Quick Revision By Doctor Of Choice

Epidemiology & Biostatistics: Detailed Explanation with Mnemonics

1. Epidemiology Definition:

Epidemiology is the study of the **distribution** and **determinants** of health-related states or events in specified populations and the application of this study to control health problems.

📌 Key Elements:

- **Distribution** \rightarrow Who, where, when? (person, place, time)
- **Determinants** → Why? (causes, risk factors)
- Health-related states → Diseases, injuries, disabilities
- **Application** → Public health action

Mnemonic: "Epi = Evidence-based Population Investigation"

2. Types of Epidemiology:

- 1. Descriptive Epidemiology → Focuses on Who, Where, When?
 - Example: Studying disease patterns in different regions.
- 2. Analytical Epidemiology → Focuses on Why and How?
 - Types:
 - Case-Control Study (Retrospective) → Compares cases vs. controls
 - **Cohort Study** (Prospective) → Follows exposed vs. non-exposed
 - **Experimental Study** \rightarrow Clinical trials, interventions

Mnemonic: "DAD: Descriptive = Distribution, Analytical = Association, Disease causation"

3. Determinants of Health:

Factors affecting health can be categorized into:

- Social: Education, employment, culture
- Economic: Income, healthcare access
- Environmental: Pollution, sanitation, housing
- Biological: Genetics, age, sex
- Behavioral: Smoking, alcohol, exercise

Mnemonic: "SEEBB" - Social, Economic, Environmental, Biological, Behavioral"

4. Levels of Prevention:

- 1. **Primary Prevention** \rightarrow Prevent disease before occurrence
 - Example: Vaccination, health education
- 2. Secondary Prevention \rightarrow Early detection and treatment
 - Example: Screening tests (Pap smear, mammography)
- 3. Tertiary Prevention \rightarrow Reduce disability, rehabilitation
 - Example: Physiotherapy for stroke patients

Mnemonic: "PST - Prevent, Screen, Treat"

5. Modes of Intervention:

- Health Promotion (e.g., lifestyle changes)
- Specific Protection (e.g., immunization)
- Early Diagnosis & Treatment (e.g., screening)
- Disability Limitation (e.g., prompt treatment)
- Rehabilitation (e.g., prosthetics, therapy)

6. Natural History of Disease:

- Stage of Susceptibility (Risk factors present)
- Stage of Subclinical Disease (Incubation period)
- Stage of Clinical Disease (Symptoms appear)
- Stage of Recovery/Disability/Death

Mnemonic: "SSCD - Susceptibility, Subclinical, Clinical, Disability/Death"

7. Disease, Disability, Impairment, Handicap, Rehabilitation:

- Disease: Abnormal condition (e.g., diabetes)
- Impairment: Loss of function (e.g., blindness)
- Disability: Limitation in daily activities (e.g., cannot read)
- Handicap: Social disadvantage due to disability (e.g., job loss)
- **Rehabilitation:** Restoring function (e.g., physiotherapy)

Mnemonic: "DIHR - Disease → Impairment → Handicap → Rehabilitation"

8. Incidence & Prevalence Relationship:

- Incidence: New cases in a specific period
- Prevalence: Total cases at a given time
- Formula: Prevalence = Incidence × Disease Duration

Mnemonic: "Prevalence is like a pool, Incidence is water flowing in, and Recovery/Death is water flowing out"

9. Mortality Indicators:

- Infant Mortality Rate (IMR): Infant deaths <1 year per 1,000 live births
- Maternal Mortality Ratio (MMR): Maternal deaths per 100,000 live births
- Crude Death Rate (CDR): Total deaths per 1,000 population
- Case Fatality Rate (CFR): % of deaths among diagnosed cases
- Under-5 Mortality Rate (U5MR): Deaths <5 years per 1,000 live births

Mnemonic: "IMR, MMR, CDR, CFR, U5MR - I Make Coffee, Can U?"

