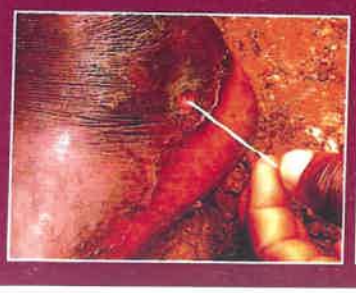
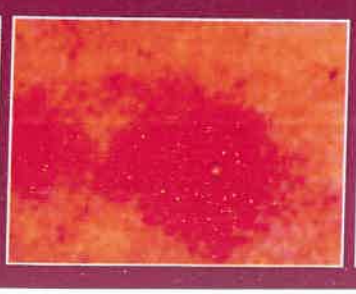
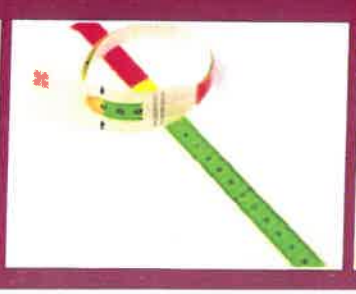
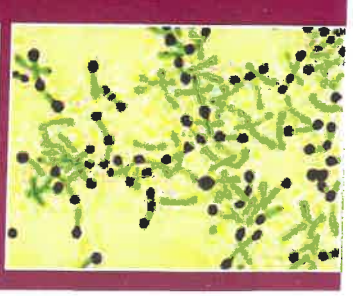
Cerebellum
Get the balance right

Cerebellum PSM

Cerebellum PSM

For the Students
By the Teachers

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List of Topics NOT-SO-IMPORTANT for FMGE-Aspirants:

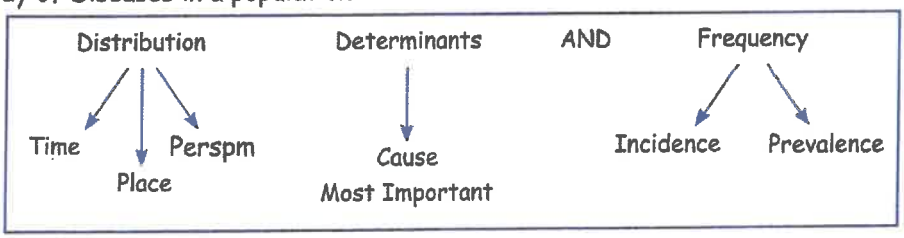
- Epidemiology: Attributable Risk, Population Attributable risk, Combined Designs, EBM, Meta-analysis, Forest Plot, Funnel Plot
- Health and Disease: HPI-1, HPI-2, Multi-dimensional Poverty Index (MDPI)
- Screening of Disease: Baye's Theorem, ROC curve, Likelihood Ratios
- Sociology: Theories of Disease Causation in Sociology
- Biostatistics: Likert Scale, Guttman Scale, Adjectival Scale, Poisson's Distribution, Confidence Intervals, Z-test, Fischer's Exact Test, Wilcoxan Test, Kolmogorov Smirnov Test, Bland-Altman Analysis, Cronbach's Alpha, Coefficient of Determination, Regression, Non-Random Sampling, Sample size estimation, Tree Diagram, Box and Whisker Plot, Stem and Leaf Plot

1A Chapter

EPIDEMIOLOGY
Definitions and Concepts

EPIDEMIOLOGY

Definition → Study of Diseases in a population



Defined by John M. Last

Distribution of DISEASE

A. Time/Seasonal Distribution

	Season	Vector
1. Malaria	Rainy	→ Anopheles culicifacies (Rural) & stephensi (URBAN)
2. Dengue	Rainy	→ Aedes aegypti [Tiger Mosquito]
3. Typhoid	Rainy	
4. Cholera	Rainy	
5. Polio	Rainy	
6. Rotaviral	Winter	

Respiratory Infections

1. Polio	Rainy
2. Measles	Winter
3. Mumps	Winter
4. Rubella	Winter
5. Chicken pox	Winter
6. H1N1	Winter
7. Diphtheria	Winter
8. Pertussis	Winter
9. DM	None
10. HTN	None

