tr>
<tr>
<td>Moron</td>
<td>50 – 69</td>
</tr>
<tr>
<td>Borderline</td>
<td>70 – 79</td>
</tr>
<tr>
<td>Low normal</td>
<td>80 – 89</td>
</tr>
<tr>
<td>Normal</td>
<td>90 – 109</td>
</tr>
<tr>
<td>Superior</td>
<td>110 – 119</td>
</tr>
<tr>
<td>Very superior</td>
<td>120 – 139</td>
</tr>
<tr>
<td>Near Genius</td>
<td>140 and over</td>
</tr>
</tbody>
</table>

- Categories of mental retardation based on IQ levels:
Mental status | IQ range
---|---
Normal IQ | / - » 70 and over
Mild mental retardation | 50 - 69
Moderate mental retardation | 35 - 49
Severe mental retardation | 21 - 34
Profound mental retardation | 20 or below

Social security
- Social security, primarily refers to a social insurance program providing social protection, or protection against socially recognized conditions, including poverty, old age, disability, unemployment and others
- Bismarck introduced a system of social insurance in Germany in 1883

Groups of populations
- Family: Is a group of biologically related individuals living together and eating from a common kitchen
  - Family is the primary unit of all societies
  - Family is the 'most powerful example of social cohesion'
- Crowd: A group of people coming together temporarily for a short period, motivated by a common interest or curiosity
  - Crowd lacks internal organization and leadership
- Mob: A group of people coming together temporarily for a short period, having a leader who forces members into action
  - Mob is more emotional than crowd
  - Like crowd, mob is unstable and lacks internal organization
- Herd: Is a crowd with a leader, where members of the group have to follow the orders of the leader without question

Interview technique
- Interview: A technique for investigation and an instrument for research
- Steps of Interview:
  - Establishing contact: first requisite before conducting an interview
  - Starting an interview
  - Securing rapport
  - Recall
  - Probe questions
  - Encouragement
  - Guiding the interview
  - Closing the interview
  - Report

Poverty line
- Below Poverty Line (BPL): Is defined on the basis of following definitions in India,

<table>
<thead>
<tr>
<th>BPL Criteria</th>
<th>Rural areas</th>
<th>Urban areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Per capita caloric intake</td>
<td>&lt; 2400 Kcal per day</td>
<td>&lt;2100 Kcal per day</td>
</tr>
<tr>
<td>Per capita income</td>
<td>&lt;22/- INR per day</td>
<td>&lt;29/- INR per day</td>
</tr>
<tr>
<td>Per capita income&quot;</td>
<td>&lt;1.25 $ per day</td>
<td></td>
</tr>
</tbody>
</table>

(# for International comparisons)
- BPL population in India: 29%. (2012)
- Human Poverty Index (HPI): Is a measure of development, whereas HPI is a measure of its deprivation
Scales for measurement of Socio-economic status

- Modified Kuppuswami Scale:
  - Is used for Urban families
  - Is based on 3 parameters:
    1) Education status of head of family
    2) Occupation of head of family
    3) Income of the family per month

Key definitions

- Acculturation: Is 'cultural contact' or mixing of two cultures
- Anthropology: Study of physical social and cultural history of man
- Community: A social group determined by geographical boundaries and/or common values or interests
- Culture: Is the learned behaviour which is socially acquired
- Custom: The established patterns of behavior that can be objectively verified within a particular social setting
  - Folk wares: Right ways of doing things in less vital areas of human conduct
  - Mores: More stringent customs
- Pedagogy: Art of science of teaching
- Socialised medicine: Provision of medical service and professional education by the State (as in state medicine), but the programme is operated and regulated by professional groups rather than by government
- Society: Is an organization of member agents characterized by 'system' - a system of social relationships between individuals
- Standard of Living: Refers to the usual scale of our expenditure, goods we consume and services we enjoy
  - Standard of living (WHO) includes
    1) Income & Occupation
    2) Standards of housing, sanitation & nutrition
    3) Level of provision of health, educational, recreational & other services
  - Standard of living depends on Per capita GNP
Safe and wholesome water

Safe and wholesome water, has been defined as water that is:

- Free from pathogenic agents
- Free from harmful chemical substances
- Pleasant to taste (free from colour and odour)
- Usable for domestic purposes

Water is said to be 'polluted' or 'contaminated' if it does not fulfill above criteria.

Water requirements

Water supply considered adequate to meet the need for domestic purposes:
- Rural: 40 litres per capita per day
- Urban: 150-200 litres per capita per day

Daily drinking water requirement: 2-3 litres per capita per day

Public Health Classification of Water borne diseases

- Water borne diseases: Occur due to drinking contaminated water, transmitted by faeco-oral route. Examples: Typhoid, Cholera, Dysentery, Viral Hepatitis A
- Water washed diseases: Include infections of the outer body surface which occur due to inadequate use of water or improper hygiene. Examples: Scabies, Trachoma, Typhus, Bacillary dysentery, Amoebic dysentery
- Water based diseases: Refers to infections transmitted through an aquatic invertebrate animal. Examples: Schistosomiasis, Dracunculiasis (Guineaworm disease)
- Water related diseases (Water breeding diseases): Are infections spread by insects that depend on water. Examples: Malaria, Filariasis, Dengue, Yellow fever, Onchocerciasis

Key guideline aspects of WHO recommended drinking water quality

- E. coli or thermotolerant coliforms or total coliforms in drinking water: NIL
  - Exception: In large urban supplies, if water samples are drawn over a continuous period of 12 months, upto 5% contaminated samples are acceptable (i.e. > 95% of samples must be coliform - free)
- Nitrate in drinking water: < 50 mg/litre
  - Nitrates in drinking water indicate: Remote contamination
  - Is solely for prevention of methemoglobinemia
- Nitrite in drinking water: < 3 mg/litre
  - Nitrites in drinking water indicate: Recent contamination
  - May lead to 'Blue baby syndrome'
- Zero pathogenic microorganisms, infectious viruses, pathogenic protozoa and infective stages of helminthes
- Fluorine <1.5 ppm (0.5 - 0.8 ppm: Optimum level)
- Nitrates <50 mg/litre
- Nitrites < 3 mg/litre
- MOST undesirable metal in drinking water: Lead

Bacteriological indicators of water quality

- Bacteriological indicators of water quality:
  - Coliforms (E.coli is most important microbiological indicator)
• Fecal streptococci (Indicator of recent contamination)
• Clostridium perfringens (Indicator of remote contamination)

o **Presumptive Coliform Test (MPN Multiple Tube test):**
  • *Culture medium*: McConkey's Lactose Bile Salt broth
  • Confirmatory tests - EIKJMAN'S Tests
  • **TRUE MPN INDEX—** from McCrady's tables

### Hardness of Water

o Hardness of water is defined as the 'soap destroying power of water'

o Hardness of water is of two types:

<table>
<thead>
<tr>
<th>Type of Hardness</th>
<th>Underlying causes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Temporary hardness</strong></td>
<td>Calcium &amp; Magnesium salts of Bicarbonates</td>
</tr>
<tr>
<td>(Carbonate hardness)</td>
<td></td>
</tr>
<tr>
<td><strong>Permanent hardness</strong></td>
<td>Calcium &amp; Magnesium salts of Sulfates</td>
</tr>
<tr>
<td>(Non-Carbonate hardness,)</td>
<td>Chlorides</td>
</tr>
<tr>
<td></td>
<td>Nitrates</td>
</tr>
</tbody>
</table>

o **Hardness of water is expressed in terms of:** milliequivalents per litre (meq/l) of CALCIUM CARBONATE (CaCO₃)

o Softening of water is recommended at level of hardnes > 3 meq/litre (>150mg/litre of Calcium carbonate)

o **Methods of removal of hardness of water:**

<table>
<thead>
<tr>
<th>Type of hardness</th>
<th>Methods of removal</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Temporary hardness</strong></td>
<td>Boiling</td>
</tr>
<tr>
<td>(Carbonate hardness)</td>
<td>Addition of lime</td>
</tr>
<tr>
<td></td>
<td>Addition of sodium carbonate</td>
</tr>
<tr>
<td></td>
<td>Permutit process</td>
</tr>
<tr>
<td><strong>Permanent hardness</strong></td>
<td>Addition of sodium carbonate</td>
</tr>
<tr>
<td>(Non-Carbonare hardness)</td>
<td>Base exchange process</td>
</tr>
</tbody>
</table>

### Chlorination of Water

o **Disinfecting action of chlorine in water is due to:**
  • Hypochlorous acid (HOCl) - Main role in disinfection
  • Hypochlorite ions (OCl⁻) - Minor role in disinfection

o **Chlorine has residual germicidal effect** (and not Ozone or UV rays)

o **Chlorine acts best as a disinfectant for water at:** pH around 7.0

o Recommended contact period of free residual chlorine in water: 1 hour

o **Level of free residual chlorine (FRC) recommended:**

<table>
<thead>
<tr>
<th>Water type W</th>
<th>Recommended Residual chlorine level[^]</th>
<th>Contact period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drinking water</td>
<td>&gt; 0.5 mg per litre (ppm)</td>
<td>1 hour</td>
</tr>
<tr>
<td>Swimming pool sanitation</td>
<td>&gt; 1.0 mg per litre (ppm)</td>
<td>1 hour</td>
</tr>
<tr>
<td>Drinking water to kill cyclops</td>
<td>&gt; 2.0 mg per litre (ppm)</td>
<td>1 hour</td>
</tr>
</tbody>
</table>

[^]: (* 1 mg per litre = 1 ppm)

o **Horrock's apparatus:**
  • **Use:** To find out the dose of bleaching powder required for disinfection of water, i.e.
  • *Chlorine demand estimation of water*
  • Indicator: Starch iodide (producing blue colour)
OT Test versus OTA Test

