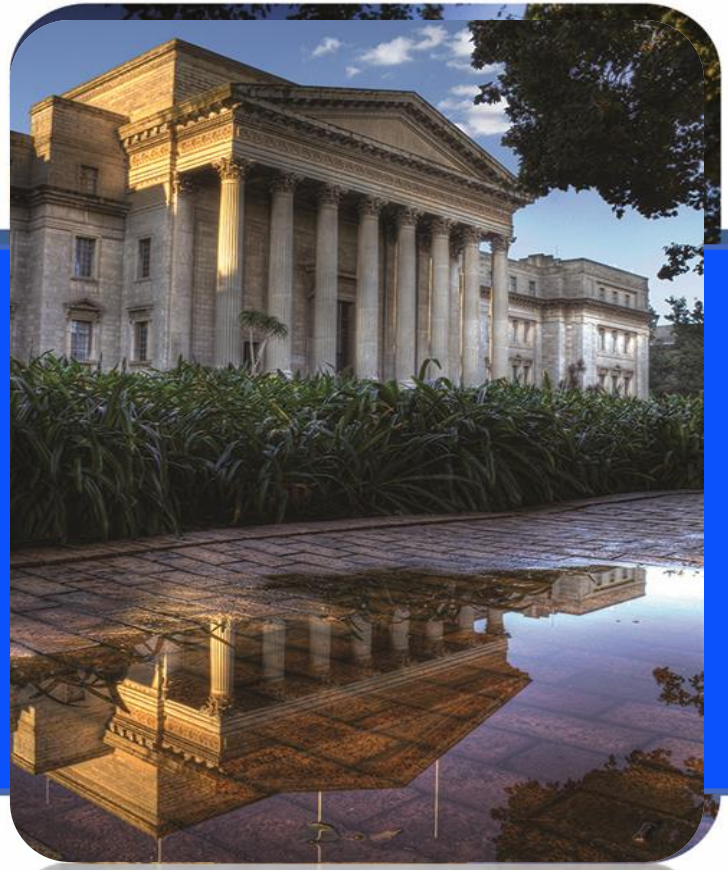


Fellows weekend 2025

Reidwaan Ally

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

FACULTY OF HEALTH SCIENCES

BIOSTATISTICS AND EPIDEMIOLOGICAL TERMS

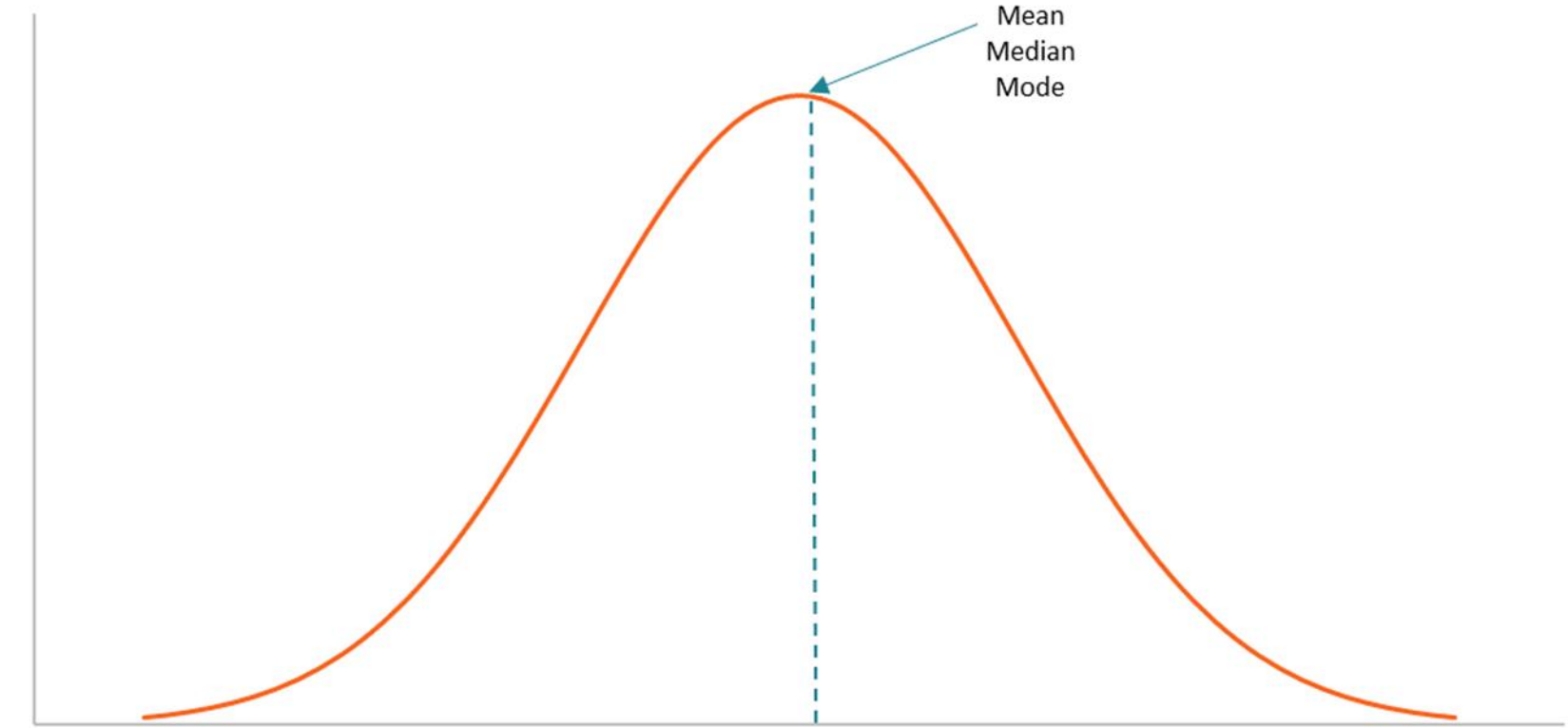
CRITICAL APPRAISAL

Introduction

- How Data Are Distributed
- Frequency of Any Event
- Magnitude of an Effect
- Accuracy and Precision
- Diagnostic Test Accuracy
- Inferences About Data
- Multivariate Analysis
- Survival Analysis