The Droplet Size that transmits most efficiently → < 5 μ
Inter Personal distance where transmission is max → < 1 meter

11. CHD Disease None
12. Cancers None
13. RTA Winter, Rainy
14. HIV None
15. Hay Fever Spring, winter [Pollen, Dust]
16. Asthma Winter
17. Covid-19 None

B. Place Distribution (Geographical Distribution)

	Place	Vector
1. Kala azar	UP, WB, Bihar, Jharkhand	Phlebotomus [Sand Fly]
2. Japanese Encephalitis	UP, WB	- Culex Triteniorhyncus - C. vishnuii - C. Gelidus
3. KFD	Kyasanur Forest [Karnataka]	Hard Tick [Haemaphysalis spinigera]
4. Malaria	East & North East India	Anopheles
5. Filariasis	Coastal Region of India	Culex Quinquefasciatus [C. fatigues]
6. Fluorosis	Central & western India	
7. HIV	High Prevalence states [7] Tamil Nadu, Karnataka, Andhra Pradesh Maharashtra Nagaland, Manipur, Mizoram, Moderate Prevalence state [3] Gujarat, Goa, Pondicherry Low Prevalence States All Other parts of India	
8. Measle Mumps Rubella C. pox	No place distribution	
9. Covid-19	Kerala, Maharashtra	
10. Polio, Yellow Fever	Do not occur in India	

New Diseases

India [Emerging/Re-emerging]

1. H1N1 [swine flu]	Metros	
2. Congo fever	Gujarat, Delhi	Hyalomma, Hard ticks
3. Litchi Virus Disease	West Bengal	d/t MCPG
4. Ebola Virus	Delhi	d/t body fluids
5. Zika Virus	Gujarat, Tamil Nadu,	Aedes
6. Plasmodium Ovale	Gujarat, WB Delhi, Mumbai	
7. NIPAH Virus	WB, Kerala	Fruits with Bat secretions
8. West Nile Fever	Kerala	
9. Covid-19 (March 2020)		
10. H5NI (July 2021)		
11. Monkey Pox (July 2022)		

New Diseases World

1. H1N1	Mexico, South Asia	
2. H5N1 [Bird Flu]	Hong Kong, South Asia	
3. H7N9	China [2013]	
4. MERS [Middle East Resp. Syn.]	Middle East Countries	MERS by COV corona virus
5. Ebola	Africa	
6. Zika	Africa	
7. Covid-19	China	MERS COV- Coronavirus 2
8. H10N3	China (June 2021)	

C. Person Distribution (As per age or sex)

C1. Age Distribution

Measles	→	6 months - 3 Yrs
Mumps	→	5-9 yrs [school going Age]
Chicken Pox	→	5-9 yrs [school going Age]
H1N1	→	No Age Distribution
Rheumatic fever	→	5-15 yrs
Rota Virus	→	Younger Infants
Neonatal Tetanus	→	Neonates
Polio	→	0-5 yrs
DM	→	> 40 yrs
HTN	→	> 40 yrs
CHD	→	> 40 yrs
Cancers	→	> 50 yrs
Cataracts	→	> 50 yrs
Typhoid / Cholera / Covid-19	→	No age distribution

Age Groups

Neonates	→	0-28 days
Infant	→	0-1 Yrs
Toddler	→	1-3 Yrs
Child	→	0-18 Yrs
Adolescent	→	10-19 yrs
		10-13 yrs [early]
		14-16 yrs [mid]
		17-19 yrs [late]
Reproductive Age Group	→	15-49 Yrs

Geriatrics	→	> 60 Yrs
Perinatal Period	→	28 weeks POG till 7 days' post delivery
Period of viability	→	POG > 28 Wks OR BW > 1000gms (or) BL > 35cm
Abortion	→	POG < 28 WKS OR BW < 1000 gms (or) BL < 35 cm
Still Birth	→	POG > 28 WKS OR BW > 1000 gms (or) BL > 35 cm BW is most sensitive criteria for POV