10. Morbidity Indicators:

- Incidence Rate (New cases)
- **Prevalence Rate** (Existing cases)
- Attack Rate (Epidemic situations)
- **Disability Adjusted Life Years (DALY)** = Years Lost due to Illness + Years Lost due to Disability
- Quality Adjusted Life Years (QALY) = Years of life × Quality of life score

Mnemonic: "IPA DQ - Incidence, Prevalence, Attack rate, DALY, QALY"

Final Quick Mnemonic Summary:

🔽 Epidemiology Definition: "Epi = Evidence-based Population Investigation"

 \mathbf{V} Types: "DAD" \rightarrow Descriptive, Analytical, Disease causation

✓ Determinants of Health: "SEEBB" → Social, Economic, Environmental, Biological, Behavioral

 \boxed{V} Levels of Prevention: "PST" → Prevent, Screen, Treat

✓ Natural History of Disease: "SSCD" → Susceptibility, Subclinical, Clinical, Disability/Death

- ✓ Mortality Indicators: "I Make Coffee, Can U?" \rightarrow IMR, MMR, CDR, CFR, U5MR
- $\boxed{}$ Morbidity Indicators: "IPA DQ" → Incidence, Prevalence, Attack rate, DALY, QALY

1. Quality of Life Indices (PQLI, HDI, etc.)

Quality of Life (QoL) indices measure overall well-being and development of a population.

a) Physical Quality of Life Index (PQLI):

- Developed as a simpler alternative to GDP-based measures.
- Components:
 - 1. Infant Mortality Rate (IMR)
 - 2. Life Expectancy at Age 1
 - 3. Literacy Rate
- Formula: Each indicator is scored from 0 to 100, and the average is taken.

🔽 Mnemonic: "ILL" - Infant Mortality, Life Expectancy, Literacy

b) Human Development Index (HDI):

- Developed by the UN to measure socio-economic development.
- Components:
 - 1. Life Expectancy at Birth (Health)
 - 2. Mean & Expected Years of Schooling (Education)
 - 3. Gross National Income (GNI) per capita (Economy)
- 🜠 Mnemonic: "LEEG" Life Expectancy, Education, Economy, GNI

2. Epidemiological Triad (Host, Agent, Environment)

📌 The Epidemiological Triad explains disease causation by three interacting factors:

- 1. Host \rightarrow The susceptible person/animal (age, immunity, genetics).
- 2. Agent \rightarrow The pathogen (bacteria, virus, toxin).
- 3. **Environment** \rightarrow Conditions that promote disease (climate, sanitation, crowding).
- 🔽 Mnemonic: "HAE" Host, Agent, Environment
- 🦠 **Example:** Tuberculosis
- Host: Malnourished individuals
- Agent: Mycobacterium tuberculosis
- Environment: Poor ventilation, overcrowding

3. Chain of Infection

- 📌 The process by which an infectious disease spreads from one person to another.
- 1. Infectious Agent (Bacteria, Virus)
- 2. Reservoir (Human, Animal, Soil, Water)
- 3. Portal of Exit (Respiratory, GI tract, Open wounds)
- 4. Mode of Transmission (Direct: Droplets; Indirect: Fomites)
- 5. Portal of Entry (Mucosal surfaces, Skin breaks)
- 6. Susceptible Host (Weakened immunity)

Mnemonic: "IRP-MPS" → Infectious agent, Reservoir, Portal of exit, Mode of transmission, Portal of entry, Susceptible host"

4. Measures of Association (RR, OR, AR, AF, etc.)

📌 These statistical measures determine the relationship between exposure and disease.

 Relative Risk (RR): Used in cohort studies. RR = [Incidence in exposed] / [Incidence in unexposed]

- RR > 1 \rightarrow Risk factor present
- RR < 1 \rightarrow Protective factor
- 2. Odds Ratio (OR): Used in case-control studies. OR = (AD/BC)
 - If $OR > 1 \rightarrow Positive association$
- Attributable Risk (AR): Risk difference between exposed and unexposed groups. AR = [Incidence in exposed] - [Incidence in unexposed]
- 4. Attributable Fraction (AF): Proportion of disease attributable to exposure.