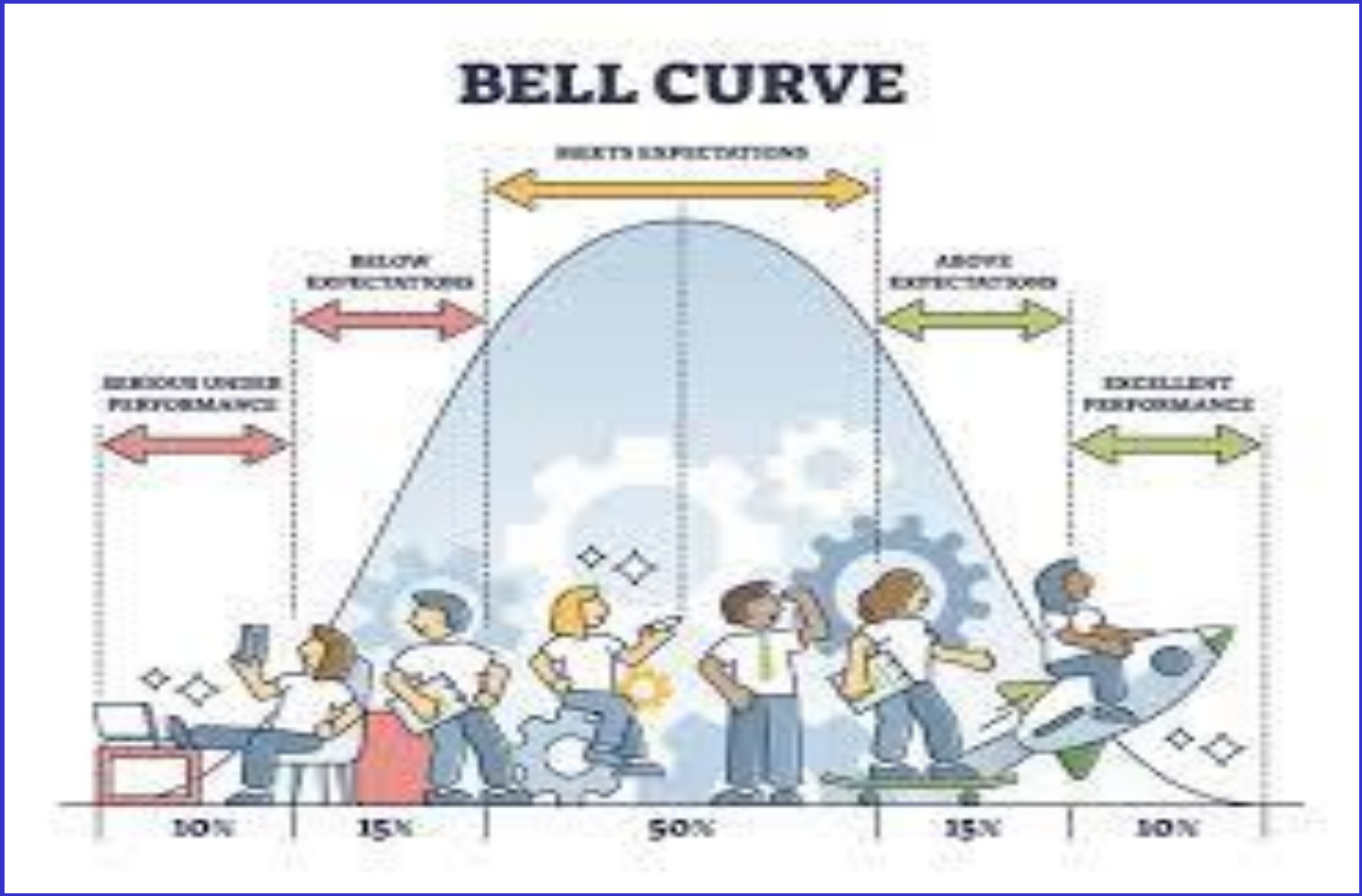
I. Data are distributed

A. Measures of central tendency

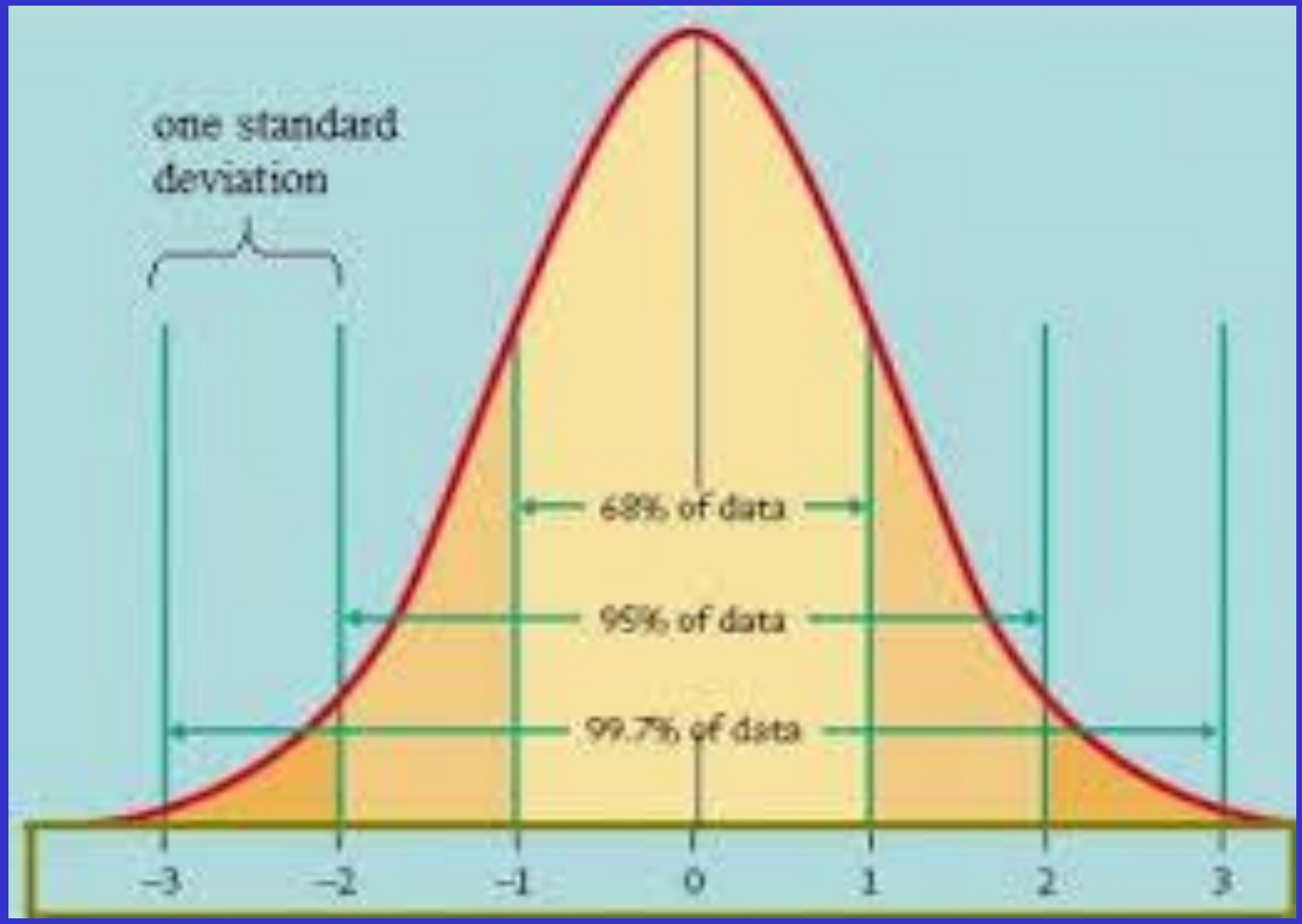


I. Data are distributed

A. Measures of central tendency



B. Measures of dispersion- dispersion (or varian.



II. Frequency of an event

A. Incidence –

(i) number of new events – in a specific time interval divided by the population at risk at the beginning of the time interval

(ii) result gives the likelihood of developing an event in that time interval

B. Prevalence –

number of individuals with a given disease at a given point in time divided by the population at risk at that point in time.