C2. Sex Distribution

Measles
Mumps
Rubella
Chicken Pox
Covid-19
} No sex Distribution

H1N1	→	No Sex Distribution
Malaria	→	No Sex Distribution
Dengue	→	No Sex Distribution
DM	→	Males
HTN	→	Females [as they have higher Life expectancy]
CHD	→	Males

Polio
Typhoid
Cholera
→ No Sex Distribution

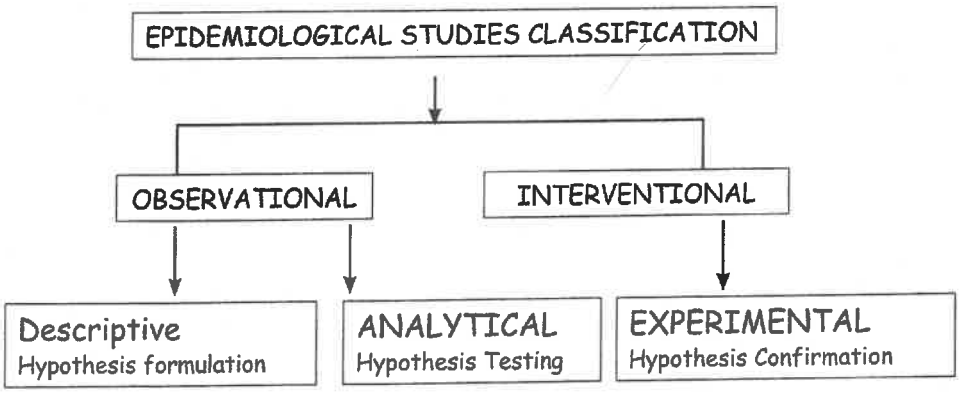
HIV	→	Females [7-10 times more chance of having infection]
RTA	→	Males

Cancers

Breast	→	Females
Cervical	→	No sex distribution [only seen in females- sex restricted]
Oral	→	Males
Lung	→	Males
Cataract	→	Females [higher life expectancy]

1B Chapter

Epidemiological Studies- Cohort Study, Case Control Study



Done In	Done by	Done by
1. Time	I. Cohort study	a. RCT
2. Place	II. Case control study	b. Clinical Trial
3. Person	III. Cross sectional study	c. Field Trial
	IV. Ecological study	d. Community Trial

COHORT STUDY

→ Forward
→ Prospective

100 smokers → Lung cancer
2025 2040

Cause	→ Effect
Exposure	→ Outcome
Risk Factor	→ Disease

CASE CONTROL STUDY

→ Backward
→ Retrospective

Smoking ← 100 Lung cancer
2010 History 2025

Cause	← Effect
Exposure	← Outcome
Risk Factor	← Disease

Cohort Study

	Exposed	Non-Exposed
→ 2025	100 smokers	100 Nonsmokers
	↓	↓
→ 2040	80 Lung smokers	10 Lung cancers
Golden rule of epidemiology		→ Always take comparison groups
→ Take 2 groups→ Exposed Non-Exposed	}	& We wait for occurrence of same disease in both groups & then compare
→ Results calculated by		→ Strength of Association

Strength of Association is given by

1. Relative Risk (RR)
2. Attributable Risk (AR)
3. Population Attributable Risk (PAR)

a. Relative Risk

RR → I_e/I_{ne} (I_e→ Incidence in exposed, I_{ne}→ Incidence in non-exposed)

RR = (80 / 100)/ (10/100) = 8

→ Implies, smokers are relatively 8 times higher risk of lung cancer as compared to Non-smokers

→ RR = Risk Ratio → Ratio of developing lung cancer b/w smokers and Non smokers → 8:1

→ RR >1 → Association present

RR = 1 → No Association

RR < 1 → Negative/Inverse Association → Risk factor is protective (beneficial)

b. Attributable Risk [AR] / Excess Risk / Absolute Risk / Risk Difference

$$AR = \frac{(Ie - Ine)}{Ie} \times 100$$

AR= [(80/100)-(10/100)] / (80/100) x 100 = 88%

Interpretation → 88% of Lung cancer can be attributed to smoking

c. Population Attributable Risk [PAR]

$$PAR = \frac{I_{TOTAL} - I_{NE}}{I_{TOTAL}} X100$$

$$PAR = \frac{(90/200 - 10/100)}{90/200} X100 = 77\%$$

Interpretation :