<table>
<thead>
<tr>
<th></th>
<th>Orthotoludine test (OTTest)</th>
<th>Orthotoludine-arsenite test (OTA Test)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determines level of</td>
<td>1) Free chlorine</td>
<td>1) Free chlorine</td>
</tr>
<tr>
<td></td>
<td>2) Total (Free + Combined)</td>
<td>2) Combined chlorine</td>
</tr>
<tr>
<td>Interference with</td>
<td>Present</td>
<td>None</td>
</tr>
<tr>
<td>nitrites, iron,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>manganese</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Bleaching powder (CaOCl) contains: 33% available chlorine
Chlorine has no effect on:
- bacterial spores, protozoal cysts & helminthic ova (except in higher doses)
- viral agents of Hepatitis A, Polio are also resistant in normal doses

14B. AIR

Air pollution
- Chemical indicators of air pollution:
  - Sulphur dioxide: BEST INDICATOR of air pollution
  - Smoke or Soiling index: Air strain on a filter paper measured through photoelectric
  - Grit & dust measurement
  - Coefficient of haze
  - Air pollution index

Air Humidity
- Air humidity is moisture content of air
- Air humidity can be measured by:
  - Dry and wet bulb thermometers
  - Hygrometer
  - Sling/Whirling Psychrometer
  - Assman Psychrometer

Instruments of importance in air environment:

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kata Thermometer</td>
<td>Assess cooling power of air &amp; air velocity</td>
</tr>
<tr>
<td>Anemometer</td>
<td>Assess air/wind velocity</td>
</tr>
<tr>
<td>Hygrometer</td>
<td>Assess air Humidity (moisture content of air)</td>
</tr>
<tr>
<td>Sling Psychrometer</td>
<td>Assess air Humidity (moisture content of air)</td>
</tr>
<tr>
<td>Assman Psychrometer</td>
<td>Assess air Humidity (moisture content of air)</td>
</tr>
<tr>
<td>Mercurial Barometer</td>
<td>Atmospheric pressure</td>
</tr>
<tr>
<td>Anaeroid Barometer</td>
<td>Atmospheric pressure</td>
</tr>
<tr>
<td>Wind Vane</td>
<td>Assess air/wind direction</td>
</tr>
</tbody>
</table>

14C. SOUND

- Human ear is sensitive to sound frequency: 20 - 20,000 Hz
- Daily maximum tolerable sound level to human ear (without substantial damage to their hearing): 85 - 90 dB
- Sound level above which tympanic membrane rupture (permanent mechanica.l damage): 150 - 160 dB
- Basic instruments used in studies of noise:
**318 PSMforFMGE**

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sound Level Meter</td>
<td>Measures intensity of sound in dB or dB(A)</td>
</tr>
<tr>
<td>Octave Band Frequency Analyser</td>
<td>Shows 'sound spectrum', characteristic (pitch)</td>
</tr>
<tr>
<td>Audiometer</td>
<td>Measures hearing ability</td>
</tr>
</tbody>
</table>

### 14D. HOUSING

**Housing standards in India:**

- **Cubic space:** > 500 cu. ft. per capita
- **Windows:** Windows area 1/5 of floor area (Doors + windows area 2/5 of floor area); placed at height of not more than 3 ft from floor

**Accepted standards to prevent overcrowding:**

- **Persons per room:**

<table>
<thead>
<tr>
<th>No. of rooms</th>
<th>Maximum no. of persons</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 room</td>
<td>2 persons</td>
</tr>
<tr>
<td>2 room</td>
<td>3 persons</td>
</tr>
<tr>
<td>3 room</td>
<td>5 persons</td>
</tr>
<tr>
<td>4 room</td>
<td>7 persons</td>
</tr>
<tr>
<td>&gt; 5 rooms</td>
<td>10 persons (additional 2 for each further room)</td>
</tr>
</tbody>
</table>

**Floor space per person:** Child between 1 - 10 years is counted as 1/4 unit; infant is not counted.

<table>
<thead>
<tr>
<th>Floor space</th>
<th>Maximum no. of persons</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;110 sq.ft.</td>
<td>2 persons</td>
</tr>
<tr>
<td>90-110 sq. ft.</td>
<td>1/4 persons</td>
</tr>
<tr>
<td>70-90 sq.ft.</td>
<td>1 person</td>
</tr>
<tr>
<td>50-70 sq.ft.</td>
<td>1/4 person</td>
</tr>
<tr>
<td>&lt;50 sq.ft.</td>
<td>Nil</td>
</tr>
</tbody>
</table>

**Sex separation:** Overcrowding is said to exist if two persons over 9 years of age, not husband and wife, of opposite sexes are obliged to sleep in the same room.

### 14E. WASTE MANAGEMENT

**Types of waste:**

- **Sewage:** Liquid waste containing excreta; sewage contains 99.9% water
- **Suitage (Grey Water):** Liquid waste without excreta
- **Domestic Refuse:** Waste generated from the living room
- **Garbage:** Waste generated from kitchen (processed food waste)

**Refuse:**

- **Methods of Refuse Disposal**

<table>
<thead>
<tr>
<th>Methods of refuse disposal</th>
<th>Insanitary methods</th>
<th>Sanitary methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hog feeding</td>
<td>Composting</td>
<td></td>
</tr>
<tr>
<td>Stacking</td>
<td>Sanitary landfill</td>
<td></td>
</tr>
<tr>
<td>Salvaging</td>
<td>Incineration</td>
<td></td>
</tr>
<tr>
<td>Dumping</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
• Most insanitary method of refuse disposal. Dumping
• Most sanitary/hygienic method of refuse disposal. Sanitary landfill (Controlled tipping)
• Most sanitary method of hospital refuse disposal. Incineration

**Sewage**
• Sewage: Is liquid waste containing excreta
• Strength of sewage is expressed in terms of
  • Biological Oxygen Demand (BOD): Strong Sewage has BOD > 300 g/litre and Weak Sewage has BOD < 100 g/litre
  • Chemical Oxygen Demand (COD)
  • Suspended solids

**Sanitation Barrier**
• 5 F’s of Faecal borne diseases:
  • Faeces
  • Flies
  • Fingers
  • Fomites
  • Food
• Sanitation barrier. Exists between 1 F (Faeces) on one side & 4 F’s (Flies, Fingers, Fomites, Food) on other side
• Depth of water seal in RCA sanitary latrine: 2 cms (3/4 inch)
  • Water seal-in RCA latrine is an example of ‘Sanitation barrier’

### 14F. MEDICAL ENTOMOLOGY

**Vectors and diseases transmitted**

<table>
<thead>
<tr>
<th>Vector</th>
<th>Disease(s) transmitted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Housefly (Musca domestica)</td>
<td>Diarrhoes, Poliomyelitis, Yaws, Anthrax, Trachoma</td>
</tr>
<tr>
<td>Sandfly (Phlebotamus argentipes)</td>
<td>Kala azar, Oriental sore, Sandfly fever, Oroya fever</td>
</tr>
<tr>
<td>Tse-Tse fly (Glossina palpalis)</td>
<td>Sleeping sickness of Africa (African Trypanosomiasis)</td>
</tr>
<tr>
<td>Reduviid bug (Triatominae)</td>
<td>Chagas Disease (American Trypanosomiasis)</td>
</tr>
<tr>
<td>Soft tick</td>
<td>Relapsing fever, Q fever, KFD (outside India)</td>
</tr>
<tr>
<td>Louse</td>
<td>Epidemic typhus, Trench fever, Relapsing fever</td>
</tr>
<tr>
<td>Rat flea (Xenopsylla cheopsis)</td>
<td>Bubonic plague, Murine typhus, Chiggerosis</td>
</tr>
<tr>
<td>Anopheles mosquito</td>
<td>Malaria, Filaria (outside India)</td>
</tr>
<tr>
<td>Culex mosquito</td>
<td>Bancroftian Filariasis, Japanese Encephalitis</td>
</tr>
<tr>
<td>Aedes mosquito</td>
<td>Yellow fever, Dengue, DHF, Chikungunya</td>
</tr>
</tbody>
</table>

**General Principles of Arthropod Control**

• Environmental control:
  • Best approach to control of arthropods, because results are likely to be permanent
  • Examples. Elimination of breeding places (source reduction), filling & drainage operation, planned water management

• Chemical control:
  • No longer fully effective if used alone: Resistance has appeared
  • Essential to use biodegradable, less toxic compounds: iVlethoxychlor, Abate, Dursban
  • Other examples: Mosquito larvicida.l oil (MLO), Paris green, Pyrethrum

• Biological control:
  • Minimises environmental pollution
  • Examples: Larvivorous fishes (Gambusia affinis, Lebister reticulata, Poecilia reticulata)
Sandfly (Phlebotamus argentipes)
- Sandfly (Phlebotamus argentipes) transmits:
  - Kala azar (Visceral leishmaniasis)
  - Oriental sore (Cutaneous leishmaniasis)
  - Sandfly fever
  - Oraya fever
- Breeding habitats: Cracks & crevices in soil & buildings, tree holes, caves, etc
- Insecticide of choice: DDT (second line: BHC)

Rodents and diseases

<table>
<thead>
<tr>
<th>Bacterial:</th>
<th>Viral:</th>
<th>Rickettsial:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plague</td>
<td>Lassa fever</td>
<td>Scrub typhus</td>
</tr>
<tr>
<td>Tularaemia</td>
<td>Hemorrhagic fever</td>
<td>Murine (Fleaborne) typhus</td>
</tr>
<tr>
<td>Salmonellosis</td>
<td>Encephalitis</td>
<td>Rickettsial pox</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parasitic:</th>
<th>Others:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hymenolepis diminita</td>
<td>Rat bite fever</td>
</tr>
<tr>
<td>Leishmaniasis</td>
<td>Leptospirosis</td>
</tr>
<tr>
<td>Amoebiasis</td>
<td>Histoplasmosis</td>
</tr>
<tr>
<td>Trichinosis</td>
<td></td>
</tr>
<tr>
<td>Chagas disease</td>
<td></td>
</tr>
</tbody>
</table>

Biological transmission of arthropod-borne diseases

<table>
<thead>
<tr>
<th>Transmission</th>
<th>Definition</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Propagative</td>
<td>Only multiplication</td>
<td>Plague bacilli in rat fleas</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yellow fever virus in Aedes mosquitoes</td>
</tr>
<tr>
<td>Cyclo-propagative</td>
<td>Multplication + development</td>
<td>Malarial parasite in anopheline mosquitoes</td>
</tr>
<tr>
<td>Cyclo-developmental</td>
<td>only development</td>
<td>Filarial parasite in culex mosquitoes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Guinea worm embryo in cyclops</td>
</tr>
</tbody>
</table>

Mosquito
- Life span of a mosquito varies from: 8 to 34 days
- Feeding-habits of mosquitoes: Females are hematophagus, required a blood meal once in 2-3 days for development of eggs.
  - Males never bite, they subsist on plant juices

Mosquito vectors in India

Important Mosquito Vectors in India.