III. Magnitude of an effect

(i) *Relationship* among variables of interest in a data set
(ii) *Effect* of one variable on another depend

A. Relative risk and cohort studies

event/disease/benefit

B. Odds ratio and case-control studies

- event/disease/benefit

Relative Risk

- Exposed
- Control

$$\frac{A/(A+B)}{C/(C+D)}$$

Odds Ratio

Event	nonevent
A	B
C	D

$$\frac{A/B}{C/D}$$

C. Absolute risk

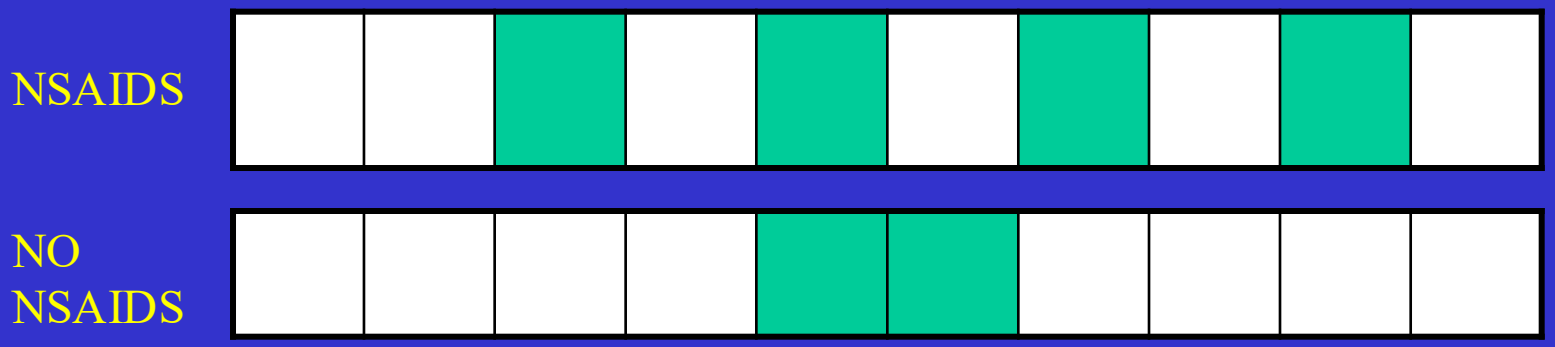
Risk Difference

$A(A+B) - C(C+D)$

D. Number Needed to Treat

1 / Risk Difference

Benefit/Harm/Power Calculations


NSAIDS
NO NSAIDS

treatment	Total	Develop an Ulcer	Did not
NSAID	10	4	6
Placebo	10	2	8
	Calculations made form these results		
Event Rate (ER)	4/10 = .4		
Control event rate (CER)	2/10 = .2		
Event Odds	4/6 = .66		
Control Odds	2/8 = .25		
Odds ratio	.66/.25 = 2.6		
Relative Risks (ER/CER)	.4/.2 = 2		
Absolute Risks (ER/CER)	.4 - .2 = .2		
NNT (1/)ER/CER)	1/.2 = 5		

- The relative risk and odds ratio are interpreted relative to the number one. An odds ratio of 0.6; for example – 40% less likely to develop a specific out come compared to the control group. Odds ratio of 1.5 – risk was increased by 50%

scientific research, **measurement error** is the difference between an observed value and the true value of something. It's also called observation error or experimental error.

ACCURACY PRECISION

- ACCURACY – how close a measured value is to the actual value……. P- value

- PRECISION - how close the various measurements are to each other – Deviation
- Confidence Interval's

Accuracy and Precision

- Collect Data
- Determine the Average Value
- Find the Percent Error
- Record the Absolute Deviations
- Calculate the Average Deviation

Average

- Average = sum of data / number of measurements
- Mean , Median

Percent Error

- Percent Error =

  {(Accepted – measured)/Accepted)} X 100

Eg – Climate :

{(96.8 – 95.3)/96.8 } X 100 = 1.5%

Produced results within 1.5% of accuracy

P - value

Absolute Deviations - Precision

- Absolute deviation =

  measured – average

- Eg you are measuring the length of an item ;
- 5 ft, 5.2 ft, 4.6 ft, 5.4 ft ….Average = 20.2/4=5.05

- AD = 0.05 , 0.15 , 0.45 , 0.35

Average Deviation

- Average deviation =
- sum of absolute deviations/ number

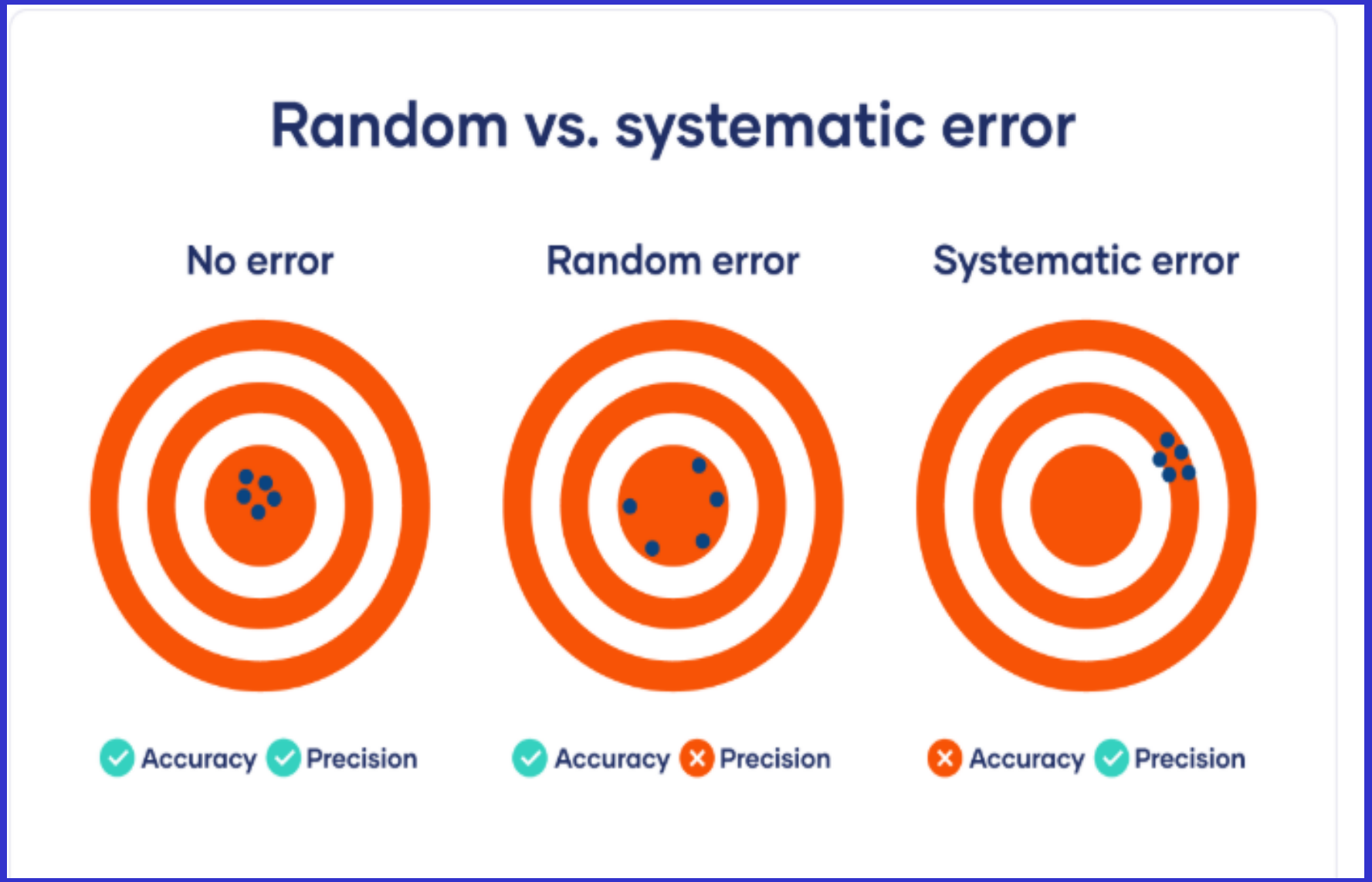
- $0.05 + 0.15 + 0.45 + 0.35 / 4 = 0.25$

  - The data is precise within a range of 0.25

Confidence Interval

systematic errors are consistent biases in the measurement system that affect ACCURACY, causing measurements to deviate in the same direction……..a consistent or proportional difference between the observed and the true value

random errors are unpredictable fluctuations in measurements that can be both positive or negative, affecting PRECISION …….chance differences between the observed and the true value