🔽 Mnemonic: "ROAA" - RR, OR, AR, AF"

5. Bias (Selection, Information, Confounding)

- 📌 Bias is a systematic error in study design that leads to incorrect conclusions.
- 1. Selection Bias: Error in choosing participants.
 - Example: Healthy worker effect
- 2. Information Bias: Incorrect measurement of exposure or outcome.
 - Example: Recall bias (patients remember exposure differently)
- 3. **Confounding:** A third variable distorts the relationship between exposure and disease.
 - Example: Smoking confounds the alcohol-lung cancer relationship.

🌠 Mnemonic: "SIC" - Selection, Information, Confounding"

6. Causality (Bradford Hill Criteria)

- 📌 These criteria help determine if an association is causal.
- 1. Strength of Association
- 2. Consistency (Repeated findings)
- 3. **Specificity** (One cause \rightarrow One effect)

- 4. Temporality (Cause before effect)
- 5. Biological Gradient (Dose-response)
- 6. Plausibility (Mechanism exists)
- 7. Coherence (Fits with current knowledge)
- 8. Experiment (Removal of exposure reduces risk)
- 9. Analogy (Similar exposures cause similar effects)
- 🜠 Mnemonic: "Some Cats Say That Big Pandas Can Eat Apples"

7. Surveillance (Active, Passive, Sentinel)

- 1. **Active Surveillance:** Public health officials actively collect data (e.g., door-to-door surveys).
- 2. Passive Surveillance: Routine reporting by health workers (e.g., hospital records).
- 3. Sentinel Surveillance: Selected sites monitor trends (e.g., influenza monitoring centers).
- 🔽 Mnemonic: "APS Active, Passive, Sentinel"

8. Screening (Yield, Sensitivity, Specificity, PPV, NPV)

- 1. Sensitivity: Ability to detect disease (True Positives).
- 2. Specificity: Ability to detect health (True Negatives).
- 3. Positive Predictive Value (PPV): Probability of disease if test is positive.
- 4. Negative Predictive Value (NPV): Probability of health if test is negative.
- 5. Yield: Number of cases detected in a population.
- Mnemonic: "SnOUT & SpIN" High Sensitivity rules OUT, High Specificity rules IN

9. Data Types (Nominal, Ordinal, Interval, Ratio)

- 1. Nominal: Categories without order (e.g., Blood group: A, B, O).
- 2. Ordinal: Categories with order (e.g., Pain scale: Mild, Moderate, Severe).
- 3. Interval: Equal intervals, no true zero (e.g., Temperature in Celsius).
- 4. Ratio: Equal intervals with true zero (e.g., Height, Weight).

🌠 Mnemonic: "NOIR - Nominal, Ordinal, Interval, Ratio"

10. Measures of Central Tendency (Mean, Median, Mode)

- 1. Mean: Sum of all values divided by total number.
- 2. Median: Middle value in an ordered dataset.
- 3. Mode: Most frequently occurring value.
- 🔽 Mnemonic: "MMM Mean, Median, Mode"

Quick Recap of Mnemonics

- 🔽 Quality of Life: "ILL" (PQLI), "LEEG" (HDI)
- 🔽 Epidemiological Triad: "HAE" Host, Agent, Environment
- 🔽 Chain of Infection: "IRP-MPS"
- 🗹 Measures of Association: "ROAA" RR, OR, AR, AF
- 🜠 Bias Types: "SIC" Selection, Information, Confounding
- 🌠 Bradford Hill Criteria: "Some Cats Say That Big Pandas Can Eat Apples"
- 🔽 Surveillance: "APS Active, Passive, Sentinel"
- 🔽 Screening: "SnOUT & SpIN"
- 🔽 Data Types: "NOIR Nominal, Ordinal, Interval, Ratio"
- 🔽 Central Tendency: "MMM Mean, Median, Mode"