<table>
<thead>
<tr>
<th>Diseases transmitted</th>
<th>Anopheles</th>
<th>Culex</th>
<th>Aedes</th>
<th>Mansonia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaria</td>
<td>Bancroftian filariasis, Japanese encephalitis</td>
<td>Dengue &amp; DHF, Chikungunya, Yellow fever, Brugian filariasis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breeding Habitat.</td>
<td>Clean water</td>
<td>Dirty, polluted water</td>
<td>Artificial collections of water, Water bodies containing aquatic plants</td>
<td></td>
</tr>
<tr>
<td>Eggs</td>
<td>Laid singly, 'boat shaped' with lateral floats</td>
<td>Laid in small clusters/rafts</td>
<td>Laid singly, cigar shaped, Laid in star shaped clusters</td>
<td></td>
</tr>
<tr>
<td>Larvae</td>
<td>No siphon tube; Rest parallel to undersurface of water</td>
<td>Siphon tube; Rest perpendicular to undersurface of water</td>
<td>Siphon tube; Rest in dark bottom corners</td>
<td>Siphon tube; Rest attached to rootlets of plants</td>
</tr>
<tr>
<td>Adults</td>
<td>Inclined at an angle to surface, Spotted wings</td>
<td>'Hunch back' rest, Stripes on body &amp; legs (TIGER MOSQUITO)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flight range</td>
<td>3-5 kms</td>
<td>11 kms</td>
<td>100 m</td>
<td></td>
</tr>
</tbody>
</table>
o International measures to restrict spread of Yellow Fever
  • Travellers:
    1) Must possess a valid International certificate of vaccination (validity 10days - l0yrs)
    2) If no such certificate available: Quarantine for 6 days
  • Mosquitoes:
    1) Airports/ seaports kept free from vector breeding: at least 400 meters around boundary
    2) Aedes aegypti index: kept below 1

Mosquito Control Measures
  o Anti-larval measures:
    • Environmental control: Source reduction (minor engineering methods - filling, leveling & drainage of breeding places and water management - intermittent irrigation)
    • Chemical, control:
      1) Mineral oils: Applied once-a-week; makes water unfit for human consumption and kills fish
      2) Paris green
      3) Synthetic insecticides: Abate (very effective larvicide and least toxic at dose of 1 ppm), Malathion, Fenthion, Chlorpyrifos
    * Biological control: through use of small fishes
      1) Gambusia affinis
      2) Lebister reticulata
      3) Poecilia
  o Anti-adult measures:
    • Residual sprays:
      1) DDT
      2) BHC
      3) Malathion
    • Space sprays:
      1) Pyrethrum extract: nerve poison
    • Genetic control
  o Personal protection measures (against mosquito bites):
    • Mosquito nets:
      1) No. of holes per square inch: 150
      2) Size of each hole diameter: < 0.0475 inch
    • Repellants

Few important mosquito control measures
  o Paris Green (Copper Acetoarsenite):
    • Anti-larval measure, kills mainly Anopheles larvae as they are surface feeders
    • Paris green is a ‘stomach poison’
    • Is most widely used larvicide for mosquito control
  o Pyrethrum:
    Space spray for killing adult mosquitoes
    Contact poison
    Knock-down effect with paralysis
    Insecticide of plant origin: Flowers of Chrysanthemum
    5 active principles (all ‘nerve poisons’): "AVX. -C-"
4) Cinerin II  
5) Jasmoline II

0 Most important step in reducing ho. of mosquitoes: Source Reduction (reduction in breeding places)

**Insecticides for arthropod control**:

<table>
<thead>
<tr>
<th>Insecticide class/ group</th>
<th>Example(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Contact poisons</td>
<td>Pyrethrum, Nicotine, Mineral oil</td>
</tr>
<tr>
<td>Synthetic Contact poisons</td>
<td></td>
</tr>
<tr>
<td>Organochlorines</td>
<td>DDT, BHC, Lindane</td>
</tr>
<tr>
<td>Organophosphates</td>
<td>Malathion, Parathion, Fenthion, Abate</td>
</tr>
<tr>
<td>Carbamates</td>
<td>Carbaryl, Propoxur</td>
</tr>
<tr>
<td>Repellants</td>
<td>DEET, benzyl benzoate</td>
</tr>
<tr>
<td>Stomach poisons</td>
<td>Paris green, Sodium fluoride</td>
</tr>
<tr>
<td>Fumigants</td>
<td>Hydrogen cyanide, SO2</td>
</tr>
</tbody>
</table>
**CHAPTER 15**

**BIOMEDICAL WASTE MANAGEMENT**

**Biomedical Waste Management**

- Bio-Medical Wastes (BMW) in India are handled and managed under 'Bio-Medical Waste Management (Management & Handling) Rules, 1998'.

- Categories of Bio medical wastes (BMW) (Schedule I):

<table>
<thead>
<tr>
<th>Cat</th>
<th>BMW</th>
<th>Wastes included</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Human Anatomical Waste</td>
<td>Human tissues, organs, body parts</td>
</tr>
<tr>
<td>2</td>
<td>Animal Waste</td>
<td>Animal tissues, body parts, organs, carcasses, fluids, blood</td>
</tr>
<tr>
<td>3</td>
<td>Microbiological and Biotechnology Waste</td>
<td>Waste from lab cultures, stocks, specimens of microorganisms, live/ attenuated vaccines, cell cultures, wastes from production of biologicals, toxins</td>
</tr>
<tr>
<td>4</td>
<td>Waste Sharps</td>
<td>Needles, syringes, blades, scalpels, glass</td>
</tr>
<tr>
<td>5</td>
<td>Discarded Medicines and Cytotoxic Drugs</td>
<td>Outdated contaminated and discarded medicines</td>
</tr>
<tr>
<td>6</td>
<td>Soiled Waste</td>
<td>Items contaminated with blood, and fluids, including cotton, dressings, soiled plaster casts, linen, beddings</td>
</tr>
<tr>
<td>7</td>
<td>Solid Waste</td>
<td>Disposable items (except sharps) including tubings, catheters, intravenous sets</td>
</tr>
<tr>
<td>8</td>
<td>Liquid Waste</td>
<td>Waste generated from lab and washing, cleaning, housekeeping and disinfecting activities</td>
</tr>
<tr>
<td>9</td>
<td>Incineration Ash</td>
<td>Ash from incineration of any BMW</td>
</tr>
<tr>
<td>10</td>
<td>Chemical Waste</td>
<td>Chemical used in disinfection (insecticides) or in production of biologicals</td>
</tr>
</tbody>
</table>

**Treatment/ Disposal of Bio medical wastes (Schedule I):**

<table>
<thead>
<tr>
<th>Cat</th>
<th>BMW</th>
<th>Treatment/disposal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Human Anatomical Waste</td>
<td>Incineration/ deep burial</td>
</tr>
<tr>
<td>2</td>
<td>Animal Waste</td>
<td>Incineration/ deep burial</td>
</tr>
<tr>
<td>3</td>
<td>Microbiology and Biotechnology Waste</td>
<td>Local autoclaving/ microwave/ incineration</td>
</tr>
<tr>
<td>4</td>
<td>Waste Sharps</td>
<td>Chemical treatment/ autoclaving/ microwave and mutilation/ shredding</td>
</tr>
<tr>
<td>5</td>
<td>Discarded Medicines and Cytotoxic Drugs</td>
<td>Incineration/ destruction/ secured landfills</td>
</tr>
<tr>
<td>6</td>
<td>Soiled Waste</td>
<td>Incineration/ autoclaving/ microwave</td>
</tr>
<tr>
<td>7</td>
<td>Solid Waste</td>
<td>Chemical treatment/ autoclaving/ microwave and mutilation/ shredding</td>
</tr>
<tr>
<td>8</td>
<td>Liquid Waste</td>
<td>Chemical treatment</td>
</tr>
<tr>
<td>9</td>
<td>Incineration Ash</td>
<td>Sanitary landfill</td>
</tr>
<tr>
<td>10</td>
<td>Chemical Waste</td>
<td>Chemical treatment-and secured landfill (for solids)</td>
</tr>
</tbody>
</table>

- Colour coding and Type of container for BMW disposal • (Schedule II):
<table>
<thead>
<tr>
<th>Color coding</th>
<th>BMW category</th>
<th>Treatment option</th>
</tr>
</thead>
<tbody>
<tr>
<td>. Yellow</td>
<td>1, 2, 3, 6, 7;?</td>
<td>Incineration/ deep burial</td>
</tr>
<tr>
<td>Red</td>
<td>3, 6, 7</td>
<td>Autoclave/ Microwave/ Chemical treatment</td>
</tr>
<tr>
<td>Blue/ White translucent</td>
<td>4, 7</td>
<td>Autoclave/ Microwave/ Chemical treatment and Destruction/ Shredding</td>
</tr>
<tr>
<td>Black</td>
<td>5, 9, 10 (solid)</td>
<td>Secured landfill</td>
</tr>
</tbody>
</table>

- Container/ bags are NOT required for disposal of:
  - BMW Cat. 8: 'Liquid waste'
  - BMW Cat. 10: Chemical waste