Random vs. systematic error
No error
Random error
Systematic error
Accuracy
Precision
Accuracy
Precision
Accuracy
Precision

Definitions of sensitivity, specificity, and positive and negative predictive values

	Disease present	Disease absent
Test positive	A	B
Test negative	C	D

Sensitivity = A ÷ (A + C)

Specificity = D ÷ (B + D)

Positive predictive value = A ÷ (A + B)

Negative predictive value = D ÷ (C + D)

VI. Making inferences about data

PROOF, P-VALUES

HYPOTHESIS TESTING

INFERENCES

A. PROOF

B. STATISTICAL TEST AND THE NULL HYPOTHESIS

- samples
- null hypothesis

C. EXPLANATION FOR THE RESULTS OF A STUDY

- P-values
- Confidence intervals
- Statistical significance
- Power in a negative study

C. EXPLANATION FOR THE RESULTS OF A STUDY

- *Truth* – The conclusion of the study may accurately reflect the answer

- *Bias* – one or more errors in the way the study was performed that distorted the results and affected the conclusion (Accuracy)

- *Confounding* – One or more variables that are associated both – exposure – outcome

- Chance – Random variations – may lead to erroneous conclusions-Type-1;2 (Precision)

CRITICAL APPRAISAL

THE HIERARCHY OF EVIDENCE

Ia Systematic review of randomised clinical trials

Ib Single randomised clinical trials

II Cohort study

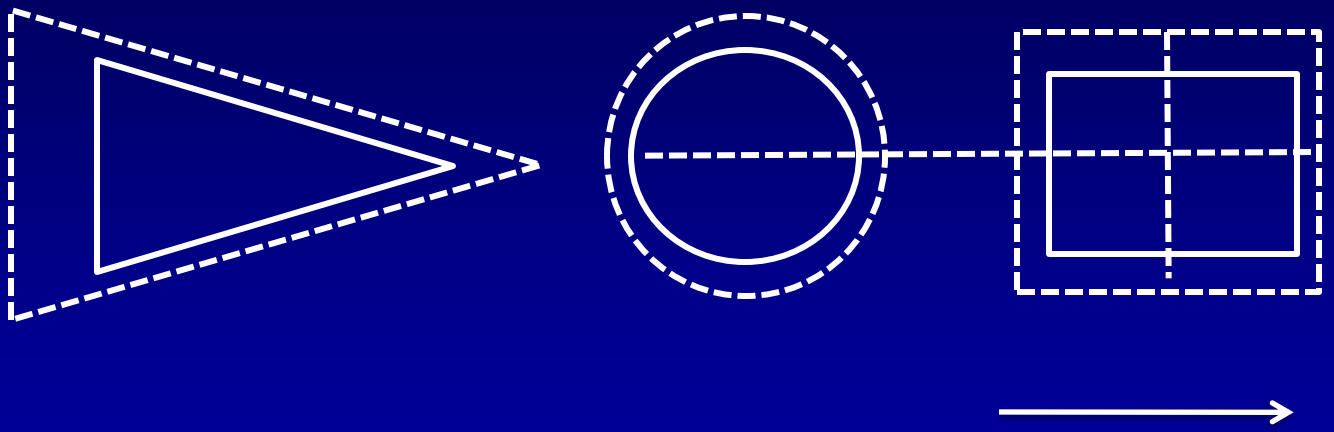
III Case-control study

IV Physiological studies, narrative overviews, consensus reports, opinion of 'experts'

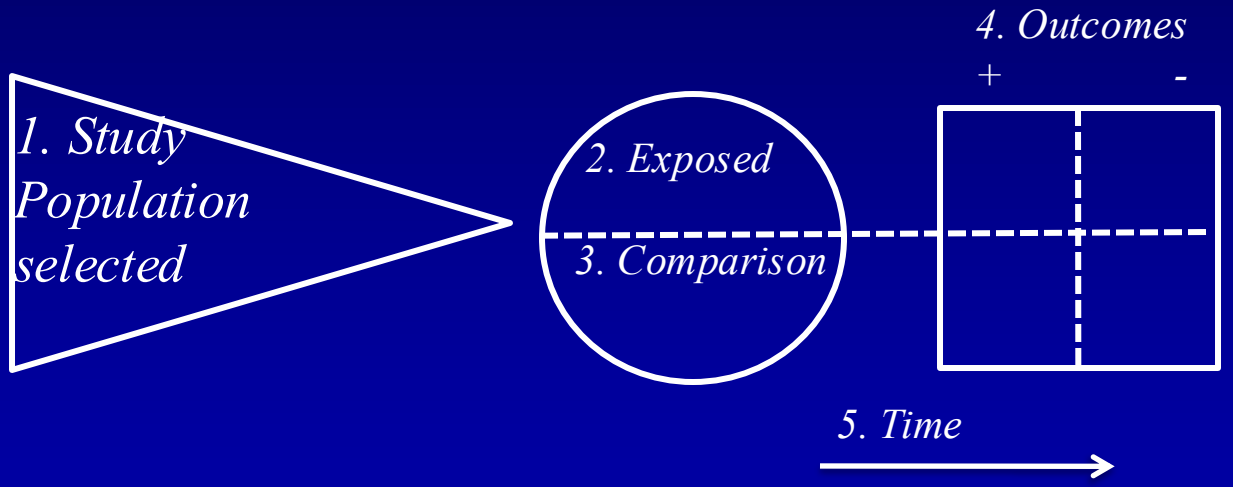
The 4 components of study appraisal

1) Is the study valid (design / bias)?
2) What's the magnitude of the effect?
3) Is the effect precise?
4) Are the findings applicable?

GATE: a Generic Appraisal Tool for Epidemiology



Components : PECOT diagram



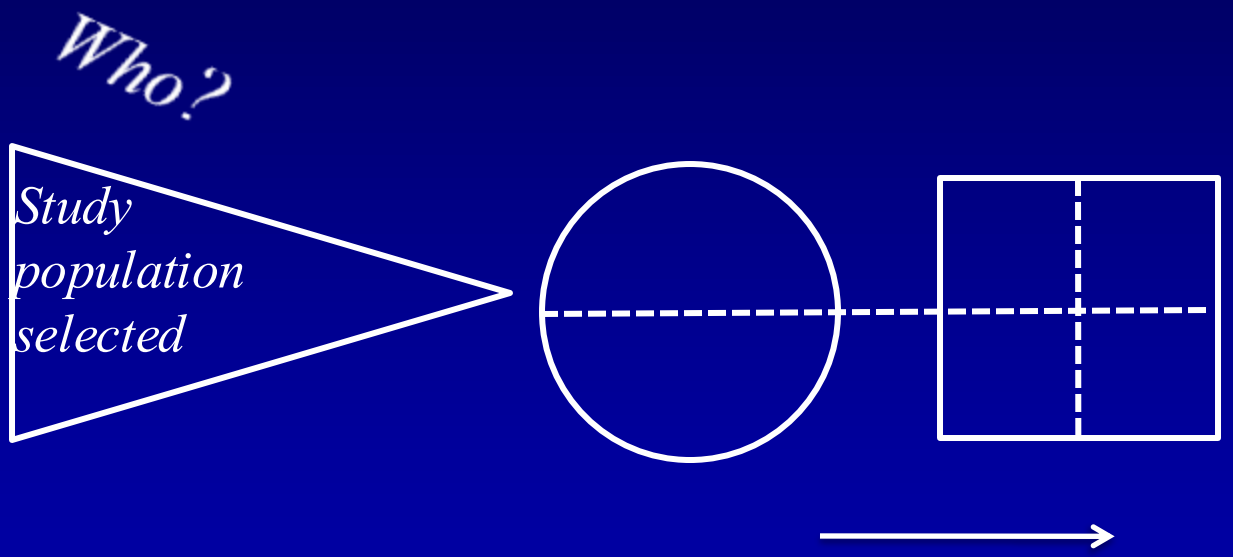
1) Is the study valid?