If smoking is eliminated from the same population then there will be a 77% reduction of new cases/ Incidence of lung cancer every year in the same population

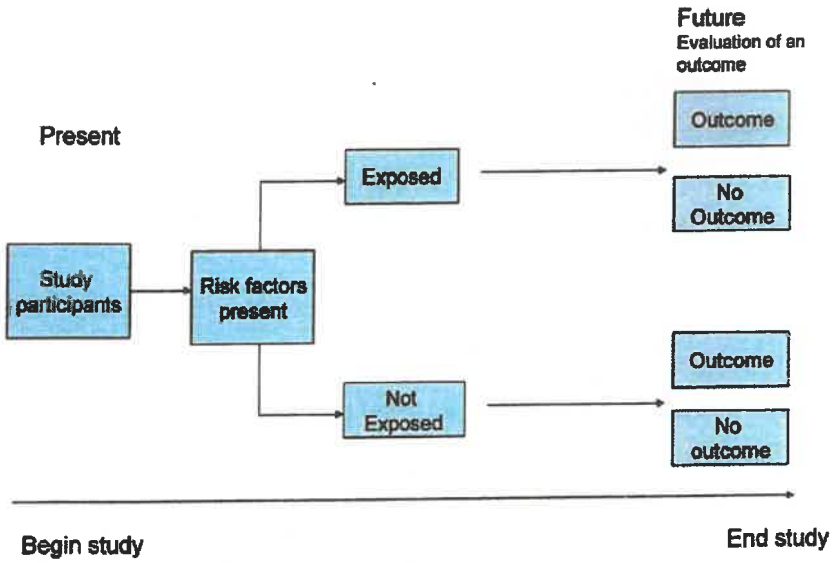


Fig 1. Cohort Study

Use of RR, AR, PAR in Public Health:

1. Clinician → Relative Risk
2. Epidemiologist → Attributable Risk
3. PH Programme Manager → Population Attributable Risk

COHORT STUDY (Synonyms)

- → Forward Looking Study
- → Prospective Study
- → Cause To Effect Study
- → Risk Factor To Disease Study
- → Exposure To Outcome Study
- → Follow Up Study
- → Incidence Study

FRAMINGHAM HEART STUDY

- → Most popular cohort study
- → For CAD [coronary artery Disease] in 1948, USA
- → Made a list of Risk factors
- → Age group → 30-62 yrs
- → Sample size → 4469 → Divided in to exposed & non exposed groups
- → Checking of Incidence of CHD every 2 yrs
- → Framingham → Town in USA
- → Type of COHORT Study
  - Cohort defined as Group of Individuals having same characteristic
  - Minimum no. of cohorts required in a cohort study → 02

CASE CONTROL STUDY

2008 → 70 smokers 10 Smokers
↑History ↑History
2023 → 100 Lung cancers 100 Healthy People
[Diseased] [Non-Diseased]
↑ ↑
Cases Controls

Take 2 groups	Cases / Controls	and ask history of same exposure in both the groups & then compare

Strength of Association → Given by ODDS Ratio/Cross Product Ratio

→Odd's Ratio → $\frac{ad}{bc}$

→ $\frac{70x90}{10x30}$ → 21

History	DISEASE: Present	DISEASE: Absent
Present	a 70	b 10
Absent	c 30	d 90
	a+c	b+d
	Cases	Controls
	100	100

Interpretation

OR> 1 → Association Present
OR =1 → No Association
OR< 1 → Inverse/Negative Association → RF is protective(beneficial)

Lung cancer cases have 21 times more chance of reporting History of smoking as compared to healthy people in the study

Case Control Study (Synonyms)