**Incineration**
- Incineration: Is a 'high temperature dry oxidation' process; It leads to significant reduction in waste-volume and weight (upto 70 - 80 %)
- Incineration does not require pre-treatment
- Biggest disadvantage of incineration: Generation of smoke
- Temperature in an incinerator:
  - Primary chamber: 800° ± 50° C
  - Secondary chamber: 1050° ± 50° C
- Wastes types not-to-be incinerated:
  - Pressurized gas containers
  - Reactive chemical wastes (large)
  - Silver/Radiographic/photographic wastes
  - Halogenated plastics (PVC)
  - Wastes with high mercury/cadmium content
  - Sealed ampoules/ ampoules with heavy metals
- Red bags should not be incinerated as they contain cadmium (heavy metal)

**Inertization**
- The process of 'Inertization' involves mixing biomedical waste with cement and other substance before disposal, so as to minimize risk of toxic substances contained in waste to contaminate ground/ surface water. Inertization is especially suitable for pharmaceuticals and for incineration ashes with high metal content
- Advantage of Inertization: Relatively inexpensive
- Disadvantage of Inertization: Not applicable to infectious waste
Disaster

- Disaster (WHO): Is any occurrence that causes damage, ecological disruption, loss of human life or deterioration of health and health services on a scale sufficient to warrant an extraordinary response from outside the affected community or area.
  - Disaster (Colin Grant): Is catastrophe causing injury or illness simultaneously to at least 30 people, who will require hospital emergency treatment.
  - During the phase of search, rescue and first aid, most immediate help cover is derived from uninjured survivors.
  - ‘Most crucial phase of disaster management’ is the stage of health and medical relief.
  - World Disaster Reduction Day: 2nd Wednesday of October.

Stages of a Disaster Cycle

- Stage I. Disaster impact and response:
  - Search, rescue and first aid
  - Field care
  - Triage
  - Tagging
  - Identification of dead

- Stage II. Stage of health and medical relief: Disaster containment
  - Primary phase (0-6 hours): First aid, medical care
  - Secondary follow-up (6-24 hours): Transportation, sanitation and immunization
  - Tertiary clean up (1-60 days): Food, clothing, shelter assistance, social service, employment, rehabilitation

- Stage III. Rehabilitation:
  - Water supply
  - Sanitation and personal hygiene
  - Food safety
  - Vector control

- Stage IV. Mitigation: Measures designed to either prevent hazards from causing emergency or to lessen the effects of emergency.

- Stage V. Disaster preparedness

Immediate post-disaster phase

- Most commonly reported disease in post-disaster phase is Gastroenteritis.
- Most practical and effective strategy of disease prevention and control in post-disaster phase is 'supplying safe drinking water and proper disposal of excreta'.
- Foremost step for disease prevention and control in post-disaster phase is chlorination of all water bodies.
- Level of residual chlorine to be maintained in all water bodies in post-disaster phase is > 0.7 mg/l (>0.7 ppm).
- A common micronutrient deficiency in disasters is Vitamin A deficiency: It occurs due to deficient relief diets, measles and diarrhea (gastroenteritis).
- WHO does not recommend Typhoid, Cholera and Tetanus Toxoid vaccinations in routine use in endemic areas.
  - However, these vaccinations are recommended for health workers.
  - Because measles can deplete Vitamin A stores in children, ‘measles is the highest priority among vaccinations for children’ living in congregate care after a disaster.
Triage
- Triage: Consists of rapidly classifying the injured ‘NOT on the basis of severity of their injuries BUT on the basis of likelihood of their survival’ with prompt medical intervention
  - First come first serve is NOT followed in emergencies
- Triage system: Most commonly uses FOUR color code system:
  - Red (Highest Priority): Immediate resuscitation or limb/life saving surgery in next 6 hours
  - Yellow (High Priority): Possible resuscitation or limb/life saving surgery in next 24 hours
  - Green (Low Priority): Minor illness
  - Black (Least Priority): Dead and moribund patients
- Triage yields best results when carried out AT THE SITE of disaster

Man-made disasters
- World’s worst man-made disaster is Bhopal gas Tragedy, 3rd December 1984:
  - Methylisocyanate (MIC) gas leaked from Union Carbide pesticide plant in Bhopal, India
  - It resulted in the death of about 3,000 people according to the Indian Supreme Court
- Chernobyl nuclear explosion accident occurred on 26th April, 1986 in Russia (now Ukraine)
  - It resulted in the emission of I_{131}, Cs_{134}, Cs_{137}, Sr_{90}
  - Chernobyl nuclear explosion accident is the ‘largest accidental release of radioactive material in the history of nuclear power’
  - It is the only instance so far of level 7 on the International Nuclear Event Scale for nuclear accidents
- Fukushima Daichii (Japan) Tragedy, 11th March, 2011
  - It resulted in emission of I_{131}, Cs_{134}, Cs_{137}, Sr_{90}
  - None deaths were reported.
CHAPTER 17
OCCUPATIONAL HEALTH

Physical hazards arid disease

- Disease manifestations associated with physical hazards:
  - **High Temperature**
    1) Heat cramps
    2) Heat hyperpyrexia (body temperature <102° F)
    3) Heat exhaustion (body temperature >106° F)
    4) Heat stroke (body temperature upto 110° F)
  - **Low Temperature**
    1) Chilblains
    2) Trench Foot
    3) Frostbite
  - **Low Pressure**
    1) Caisson Disease
  - **Vibration**
    1) Vibration sickness
    2) Neurogenic damage
  - **Non-ionizing Radiation**
    1) Microwave Injuries
    2) Laser injuries

**Pneumoconioses**

- Pneumoconiosis occurs due to occupational exposure to dust.
- *Particles size 0.5 to 3.0 microns* are the MOST DANGEROUS (as a health hazard causing pneumoconiosis), as they reach the interior of lungs with ease.
- **Particle size and behavior.***

<table>
<thead>
<tr>
<th>Particle size</th>
<th>Behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;10 microns</td>
<td>Settle down by gravity</td>
</tr>
<tr>
<td>&lt;10 microns</td>
<td>Remain suspended in air</td>
</tr>
<tr>
<td>5-10 microns</td>
<td>Arrested in upper respiratory tract</td>
</tr>
<tr>
<td>3-5 microns</td>
<td>Deposited in mid respiratory tract</td>
</tr>
<tr>
<td>1-3 microns</td>
<td>Enter alveoli and settle there</td>
</tr>
<tr>
<td>&lt;1 microns</td>
<td>Brownian movement</td>
</tr>
</tbody>
</table>

- **List of Pneumoconioses:**

<table>
<thead>
<tr>
<th>Disease</th>
<th>Exposure source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silicosis</td>
<td>Silica dust</td>
</tr>
<tr>
<td>Anthracosis</td>
<td>Coal dust</td>
</tr>
<tr>
<td>Asbestosis</td>
<td>Asbestos dust</td>
</tr>
<tr>
<td>Byssinosis</td>
<td>Cotton fibre</td>
</tr>
<tr>
<td>Bagassosis</td>
<td>Molasses (sugarcane)</td>
</tr>
<tr>
<td>Berylliosis</td>
<td>Beryllium</td>
</tr>
<tr>
<td>Farmer’s Lung</td>
<td>Mouldy hay</td>
</tr>
<tr>
<td>Siderosis</td>
<td>Iron dust</td>
</tr>
<tr>
<td>Stannosis</td>
<td>Tin dust</td>
</tr>
<tr>
<td>Bird fancier’s lung</td>
<td>Avian/ bird droppings</td>
</tr>
<tr>
<td>Compost lung</td>
<td>Compost</td>
</tr>
</tbody>
</table>
Antigens involved in Pneumoconioses:

<table>
<thead>
<tr>
<th>Disease</th>
<th>Antigen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bagassosis</td>
<td>Thermoactinomyces sacchari</td>
</tr>
<tr>
<td>Farmer's Lung</td>
<td>Micropolyspora faeni</td>
</tr>
<tr>
<td>Compost lung</td>
<td>Aspergillus</td>
</tr>
<tr>
<td>Chemical workers lung</td>
<td>Isocyanates</td>
</tr>
</tbody>
</table>

Coal workers lung is known as 'black Lung'
Silicosis is known as 'grinder's disease'

Silicosis:

- Among the occupational diseases, silicosis is the major cause of permanent disability and mortality
- Particles of the size 0.5 - 3 microns are most dangerous for causation of silicosis
- Silicosis is a notifiable disease under Factories Act, 1948 and mines Act 1952
- Incubation period: Few months to 6 years
- X-ray shows 'snow storm appearance'
- No effective treatment is available
- Patients with silicosis are particularly susceptible to tuberculosis (TB) infection, known as 'Silicotuberculosis'. (ST)
  - The reason for the increased risk, 10-30 fold increased incidence, is not well understood
  - It is thought that silica damages pulmonary macrophages, inhibiting their ability to kill mycobacteria
- In recent years doubts have risen in the association between silicosis and tuberculosis as
  - Sputum is rarely AFB+
  - Children and women of STs do not develop tuberculosis
  - Post mortem of STs fail to prove existence of tuberculosis
  - Radiological evidence of both conditions is similar

Asbestosis:

- Occurs due to exposure to asbestos
- Does not usually appear until after 5 - 10 years of exposure. Once established, the disease is progressive even after removal of worker from contact
- Sputum shows 'asbestos bodies' which are asbestos fibres coated with fibrin
- May lead to pulmonary fibrosis, carcinoma of bronchus, mesothelioma of peritoneum/pleura and cancer of GIT
- Asbestos type most dangerous is 'amphibole'

Bagassosis:

- Bagassosis occurs due to occupational exposure to fibrous residue of sugarcane (bagasse)
- Bagassosis has been shown to be due to Thermoactinomyces sacchari
- Bagasse contains a percentage of silica, innumerable fungal spores and micro-organisms: Bagasse dust blocks bronchioles thus, leading to bronchitis and bronchopneumonia.
- Prevention and control measures:
  - Dust control
  - Personal protection
  - Medical control
  - Bagasse control
  - Keeping moisture content > 20%
  - Spraying bagasse with 2% PROPIONIC ACID (FUNGICIDE)
- Bagassosis is a form of extrinsic allergic alveolitis
- Organisms involved in causation of bagassosis:
• Thermoactinomyces sacchari
• Thermoactinomyces vulgaris
• Micropolyspora faeni

**Lead Poisoning**

- 'Lead poisoning is a notifiable and compensatable disease' in India since 1924
- Lead Poisoning is known as 'Plumbism', Saturnism or Painter's Colic
- Source of lead: Greatest source of environmental (non-occupational) lead is Gasoline/ petrol/ vehicular exhaust/ automobile exhaust

**Mode of absorption** - Lead can be absorbed by inhalation (most common), ingestion or through skin

**Clinical picture of lead poisoning:**
- Facial pallor: Earliest and most consistent sign
- Anemia: Microcytic hypochromic
- Punctate basophilia or basophilic stippling of RBCs
- Burtonian Line: Lead sulphide line on gums (upper jaw)
- Lead colic: Constipation (but sometimes diarrhea)
- Lead Palsy (Peripheral neuropathy): Wrist drop or Foot drop.
- Lead encephalopathy
- CNS effects: mostly due to organic lead compounds

**Diagnosis of lead poisoning:**

<table>
<thead>
<tr>
<th>Laboratory parameter</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coproporphyrin in Urine (CPU) &gt;150 mcg/l</td>
<td>Exposure to lead</td>
</tr>
<tr>
<td>Amino levulinic acid in urine (ALAU) &gt;5 mg/l</td>
<td>Indicates lead absorption</td>
</tr>
<tr>
<td>Lead in blood &gt;70 meg/100 ml</td>
<td>Clinical symptoms appear</td>
</tr>
<tr>
<td>Lead in urine &gt;0.8 mg/l</td>
<td>Leed.exposure and absorption</td>
</tr>
<tr>
<td>Basophilic stippling of RBCs</td>
<td>Punctate basophilia</td>
</tr>
</tbody>
</table>

**A useful screening test is Coproporphyrin in Urine (CPU)**.

**A sensitive parameter of hematological response is Basophilic stippling of RBCs**.

**Peripheral neuropathy causes extensor muscle weakness** (wrist/foot drop)

**Radiation exposure**

- International Commission of Radiological Protection (ICRP) has set the maximum permissible level of whole body occupational exposure to ionizing radiation at '5 rem per year for workers' AND at '0.5 rem per year for general public'

**Radiation exposure and effects:**

<table>
<thead>
<tr>
<th>Dose (rem)</th>
<th>Effects</th>
<th>Signs &amp; symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 - 20</td>
<td>No symptoms</td>
<td>Temporary ? in RBC count</td>
</tr>
<tr>
<td>20 - 50</td>
<td>No symptoms generally</td>
<td>Headache, ? infection risk, temporary male sterility</td>
</tr>
<tr>
<td>50 - 100</td>
<td>Mild radiation sickness</td>
<td>Vomiting, fatigue, ? immunity, spontaneous abortion, stillbirth</td>
</tr>
<tr>
<td>200 - 300</td>
<td>Light radiation poisoning</td>
<td>Loss of hair, massive, leucopenia, permanent female sterility</td>
</tr>
<tr>
<td>300 - 400</td>
<td>Severe radiation poisoning</td>
<td>T. -do-,-, Uncontrollable bleeding-in mouth, under skin, kidneys</td>
</tr>
<tr>
<td>400 - 600</td>
<td>Acute radiation poisoning</td>
<td>-do- (? severity)</td>
</tr>
<tr>
<td>600 - 1,000</td>
<td>Acute radiation poisoning</td>
<td>Complete bone marrow failure</td>
</tr>
<tr>
<td>1000 - 5000</td>
<td>Acute radiation poisoning</td>
<td>Massive diarrhea, bleeding, dyselectrolytemia, delirium, death</td>
</tr>
<tr>
<td>&gt; 5000</td>
<td>Acute radiation poisoning</td>
<td>Death</td>
</tr>
</tbody>
</table>
Vibration
- After some months or years of exposure to vibrations (10 - 500 Hz), the fine blood vessels of fingers may become extremely sensitive to spasm, known as 'White fingers'.
- White fingers are a form of Reynaud'S Disease
- Vibration White finger (VWF) causes the fingers to become numb and begin turning white.

Occupational cancers
- Occupational cancers affect skin, lungs, bladder and blood forming organs
- **Occupational exposures and cancers:**

<table>
<thead>
<tr>
<th>Agent</th>
<th>Cancer(s) caused</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asbestos</td>
<td>Mesothelioma</td>
</tr>
<tr>
<td>Arsenic</td>
<td>Skin. Lung. Liver</td>
</tr>
<tr>
<td>Benzene</td>
<td>Leukemia</td>
</tr>
<tr>
<td>Benzidine</td>
<td>Urinary bladder</td>
</tr>
<tr>
<td>Beryllium</td>
<td>Lung</td>
</tr>
<tr>
<td>Cadmium . . ; : . . . ; . ;</td>
<td>Lung</td>
</tr>
<tr>
<td>Chromium . . ; : . . ; . . ;</td>
<td>Nasal sinus, Lung</td>
</tr>
<tr>
<td>Ethylene oxide</td>
<td>Leukemia</td>
</tr>
<tr>
<td>Ionizing radiation</td>
<td>Skin. Thyroid. Lung</td>
</tr>
<tr>
<td>Nickel</td>
<td>Nasal sinus, Lung</td>
</tr>
<tr>
<td>Polycyclic aromatic hydrocarbons</td>
<td>Skin. Scrotum. Lung</td>
</tr>
<tr>
<td>Radon. . ; : . ; - V V . . ;</td>
<td>Lung</td>
</tr>
<tr>
<td>Silica . ; . ; . ; . ;  . ; . ;</td>
<td>Lung</td>
</tr>
<tr>
<td>Vinyl chloride . ; . ; . ; . ;</td>
<td>Liver</td>
</tr>
<tr>
<td>Wood dust . . ; . ; . ; . ; . ;</td>
<td>Nasal sinus</td>
</tr>
</tbody>
</table>

- **Most common occupational cancers:** Nearly 75% are skin cancers
  - Occupational skin cancers are predominantly 'squamous cell carcinomas'
  - Only characteristic feature of occupational skin cancers their occurrence on exposed parts of the body (head, neck, hands, arms) that have remained in direct contact with a carcinogenic source

  Carcinogens implicated in occupational skin cancers include UV light, ionizing radiation, coal products, petroleum products, lubricating oils, fuel oils, etc.

Caisson Disease
- **Caisson Disease (Decompression Sickness, DCS):** Occurs due to low pressure, when a diver ascends rapidly to surface or air passengers ascend too rapidly to high altitudes
  - Manifestations of air expansion:
    1) Barodontalgia: Air trapped beneath teeth expands
    2) Barosinusitis: Compressed air trapped in sinuses expands
    3) Barotitis: Air under pressure trapped in middle ear expands
    4) Emphysema: Most serious complication (may lead to cerebral embolism)
    5) Abdominal distension: Air trapped in intestinal canal expands
  - Effects of Nitrogen effervescence:
    1) Bends: Steady aching pain in joints
    2) Chokes: Rapid, shallow, dyspneic breathing
    3) Prickles: Irritation of nerve terminals in skin
    4) Paralysis: MOST SERIOUS COMPLICATION
    5) Aseptic bone necrosis: Hip, knee and shoulder joints

- Caisson Disease is a type of diving hazard and dysbarism.
- **Recompression is the only effective treatment for severe DCS,** although rest and oxygen applied to lighter cases can be effective.
- **Gases implicated in DCS:**
• Thenoactinomyces sacchari
• Thermoactinomyces vulgaris
• Micropolyspora faeni

**Lead Poisoning**

- *Lead poisoning is a notifiable and compensatable disease* in India since 1924
- Lead Poisoning is known as *Plumbism*, Saturnism or Painter's Colic
- Source of lead: Greatest source of environmental (non-occupational) lead is Gasoline/ petrol/ vehicular exhaust/ automobile exhaust
- Mode of absorption: Lead can be absorbed by inhalation (most common), ingestion or through skin
- Clinical picture of lead poisoning:
  - Facial pallor: *Earliest and most consistent sign*
  - Anemia: Microcytic hypochromic
  - Punctate basophilia or basophilic stippling of RBCs
  - Burtonian Line: Lead sulphide line on gums (upper jaw)
  - Lead colic: Constipation (but sometimes diarrhea)
  - Lead Palsy (Peripheral neuropathy): Wrist drop or Foot drop.
  - Lead encephalopathy
  - CNS effects: mostly due to organic lead compounds

Diagnosis of lead poisoning:

<table>
<thead>
<tr>
<th>Laboratory parameter</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coproporphyrin in Urine (CPU) &gt;150 mcg/1</td>
<td>Exposure to lead</td>
</tr>
<tr>
<td>Amino levulinic acid in urine (ALAU) &gt;5 mg/l</td>
<td>Indicates lead absorption</td>
</tr>
<tr>
<td>Lead in blood &gt;70 mcg/100 ml</td>
<td>Clinical symptoms: appe.ar</td>
</tr>
<tr>
<td>Lead in urine &gt;0.8 mg/l</td>
<td>Ledd.exposure and absorption</td>
</tr>
<tr>
<td>Basophilic stippling of RBCs</td>
<td>Punctate basophilia.</td>
</tr>
</tbody>
</table>

- A useful screening test is Coproporphyrin in Urine (CPU)
- A sensitive parameter of hematological response is Basophilic stippling of RBCs
- Peripheral neuropathy causes extensor muscle weakness (wrist/foot drop.)