Design

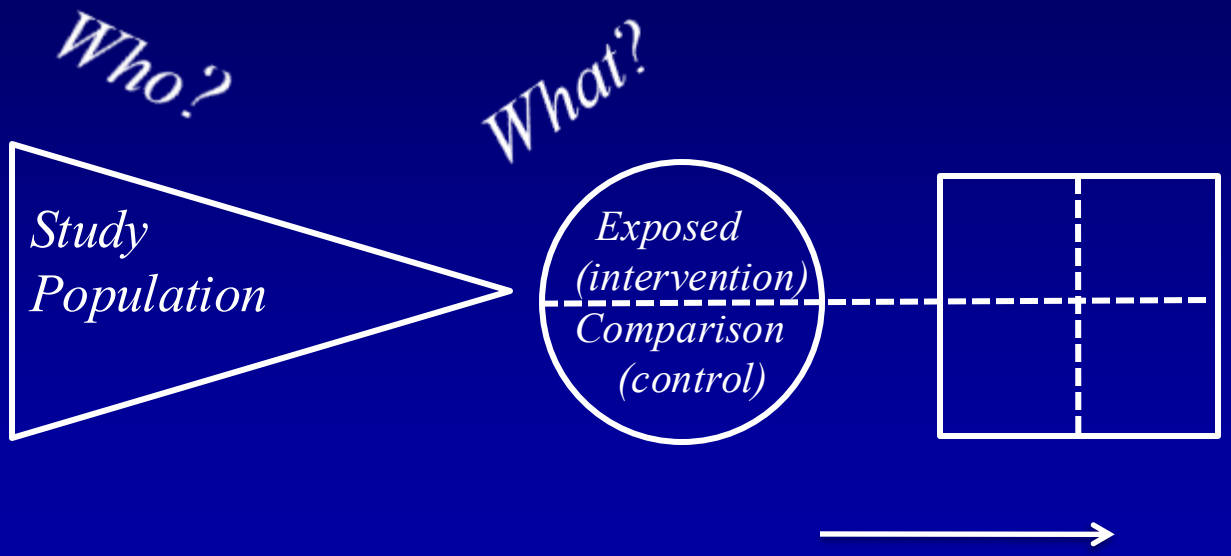
- Who
- What
- Outcomes
- Time

- **PECOT**

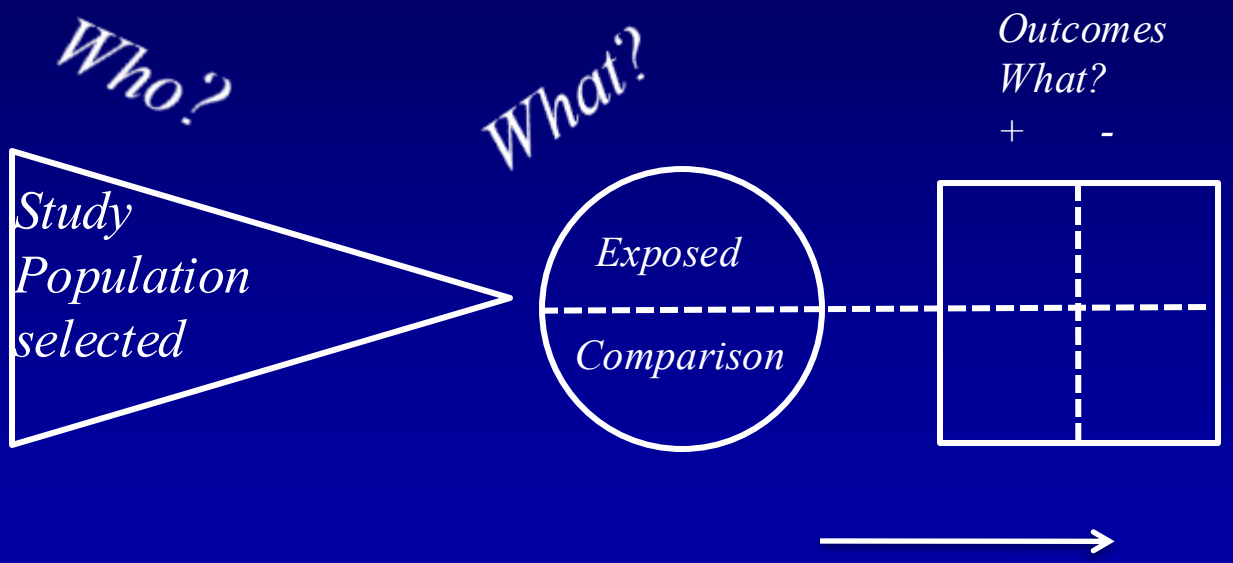
: design - WHO



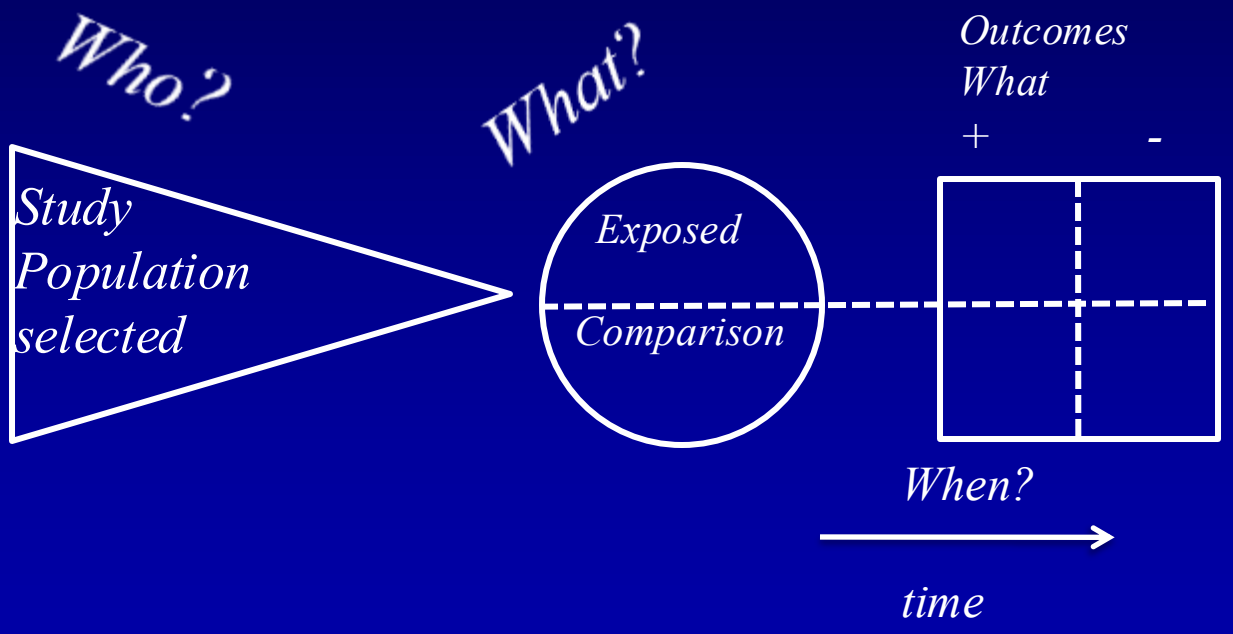
: design - WHAT


Who?
What?
Study Population
Exposed (intervention)
Comparison (control)

: design - OUTCOMES



: design - TIME


Who?
What?
Outcomes
What
+
-
Study
Population
selected
Exposed
Comparison
When?
time

1) Is the study valid?