→ Backward looking study
→ Retrospective study
→ Effect to cause study
→ Disease to Risk factor study
→ Outcome to exposure study
→ TROHOC study
→ Case reference study

	Case		Control
→ Ideal Ratio for Good case control study→	1	:	4
Minimum ratio for case control study→	1	:	1

Advantages & Disadvantages: (Cohort VS Case Control Study)

COHORT STUDY	CASE CONTROL STUDY
D → Time consuming study	A → Quicker study
D → Expensive study	A → Cheaper study
A → Incidence, RR [more accurate]	D → Odds Ratio
A → No Recall Bias	D → Recall Bias +nt
D → Loss to follow up [Attrition] Max allowable attrition Rate <5% Ideal retention rate >> 95%	A → No loss to follow up
A → Multiple Outcomes can be studied together	A → Multiple Risk factors can be studied together.
D → HAWTHORNE BIAS - Study subjects alter their Behavior without notice	A → No Hawthorne Bias
D → Ethical Problems present	A → No Ethical problems
D → Not useful for rare diseases	A → Useful for rare diseases

Cohort study is better study than case control study → b/c → most accurate

1C Chapter | Combined Designs & Other Studies

COMBINED DESIGNS

PROSPECTIVE Cohort study	Retrospective Cohort Study	Case control study
Smoking 2025 → lung ca 2040	Combination of both smoker 2010 → Lung CA 2025	Smoking 2010 ← lung ca 2025
Incidence RR	Incidence RR saves time	ODD'S Ratio

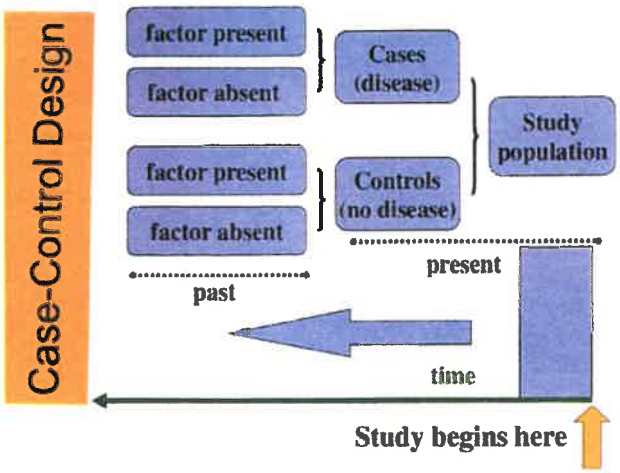


Fig. 1: Case Control Study

Mixed Cohort Study

→ Combination of both retrospective & prospective cohort study

Smokers 2010 —RC→ Lung CA 2025 —PC→ Lung CA 2040

NESTED CASE CONTROL STUDY

- → Type of cohort study
- → Temporality → forward looking study
- → Only done if
  1. Disease New & Rate
  2. Diagnostic tests very expensive