**Radiation exposure**

- International Commission of Radiological Protection (ICRP) has set the maximum permissible level of whole body occupational exposure to ionizing radiation at '5 rem per year for workers' AND at '0.5 rem per year for general public'
- Radiation exposure and effects:

<table>
<thead>
<tr>
<th>Dose (rem)</th>
<th>Effects</th>
<th>Signs &amp; symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 - 20</td>
<td>No symptoms</td>
<td>-do-</td>
</tr>
<tr>
<td>20 - 50</td>
<td>No symptoms generally</td>
<td>Temporary ? in RBC count</td>
</tr>
<tr>
<td>50 - 100</td>
<td>Mild radiation sickness</td>
<td>Headache, ?, infection risk,, temporary male sterility</td>
</tr>
<tr>
<td>100 - 200</td>
<td>Light radiation poisoning</td>
<td>Vomiting, fatigue, ?, immunity, spontaneous abortion, stillbirth</td>
</tr>
<tr>
<td>200 - 300</td>
<td>Moderate radiation poisoning</td>
<td>Loss -of.hair, massive leucopenia, permanent female sterility</td>
</tr>
<tr>
<td>300 - 400</td>
<td>Severe radiation poisoning</td>
<td>-do-</td>
</tr>
<tr>
<td>400 - 600</td>
<td>Acute radiation poisoning</td>
<td>-do-</td>
</tr>
<tr>
<td>600 - 1,000</td>
<td>Acute radiation poisoning</td>
<td>Complete bone marrow failure</td>
</tr>
<tr>
<td>1000 - 5000</td>
<td>Acute radiation poisoning</td>
<td>Massive diarrhea, bleeding, dyselectrolytemia, delirium, death</td>
</tr>
<tr>
<td>&gt; 5000</td>
<td>Acute radiation poisoning</td>
<td>Death</td>
</tr>
</tbody>
</table>
Vibration
- After some months or years of exposure to vibrations (10 - 500 Hz), the fine blood vessels of fingers may become extremely sensitive to spasm, known as 'White fingers'.
- White fingers are a form of Reynaud's Disease
- Vibration White finger (VWF) causes the fingers to become numb and begin turning white.

Occupational cancers
- Occupational cancers affect skin, lungs, bladder and blood forming organs
- Occupational exposures and cancers:

<table>
<thead>
<tr>
<th>Agent</th>
<th>Cancer(s) caused</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asbestos</td>
<td>Mesothelioma</td>
</tr>
<tr>
<td>Arsenic</td>
<td>Skin, Lung, Liver</td>
</tr>
<tr>
<td>Benzene</td>
<td>Leukemia</td>
</tr>
<tr>
<td>Benzidine</td>
<td>Urinary bladder</td>
</tr>
<tr>
<td>Beryllium</td>
<td>Lung</td>
</tr>
<tr>
<td>Cadmium</td>
<td>Lung</td>
</tr>
<tr>
<td>Chromium</td>
<td>Nasal sinus, Lung</td>
</tr>
<tr>
<td>Ethylene oxide</td>
<td>Leukemia</td>
</tr>
<tr>
<td>Ionizing radiation</td>
<td>Skin, Thyroid, Lung</td>
</tr>
<tr>
<td>Nickel</td>
<td>Nasal sinus, Lung</td>
</tr>
<tr>
<td>Polycyclic aromatic hydrocarbons</td>
<td>Skin, Scrotum, Lung</td>
</tr>
<tr>
<td>Radon</td>
<td></td>
</tr>
<tr>
<td>Silica</td>
<td>Lung</td>
</tr>
<tr>
<td>Vinyl chloride</td>
<td>Liver</td>
</tr>
<tr>
<td>Wood dust</td>
<td>Nasal sinus</td>
</tr>
</tbody>
</table>

- Most common occupational cancers: Nearly 75% of are skin cancers
  - Occupational skin cancers are predominantly 'squamous cell carcinomas'
  - Only characteristic feature of occupational skin cancers their occurrence on exposed parts of the body (head, neck, hands, arms) that have remained in direct contact with a carcinogenic source.
  - Carcinogens implicated in occupational skin cancers include UV light, ionizing radiation, coal products, petroleum products, lubricating oils, fuel oils, etc.

Caisson Disease
- Caisson Disease (Decompression Sickness, DCS): Occurs due to low pressure, when a diver ascends rapidly to surface or air passengers ascend too rapidly to high altitudes
  - Manifestations of air expansion:
    1) Barodontalgia: Air trapped beneath teeth expands
    2) Barosinusitis: Compressed air trapped in sinuses expands
    3) Barotitis: Air under pressure trapped in middle ear expands
    4) Emphysema: Most serious complication (may lead to cerebral embolism)
    5) Abdominal distension: Air trapped in intestinal canal expands
  - Effects of Nitrogen effervescence:
    1) Bends: Steady aching pain in joints
    2) Chokes: Rapid, shallow, dysphic breathing
    3) Prickles: Irritation of nerve terminals in skin
    4) Paralysis: MOST SERIOUS COMPLICATION
    5) Aseptic bone necrosis: Hip, knee and shoulder joints
- Caisson Disease is a type of diving hazard and dysbarism.
- Recompression is the only effective treatment for severe DCS, although rest and oxygen applied to lighter cases can be effective.
- Gases implicated in DCS:
Sickness absenteeism
- Sickness absenteeism is a ‘useful index in industry to assess the state of health of workers’, and their physical, mental and social well-being
- The causes of sickness absenteeism may not be entirely due to sickness:
  - Economic causes
  - Social causes
  - Medical causes
- Methods of reducing sickness absenteeism:
  - Good factory management and practices
  - Adequate pre-placement examination
  - Good human relations
  - Application of ergonomics
- Rate of absenteeism reported in India: 8 - 10 days per worker per year

Pre-placement Examination
- Pre-placement Examination: Is the foundation of an efficient occupational health service. It is done at the time of employment and includes worker's history (medical, family, occupational and social), physical examination and biological and radiological examinations
- Main purpose of Pre-placement Examination is to place ‘the right man in right job’ so that worker can perform his duties efficiently without detriment to his health (Ergonomics)

Ergonomics
- Ergonomics (human factors): Is the application of scientific information concerning objects, systems and environment for human use
  - Physical Ergonomics: deals with the human body's responses to physical and physiological stress
  - Cognitive Ergonomics (engineering psychology): concerns mental processes as they affect interactions among humans and other elements of a system; includes workload, training, interaction, decision-making, errors, etc
  - Organizational Ergonomics (macroergonomics), is concerned With the optimization of systems, including their organizational structures, policies, and processes; includes job-satisfaction, motivation, supervision, team work, ethics, etc

Post-placement examination
- Periodic Medical Examination: (for industrial workers) is held at appropriate intervals to test their physical and mental efficiency and to detect any departure from health at the earliest; objective being early diagnosis and prompt treatment (Secondary level of prevention). Frequency of periodic examinations:
  - Annual: for most of occupational exposures.
  - Monthly: for lead, radium and dye-stuffs exposure.
  - Daily: for dichromates exposure.

The Factory Act, 1948
- The Factories Act, 1948:
  - Scope: The Act defines factory as an establishment employing 10 or more persons where power is used and 20 or more persons where power is not used [NEW DEFINITION :]
  - Health, Safety and Welfare recommendations: > *. > 10 people with or without power]
    1) A minimum of 300 cubic feet space per worker
    2) 1 Safety Officer per 1000 workers
  - Employment of young persons:
1) Employment prohibited for age less than 14 years
2) 15 —18 years old adolescents to be declared fit by 'certifying surgeons'; will work only between 6AM to 7PM

- Hours of work:
  1) A maximum of 48 hours per week (9 hours per day)
  2) A maximum of 60 hours: per week including overtime
- Leave with wages:
  1) 1 day per 20 days of work (adults) and 1 day per 15 days of work (children)

- Under Factories Act 1948; there are 29 diseases which are notifiable (Schedule 3)

**The Employees State Insurance (ESI) Act, 1948**

- **Scope of ESI Act.** The act covers all the factories in India 'excluding mines, defence, railways'. The Act in the first instance applies to all non-seasonal factories, using power and employing 10 or more persons, and to non-power using factories employing 20 or more persons for wages on any day in implemented areas. It also covers shops, hotels and restaurants, cinemas and theatres, road-motor transport establishments and newspaper establishments. It covers all states except Nagaland, Manipur, Tripura, Sikkim, Arunachal Pradesh and Mizoram; and UTs of Delhi, Pondicherry and Chandigarh.
- **It covers all employees getting up to Rupees 15,000/- per month**
- **It excludes educational institutions**

- **Administration:** The Union Minister of Labour is the Chairman of ESI Corporation

- **Finance:** The employer contributes 4.75% of total wage bill; the employee contributes 1.75% of wages. State and Central Government, share medical expenditure in ration of 1:7

- **Benefits to employees under ESI:**
  - **Medical benefit.** Full medical care,
  - **Sickness benefit:** 50% of the average daily wages and is payable for 91 days (in any continuous period of 365 days)
    - **Extended sickness benefit:** Payable for 2 years for a set of 34 diseases
    - **Enhanced sickness benefit:** Full average daily wage for duration upto 7 days in the case of Vasectomy and upto. 14 days in the case of the Tubectomy
  - **Maternity benefit:** Full average daily wage for duration upto 12 weeks (confinement) or 6 weeks (miscarriage or MTP) or 4 weeks (sickness arising out of pregnancy, confinement, premature birth), as the case may be
  - **Temporary disablement benefit:** 90% of the average daily wages till recovery
    - **Permanent disablement benefit:** Pension (full/partial) as worked out by a medical board
  - **Dependents' benefit:** Pension at rate of 70% of wages
  - **Funeral expenses:** Cash not exceeding Rupees 5000/-
  - **Rehabilitation benefit**

- To become eligible to Sickness Benefit, one should have paid contribution for 'not less than 78 days' during the corresponding contribution period
Eugenics & Euthenics