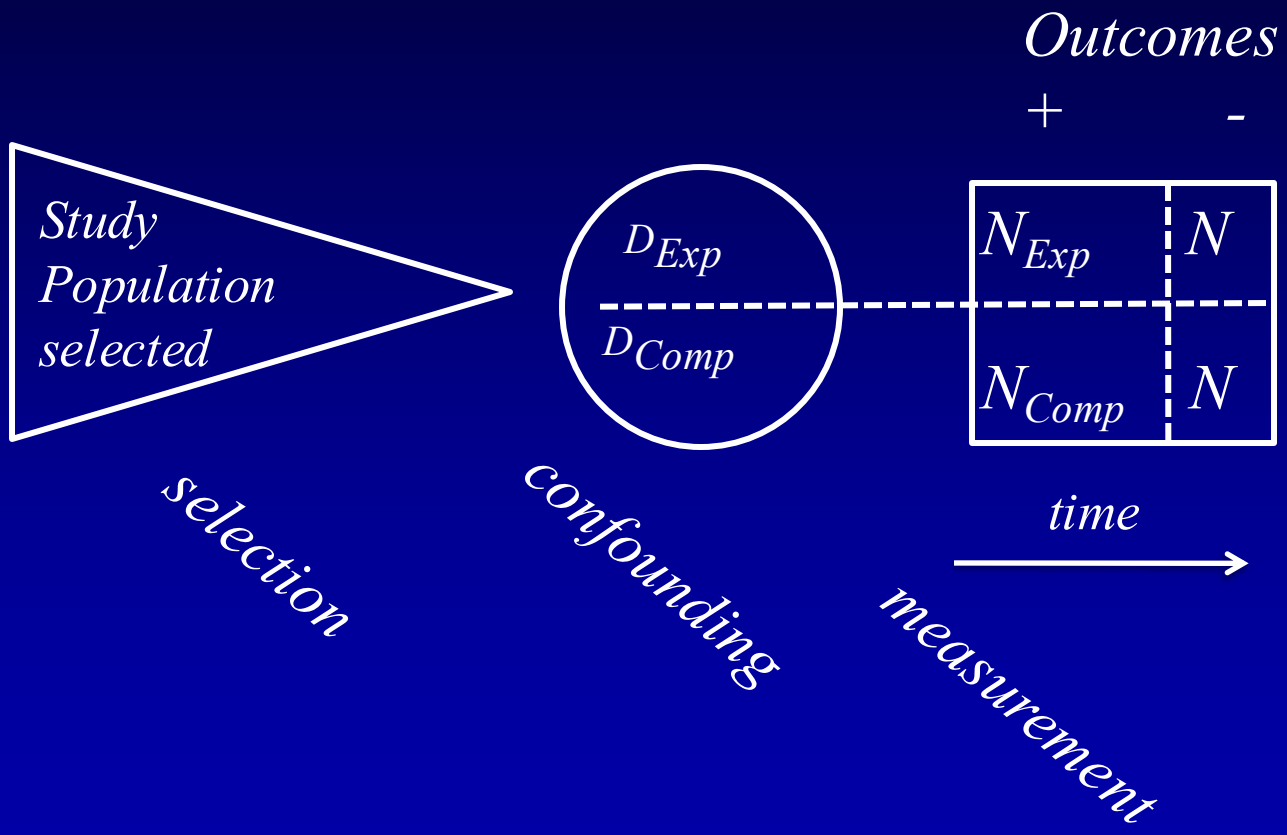
Bias

random or systematic error

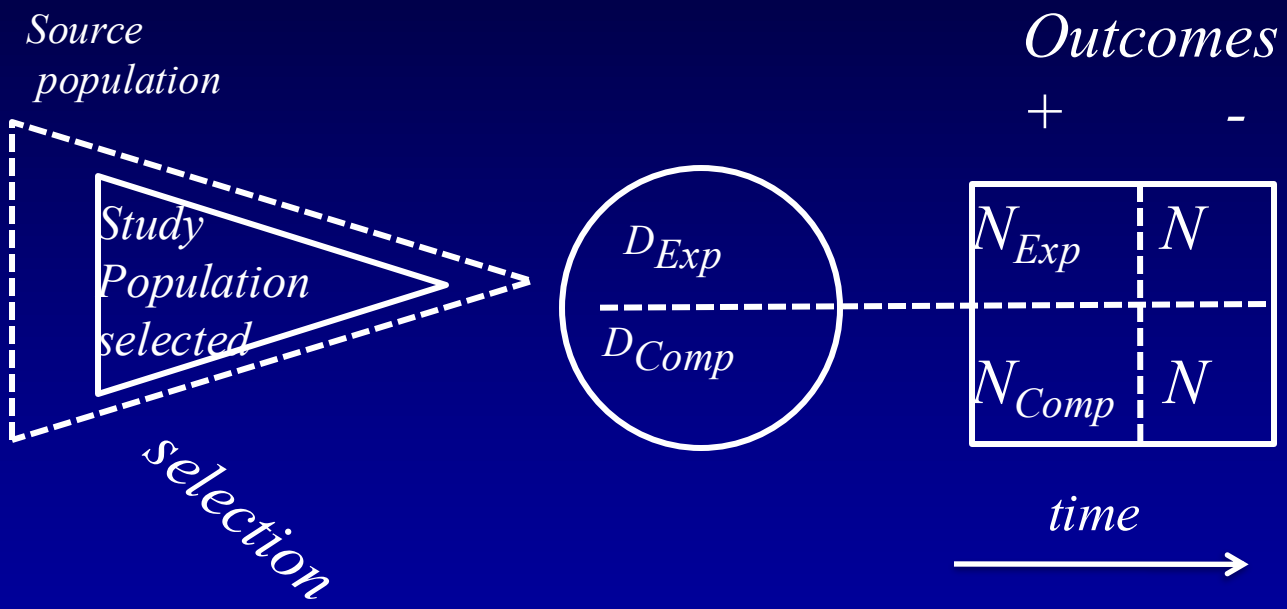
Methodological Quality

- Generation of the allocation sequence
- Allocation concealment
- Double blinding
- Sample size
- Intention-to-treat analysis

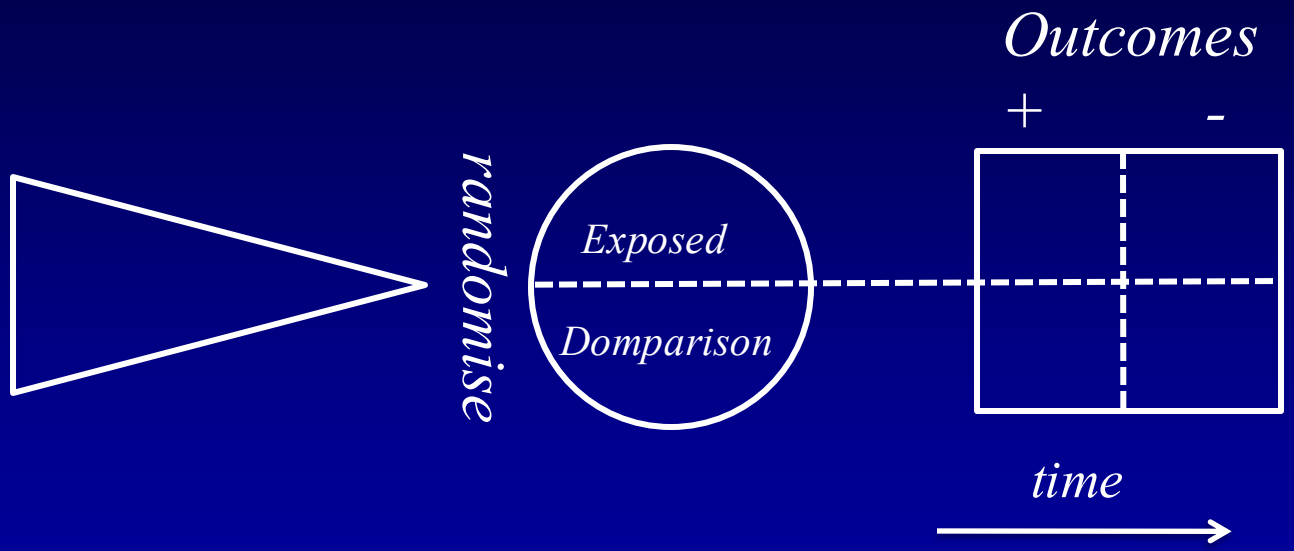
PECOT : Bias


Outcomes
+
-
Study Population selected
D_{Exp}
D_{Comp}
N_{Exp}
N
N_{Comp}
N
selection
confounding
time
measurement