→ E.g. → Stem cell Banking

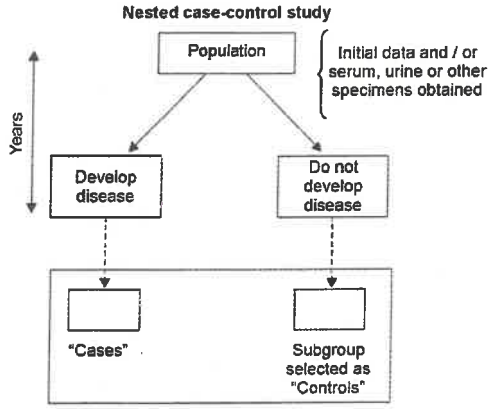


Fig. 2: NCC Study

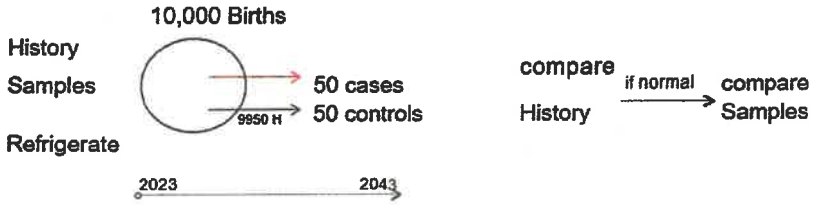
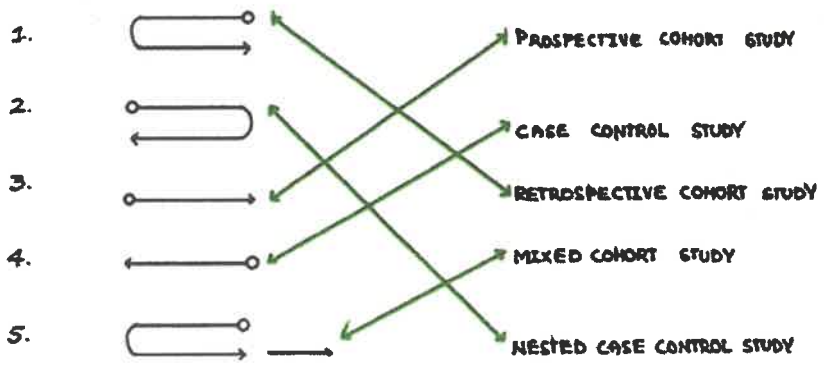


Fig. 3: NCC Study

→ A Nested case control study is a small case control study which is nested in a big cohort study

Present "At The Start" of Study

	Exposure	Outcome
1. Prospective Cohort Study	✓	X
2. Case Control Study	✓	✓
3. Retrospective Cohort Study	✓	✓
4. Mixed Cohort Study	✓	✓ → ✓
5. Nested Case Control Study	✓	X



Retrospective cohort study > Prospective cohort study > Case control study
Incidence relative risk saves time Incidence relative risk Odds ratio

OTHER ANALYTICAL STUDIES

Cross Sectional Study / Snapshot Study / Prevalence Study

- Done at a point time, neither forward or backward in direction
- E.g. 2023
  - Smokers → 40%
  - Lung CA → 01%
- Can't calculate strength of association (incidence, OR, RR)
- Gives Prevalence
- Based on primary date [Investigator collects data himself]

ECOLOGICAL STUDY / CO-RELATIONAL STUDY

- Done at a point of time [E.g., in 2023]
- Used in Nutritional surveys
  - E.g., → Avg. fat intake = 20gm/day
- Can't calculate strength of Association or Prevalence
- Based on secondary data [collected by someone else, studied by investigator]

RCT > RCS > PCS > CC > CS > E

Unit of Study

- Results of study Applicable on
- Cohort
- Case control } Individual
- Cross sectional

E → Population
RCT → Patient / Case
Descriptive → population

Ecological fallacy (E. study results are not applicable on Individuals in the study)

- All analytical studies have individual as unit of study except Ecological

Must Know

- Cohort study, Case control study and their Combined study designs are Horizontal studies (having a direction)
- Cross Sectional study, Ecological study are Vertical studies (having no direction)

1D Chapter

Confounding & Bias

CONFOUNDING = Error

→ Any factor associated both with exposure & outcome

↓leads to

Mistaken estimate of outcome

Example

→ Smoking [Exposure] Leads to Lung CA [outcome]. Factors associated with both smoking and lung cancer (for example old age, male sex) will lead to mistaken estimate of outcome. This is known as confounding.

→ Confounding can be removed by MATCHING

- Equal distribution of confounding factors in both the groups

Confounding can be removed by

1. Matching → MC used /simplest
2. Randomisation → 2nd Best Method
3. Restriction
4. Stratification
5. Statistical Modelling / Multivariate analysis (MVA)
6. Stratified Randomization → Overall Best Method

- **Confounding factor:** Any factor associated with both exposure and outcome, and has an independent effect in causation of outcome is a confounder
  - It is found unequally distributed between the study and control groups
- **Mediator:** Third variable (mediator, M) carries the influence of a given risk factor to a given disease/outcome
  - Mediator comes in between the risk factor - disease continuum
- **Effect modifier (Interactor):** Third variable (Effect modifier) whose level determines the magnitude of effect in a study
  - It modifies Strength of association between exposure and outcome
- **Collinearity:** Two independent factors are so highly correlated that it becomes difficult to distinguish their individual effect on disease/outcome