- **Eugenics (Sir Francis Galton)**: Is a social philosophy which advocates the improvement of human hereditary traits through various forms of intervention (GENETIC MANIPULATION)
  - **Negative Eugenics**: Is aimed at lowering fertility among the genetically disadvantaged. This includes abortions, sterilization, and other methods of family planning
  - **Positive Eugenics**: Is aimed to encourage reproduction among the genetically advantaged. Possible approaches include financial and political stimuli, targeted demographic analyses, in vitro fertilization, egg transplants, and cloning
  - Earlier proposed means of achieving EUGENIC GOALS focused on selective breeding, while modern ones focus on prenatal testing and screening, genetic counseling, birth control, in vitro fertilization, and genetic engineering

- **Euthenics**: Deals with human improvement through altering external factors such as education and the controllable environment, including the prevention and removal of contagious disease and parasites, environmentalism, education regarding home economics, sanitation, and housing (ENVIRONMENTAL MANIPULATION)
  - Euthenics is a pre-requisite for Eugenics

Amniocentesis

- **Amniocentesis**: Examination of a sample of amniotic fluid makes possible the prenatal diagnosis of chromosomal anomalies and certain metabolic defects; The procedure can be used as early as 14th week of pregnancy when abortion of affected fetus is still feasible

- **Amniocentesis is indicated in following circumstances:**
  - A mother aged >35 years (high risk of Down's Syndrome)
  - Patients who have had a child with Down's Syndrome or other chromosomal anomalies
  - Parents known to have chromosomal translocation
  - Patients who have had a child with metabolic defect
  - When sex-determination is warranted

Mendelian diseases and their inheritance

<table>
<thead>
<tr>
<th>Autosomal dominant traits</th>
<th>Autosomal recessive traits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Achondroplasia</td>
<td>Albinism</td>
</tr>
<tr>
<td>Huntington's chorea</td>
<td>Phenylketonuria</td>
</tr>
<tr>
<td>Neurofibromatosis</td>
<td>Tay Sachs disease</td>
</tr>
<tr>
<td>Familial polyposis coli</td>
<td>Alcaptonuria</td>
</tr>
<tr>
<td>Marfan's Syndrome</td>
<td>Cystic fibrosis</td>
</tr>
<tr>
<td>Retinoblastoma</td>
<td>Galactosemia</td>
</tr>
<tr>
<td>ABO blood group system</td>
<td>Hemoglobinopathies</td>
</tr>
<tr>
<td>Hyperlipoproteinemia I, II, III, IV</td>
<td>Maple syrup urine disease</td>
</tr>
<tr>
<td>Polycystic kidney</td>
<td>Megacolon (Hirschsprung Dis)</td>
</tr>
<tr>
<td>Hereditary spherocytosis</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sex-linked dominant traits</th>
<th>Sex-linked recessive traits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin-D resistant rickets</td>
<td>Hemophilia type A &amp; B</td>
</tr>
<tr>
<td>Blood group Xg</td>
<td>Duchenne muscular dystrophy</td>
</tr>
<tr>
<td>Familial hypophosphatemia</td>
<td>Colorblindness'</td>
</tr>
<tr>
<td></td>
<td>G6PD deficiency</td>
</tr>
<tr>
<td></td>
<td>Hydrocephalus</td>
</tr>
<tr>
<td></td>
<td>Retinitis pigmentosa</td>
</tr>
</tbody>
</table>
**Human Genome Project (HGP)**
- *Human Genome Project.* HGP is an international/scientific research project.
- The project began in 1990 initially headed by James D. Watson.
- Ongoing sequencing led to the announcement of the essentially complete genome in April 2003.
- The goals of the original HGP were not only to determine more than 3 billion base pairs in the human genome, but also to identify all the genes in this vast amount of data.
  - This part of the project is still ongoing, although a preliminary count indicates about 22,000-23,000 genes in the human genome.

**Hardy Weinberg Law**
- *Hardy Weinberg Law.* The 'genotype frequencies in a population remain constant or are in equilibrium from generation to generation' unless specific disturbing influences are introduced.
  - Disturbing influences: non-random mating, new mutations, selection, random genetic drift and gene flow.
  - Genetic equilibrium (HW law) is a basic principle of population genetics; the entire principle is based on Mendelian genetics.
  - Deviations in HW law. HW law fails to apply in,
    1) non-random mating (assortative mating)
    2) new mutations
    3) genetic drift
    4) gene flow
    5) natural selection (mortality selection, fecundity selection).
- HW law assumes that human population is static.

**Key definitions**
- *Genome:* The sum total of genetic information of an individual which is encoded in structure of DNA.
- *Genomics:* Is the study of genome.
- *Gene Therapy:* Introduction of a gene sequence into a cell to modify its behavior.
Mental health disorders

- Causes of mental health disorders:
  - Organic conditions: Cerebral arteriosclerosis, neoplasma, metabolic diseases, endocrine diseases and chronic diseases (TB, leprosy, epilepsy)
  - Heredity: Schizophrenia
  - Socio-pathological: Worries, anxiety, emotional stress, tension, frustration, unhappy married life, broken homes, poverty, industrialization, urbanization, cruelty, rejection, neglect, etc.

Mental health statistics

- WHO analysis shows a global point prevalence of neuro-psychiatric conditions is about 10% for adult
  - MCC of DALYS lost: Unipolar depressive disorders
  - MCC of deaths: Alzheimer's and other dementias
- Mental morbidity in India: 18-20 per 1000

DSM - IV criteria

- DSM-IV Criteria: Diagnostic and Statistical Manual of Mental Disorders, 4th Edition, Text Revision, DSM-IV-TR, is a manual published by the American Psychiatric Association (APA) that includes all currently recognized mental health disorders. The coding system utilized by the DSM-IV is designed to correspond with codes from the International Classification of Diseases, ICD
CHAPTER 20
HEALTH EDUCATION AND COMMUNICATION

Communication process

- **Communication process:** Is the process of exchanging ideas, feelings and information
- **Components of communication process:**
  - Sender (source)
  - Receiver (audience)
  - Message (content)
  - Channel(s) (medium)
  - Feedback (effect)

Types of Communication

- **One-way communication (Didactic Method):** Flow of communication is one way - from communicator to audience
  - **Disadvantages of one way communication:**
    1. Knowledge is imposed & learning authoritative
    2. Little audience participation & no feedback
    3. Does not influence human behaviour
    4. Makes no attempt at removing misconceptions & misunderstandings
    5. Communicates message even if unintelligible or unacceptable
  - **Examples of one way communication:**
    1. Lecture method (Chalk and talk method)
    2. Television
    3. Radio
    4. Newsprint

- **Two-way communication (Socratic Method):** Two way communication in which both the communicator and the audience take part
  - **Advantages of two way communication:**
    1. Active participatory and democratic process
    2. More likely to influence human behaviour
    3. Better audience participation & feedback
  - **Examples of two way communication:**
    1. Focus Group Discussion (FGD)
    2. Symposium
    3. Panel, discussion

Health Education

- **Health Education:** The process by which individuals and groups of people learn to behave in a manner conducive to the promotion, maintenance or restoration of health (John M. Last)

Approaches to Health Education:
- **Regulatory approach (Managed prevention):**
  1. Defined as any Governmental intervention
  2. Coercive approach or Legislative approach
  3. Useful in times of emergency
- **Service approach:**
  1. Providing health services at peoples'door step
  2. Not based on felt needs
- **Health education approach:**
  1. Slow but enduring results
• Primary health care approach:
  1) Radically new approach
  2) Community involvement & intersectoral coordination
  3) Help individuals becomes self reliant in health

- Principles of Health Education:
  • Credibility
  • Interest
  • Participation
  • Motivation
  • Comprehension
  • Reinforcement
  • Learning by doing
  • Known to unknown
  • Setting an example
  • Good human relations
  • Feedback
  • Leaders

Audiovisual aids

No health education can be effective without audiovisual aids

- Auditory aids: radio, cassette tape-recorder, microphone, amplifier, earphone, public address system, disks
- Visual aids:
  • Not requiring projection: Chalk-board, leaflets, posters, charts, flannelgraph, exhibits, models, specimens, diagrams, photographs
  • Requiring projection: Slides, filmstrips, overhead projector, epidiascope
- Combined A-V aids: Television, sound films (cinema), synchronized slide-tape combination, multimedia, videotape system, drama, skits

Group Approach to Health Education

- Chalk and Talk (Lecture)
  • For effective communication through lecture method:
    1) Group size should be <30
    2) Talk duration <15-20 minutes
  • Advantages of lecture method:
    1) Most economical method
    2) Information transfer in a short time to a large group
  • Disadvantages of lecture method:
    1) Learning is passive; does not motivate
    2) Suitable only for small groups
    3) Students are involved to minimal extent

- Demonstrations
  • Is a carefully prepared presentation to show how to perform a skill or procedure
  • Advantages of demonstrations:
    1) Upholds principles of 'seeing is believing' and 'learning by doing'

- Group Discussion: A group is an aggregation of people interacting in a face-to-face situation
  • Advantages of group discussion:
    1) Well conducted group discussion is 'very effective to change health behavior & attitudes'
    2) Permits learning by free exchange of ideas, knowledge and opinions
    3) Provides a wider interaction among members
    4) Valuable to ensure long term compliance
  • Ensuring an effective discussion:
    1) Group size of '6 - 12 members', including
i. 1 group leader: Initiates and helps discussion in a proper manner
ii. 1 recorder

**Panel Discussion:**
- **Features of a panel discussion:**
  1) ‘4-8 persons’ who are qualified to talk about the topic sit and discuss a given problem/topic in front of a target group or audience
  2) Panel comprises,
     i. A chairman or moderator
     ii. 4 - 8 speakers
  3) There is ‘no specific agenda, no order of speaking and no set speeches’

**Symposium:**
- **Features of a symposium:**
  1) A series of speeches on a selected subject
  2) Each person or expert presents an aspect briefly
  3) There is ‘no discussion among symposium members
  4) Audience may raise questions in the end
- **Disadvantage of a symposium:**
  1) No discussion during symposium (Q & A at end)