Selection

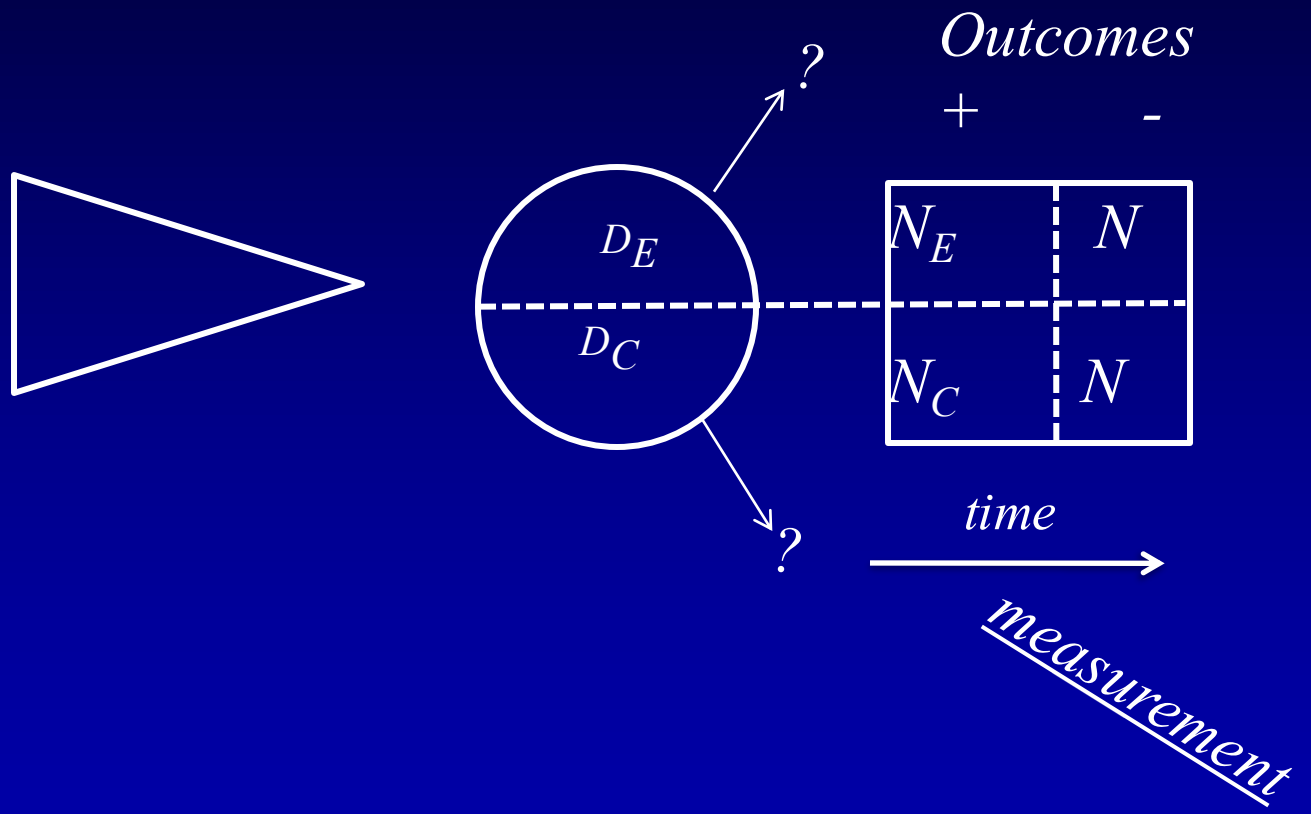

Source
population
Study
Population
selected
selection
Outcomes
+
-
D_{Exp}
D_{Comp}
N_{Exp}
N
N_{Comp}
N
time