Bias:

→ Type of Systematic error

→ 3 Types

1. **Subject Bias**
   - Recall Bias (Case control study)

- Hawthorne Bias (Cohort study)

2. Investigator Bias
   - Interviewer Bias → ELIMINATED by devoting EQUAL time to cases and controls
   - Selection Bias
   - Misclassfication Bias
3. Analyser Bias Calculation Error – Not Seen Now-a-days

OTHER TYPE OF BIASES

Berkesonian Bias → d/t different hospital admission rates

→ Based on location & reputation of an institute → Type of Investigator (selection) bias

Pygmalion Bias

→ Motivation by teacher, can increase the marks of students

→ Type of Investigator [3rd person] Bias → Selection Bias

Golem Bias

→ Demotivation by teacher can decrease marks of students.

→ **Apprehension bias:** Certain levels (pulse, blood pressure) may alter systematically from their usual levels when the subject is apprehensive

→ **Attention bias (Hawthorne effect):** Study subjects may systematically alter their behaviour when they know they are being observed

→ **Lead time bias (Zero time shift bias):** Bias of over-estimation of survival time, due to backward shift in starting point, as by screening procedures

→ **Neyman bias (Prevalence-incidence bias):** Bias in case load estimation due to missing of fatal cases, mild/silent cases and cases of short duration of episodes from the study

Types of blinding

Single Blinding	→	**Subjects are not aware of Rx** (used to remove subject Bias)
Double Blinding	→	**Subject & investigator both not aware of treatment** Removes subject & Investigator Bias (Most common type of Blinding seen)
Triple Blinding	→	**Subject, Investigator & Analyzer not aware of treatment** Removes subjects, Investigator &Analyzer Bias (Best Blinding)
Open Study	→	**Complete absence of Blinding**

1E Chapter

RCT, Trials

- A New Antipyretic drug – M
- Unit of study – Patient / Cases

RCT

100 pt
Experimental Group
Intervention Given

I. M Drug given
80% Reduction of fever

II. M Drug Given

80% Reduction of fever

III. M Drug given

1 Death occurs

Drop Out

Cross Over

100 pt
Reference Group
No Intervention

I. No Drug given
10% Reduction of fever
20% people may take PCM → Subject on their own Bias

Hawthorne Bias
II. Placebo given
Single Blinding
10% Reduction of fever

III. Old Drug [PCM]

- ITT [Intention to Treat Trial]
- Results of RCT are not affected by death, dropout, crossover

Selection Bias is an Investigator Bias

Selection Bias in RCT removed by Randomization

MCQ. Randomization Applied

1. At selection of 200 pts
2. At distribution into EG & RG (Best time for Randomization)
3. At Medication
4. At comparison of Results

Randomization → Remove Selection Bias
Remove Confounding
Matching removes → Confounding
Blinding removes → Bias

RCT > RCS > PCS > CC > CS > E

Types of Randomized Trials

1. Clinical Trials
2. Preventive Trials
3. Risk factor Trials
4. Cessation Experiments
5. Trials of etiological agents
6. Evaluation of health services

Types of Non Randomized trials

1. Uncontrolled Trials
2. Natural Experiment
3. Before & After comparison studies

Clinical Trials

Phase I	Healthy Human Volunteers
	Done for safety & Non-toxicity
	Maximum Tolerated dose (MTD) tested
Phase II	Patients
	Done for Efficacy
	Maximum drug failure is seen
Phase III	Patients
	Comparison with existing drug
	New Drug launched in market after phase III
	RCT done
	Most important phase
Phase IV	Patients
	Done for long term side effects
	Post Marketing Surveillance
	Longest - Time period
	Lifelong [ideal] or 10-25 Years
Phase O	Few Healthy Human Volunteers
	For micro dosing [e.g. 1/10th dose]
Pre-clinical Trials	done in Animals (before clinical Trials)