**Workshop:**
- **Features of workshop:**
  1) A series of >4 meetings usually meant for training
  2) Individuals solve a problem through personal effort with help of consultants, contribute to group work and group discussion and leave workshop with concrete suggestions and a ‘plan of action’ on problem
- **Advantages of workshop:**
  1) Learning takes place in a friendly, happy and democratic atmosphere, under expert guidance

**Role-playing (Socio-drama):**
- **Features of role-playing:**
  1) Situation is dramatized by a group
  2) Group enact as if they have observed/experienced it
  3) Audience not passive; actively concerned with drama;, can suggest alternative solutions at request of leader
  4) Followed by discussion of the problem
  5) Ideal size of the group: 25
- **Advantages of role-playing:**
  1) Useful to discuss problems of human relationships
  2) Useful educational device for school children

**Conferences and Seminars:**
- **Features of conferences and seminars:**
  1) Contains a large component of commercialized continuing education
  2) Usually held on a regional, state or national level

**Mass Media**
- Mass media are mainly a One-way communication (Didactic Methods)
- **Advantages of mass media:**
  1) Reaches a relatively larger population in a shorter time than with other means-
  2) More influential with average, and below average education level
- **Disadvantages of mass media:**
  1) Being impersonal, not usually effective in changing established modes of behaviour if used alone
  2) One way communication: Carry messages from centre to periphery; feedback mechanisms are poorly organized
Methods of mass media

- Television
  1) Most popular of all media
  2) Creates awareness, influence public opinions and introduce new ways of life
  3) Raise levels of understanding

- Radio
  1) Purely didactic medium
  2) Valuable aid in putting across health information

- Internet
  1) Fast growing communication media

- Newspapers
  1) Most widely disseminated of all forms of literature
  2) Reach only to limited population (literate)

Printed material

Direct mailing

Posters, billboards, signs
  1) Can be displayed at public-places
  2) Less effective in changing behaviour

Health museums and exhibitions

Folk media

Counselling

1. Counselling is face-to-face communication through which a person is helped to make a decision or solve a problem
2. Counselling helps clients make informed choices
3. COUNSELLING IS DIFFERENT FROM ADVICE; In Counselling, 'Choice is given to clients'
4. Elements of Counselling: (GATHER Approach; used for contraceptives)
   - G: Greet the clients (make them comfortable, give attention)
   - A: Ask/ascertain needs/problems or reasons for coming
   - T: Telling different methods/options/choices to solve the problem
   - H: Help client to make voluntary decisions
   - E: Explain fully the chosen decision/action/method
   - R: Return for follow-up visit
HEALTH PLANNING AND MANAGEMENT

21 A. HEALTH PLANNING

Objectives and Goals

- **Objective:** Is planned en-point of all activities
  - Is precise and specific
  - Is either achieved or not achieved
  - Is concerned with the problem itself

- **Target:** A discrete activity which helps measure the extent of attainment of objectives
  - Is a concept of degree of achievement
  - Is concerned with the factors involved in a problem

- **Goal:** Ultimate desired state towards which objectives and resources are directed
  - Is not constrained by time or existing resources
  - Is not necessarily attainable
  - Shows all or none phenomenon

- **Mission:** Is a description of fundamental principle of existence of a programme
  - Is usually time bound
  - Is a statement of purpose

- **Impact:** Is an expression of the positive effect of a programme, service or institution on the overall health development and on related social and economic development

Planning Cycle

- **Planning Cycle consists of:** (Mnemonic: GOAL - AORPPIME)
  - Step 1: Analysis of health situation
  - Step 2: Objectives and goals establishment
  - Step 3: Resource assessment
  - Step 4: Prioritization
  - Step 5: Plan formulation
  - Step 6: Implementation
  - Step 7: Monitoring
  - Step 8: Evaluation

Health Committees in India

- **Bhore Committee (1946):** 'Health Survey and Development Committee'
  - Short term measure: 1 PHC per 40,000 population, 30 beds, 3 subcentres and 2 medical officers
  - Long term measure (3 Million Plan): Primary health units with 75-bedded hospitals per 10,000-20,000 population; Secondary health units with 650-bedded hospitals; Regional health units with 2,500 beds.
  - Prepare 'Social Physicians' (3 months training in preventive and social medicine in medical education)

- **Mittal Committee (1962):** 'Health Survey and Planning Committee'
  - 1 PHC per 40,000 population maximum
  - Constitution of 'All India Health Service'

- **Chadah Committee (1963):** Constituted to study arrangements necessary for the 'Maintenance Phase of National Malaria Eradication Programme (NMEP)'.
• 1 Basic Health Worker per 10,000 population (for malaria vigilance, collection of vital statistics and family planning)

o Mukherji Committee (1965):
  • Delink malaria activities from family planning

o Mukherji Committee (1966):
  • BASIC HEALTH SERVICE should be provided at block level

o Jungalwalla Committee (1967): 'Committee on Integration of Health Services'
  • 'equal pay for equal work'
  • 'no private practice'

o Kartar Singh/Committee (1973): 'Committee on Multipurpose Workers under Health and Family Planning'
  • ANMs to be replaced by 'Female Health Workers'
  • Basic health workers, Malaria surveillance workers, Vaccinators, Health education assistants and family planning health assistants be replaced by 'Male Health Workers'

o Shrivastava Committee (1975): 'Group on Medical Education and Support Manpower'
  • Create 'Bands of Para-professionals and Semi-professional health workers' from within the community
  • Development of 'Referral Services Complex' (between PHCs and higher level referral and services centers)
  • 'Reorientation of Medical Education' (ROME) Scheme
  • 'Village Health Guide (Community Health Worker) Scheme'

**Millennium Development Goals (MDGs)**

o In September 2000, 189 countries adopted UN Millennium Declaration. Millennium Development Goals (MDGs) Goals place health at the heart of development and represent commitments by governments

o **Baseline Year for MDGs:** 1990

o **Deadline year for MDGs:** 2015

o **There are 8 MDGs:**
  - Goal 1: Eradicate extreme poverty and hunger
  - Goal 2: Universalize primary education
  - Goal 3: Gender equality and women empowerment
  - Goal 4: Reduce child mortality
  - Goal 5: Improve maternal health
  - Goal 6: Combat HIV/AIDS, malaria and other disease (Tuberculosis)
  - Goal 7: Ensure-environmental sustainability
  - Goal 8: Develop global partnerships for development

  o 3 out of 8 goals, 8 out of 18 targets required to achieve them and 18 out of 48 indicators of progress are 'directly health related'
  o 2 out of 8 goals, 2 out of 18 targets required to achieve them and 18 out of 48 indicators of progress are 'do not pertain to health'

**Modern Management Techniques**

o **Cost Benefit Analysis:** A management technique where economic benefits of any programme are compared with cost of that programme
  • The 'benefits are expressed in monetary terms'.
  • The main drawback of this technique is that all benefits in field of health cannot be expressed in monetary terms.

o **Cost Effective Analysis:** A management technique where benefits are expressed in terms of results achieved, e.g., number of lives saved or number of days free from disease
  • It is a more promising tool than cost benefit analysis in the health field
  • Most comprehensive indicator of CEA: Quality adjusted life years (QALYs) gained
Network Analysis: Is the graphic plan of all events and activities to be completed in order to reach an end objective. Two common types of network techniques are:

- Programme Evaluation and Review Technique (PERT): An arrow diagram representing the logical sequence in which events must take place.
- Critical Path Method (CPM): The 'longest path' of the network is called as critical path. If any activity along the critical path is delayed, entire project will be delayed.

Systems Analysis: Is a management technique of finding out the cost-effectiveness of the available alternatives.

Zero Budget Approach: All budgets start at zero and no one gets any budget that he cannot specifically justify on a year-to-year basis.

Cost accounting - Budget, resources, financial allocation to various components of a health program.

Critical Path Method (CPM)

- Is a type of network analysis (the graphic plan of all events and activities to be completed in order to reach an end objective).
- The 'longest path' of the network is called as critical path.
- If any activity along the critical path is delayed, entire project will be delayed.
CHAPTER 22
HEALTH CARE IN INDIA

Primary Health Care

- **Definition**: Essential health care, based on practical, scientifically sound, and socially acceptable methods and technology, made universally accessible to individuals and families in the community, through their full participation and at a cost that the community and country can afford

- **8 essential ELEMENTS/components of Primary Health Care (as outlined by the ‘Alma-Ata Declaration, 1978)’**:
  - E: Education concerning health problems and their control
  - L: Locally endemic diseases prevention and control
  - E: Essential drugs
  - M: Maternal and child health care including family planning
  - E: EPI (Immunization) against Vaccine Preventable Diseases
  - N: Nutrition and promoting proper food supply
  - T: Treatment of common diseases and injuries
  - S: Safe water supply and sanitation

- **Hallmarks of Primary health care: 4 A’s of Primary Health Care**
  - Affordability
  - Acceptability
  - Accessibility
  - Availability

- **4 Principles/Pillars of Primary Health Care**:
  - Equitable distribution
  - Community Participation
  - Intersectoral Coordination
  - Appropriate Technology

PRIMARY HEALTH CARE SYSTEM IN INDIA

- **Primary Level of Health Care**:
  - Is the first level of contact between population and health care system in India
  - Health services are delivered through:
    1) Sub-centre
    2) Primary Health Centre

- **Secondary Level of Health Care**:
  - Is ‘First referral level of health care’ in India
  - Health services are delivered through:
    1) Community Health Centre

- **Tertiary Level of Health Care**:
  - Is ‘Second referral level of health care’ in India
  - Health services are delivered through:
    1) Medical Colleges and Hospitals

**SUB-CENTRE:**

- **Staff of Sub-centre**:
  3
  - Multi-purpose worker-male (MPW-M)
  - Multi-purpose worker- female (MPW-F)
  - Volunteer worker