Minimising confounding

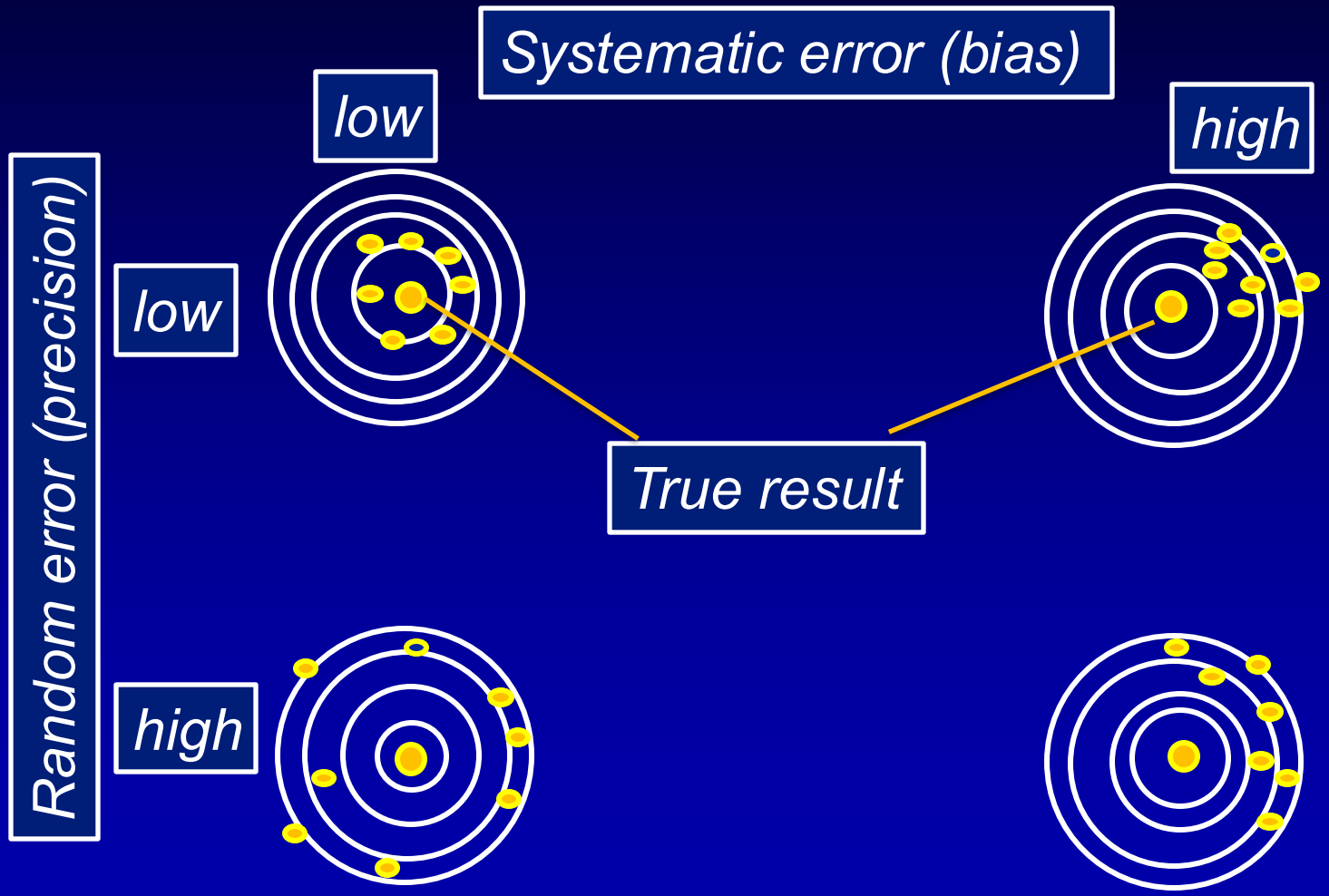


confounding

Measurement
loss f-p/compliance/contamination



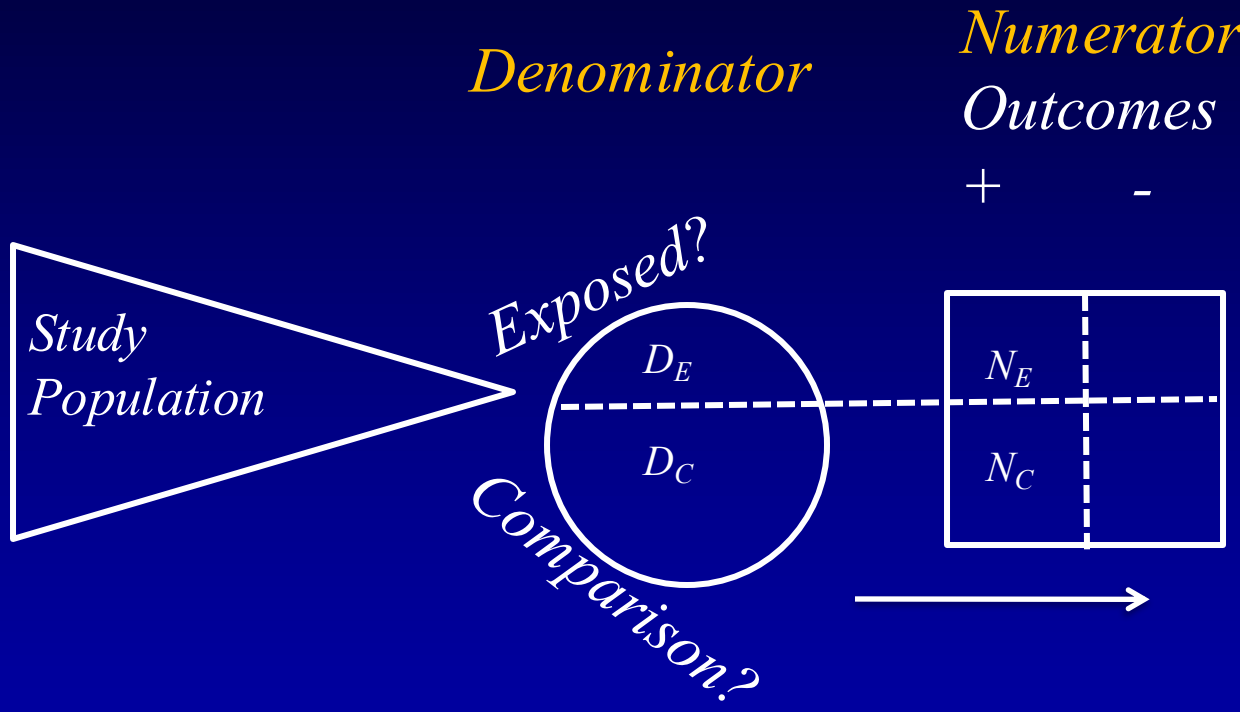
Systematic and random error



2) What is the magnitude of the effects measured in the study?

The numbers

GATE approach: numbers



Relative Risk

- Exposed
- Control

$$\frac{A/(A+B)}{C/(C+D)}$$

Odds Ratio

Event	nonevent
A	B
C	D

$$\frac{A/B}{C/D}$$

THE NUMBERS TABLE
occurrence, effects & precision

Outcomes & time	Comparison occurrence (CO)	Exposure occurrence (EO)	Rel. Risk (EO/CO) ±95% CI	Risk Diff (CE-EO) ±95% CI	NRT (1/RD) ±95% CI

3) Is the EFFECT Precise

4) Are the findings Applicable

Relevant, feasible, affordable, generalisable

Ward Round

. 80 yr man with acute severe biliary pancreatitis

. Glasgow criteria – score of 4

. What is the role of Antibiotic therapy to minimise necrosis

APPLICABILITY

1. Translate info needs into answerable questions
2. Track down best evidence to answer them
3. Appraise evidence for validity, impact and applicability
4. Integrate evidence with practice expertise and apply in practice
5. Evaluate performance

1-3 = Critically Appraised Topic

Train the Trainers 2003 - Education and Training Committee

CATs

Critically Appraised Topics

Clinical Questions

1. Participants (patient group / problem)
2. Exposure (intervention if about therapy)
3. Comparison (if relevant)
4. Outcome
5. Time

Summary: 4 components of study appraisal

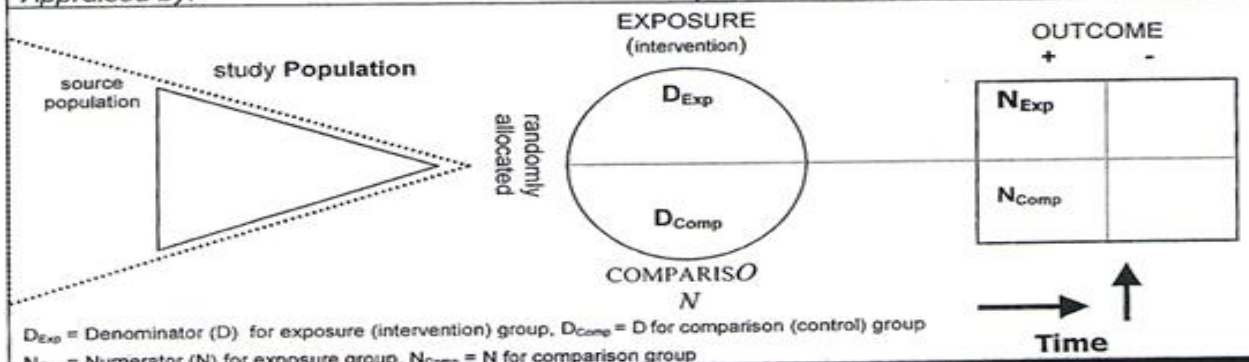
1) Is the study valid (i.e. good design / little bias)?
2) What's the magnitude of the effect?
3) Is the effect precise?
4) Are the findings applicable?

GATE Checklist for Randomised Controlled Trials (Intervention: benefit or harm)

Study author, title, publication reference:

Appraised by:

Key 5-part study question (PECOT). Was it focussed?



D_{Exp} = Denominator (D) for exposure (intervention) group, D_{Comp} = D for comparison (control) group

N_{Exp} = Numerator (N) for exposure group, N_{Comp} = N for comparison group

SECTION 1: STUDY DESIGN & VALIDITY

	Evaluation criterion	*How well was this criterion addressed?*	*Quality ✓ ± x ?*
Population	What were the key selection (inclusion & exclusion) criteria for the study pop?		
	Were they well defined? Replicable?		
	Did everyone selected participate?		
Exposures & Comparison	What were the exposures (interventions) & comparison?		
	Were they well defined? Replicable?		
	Was assignment to exposure & comparison groups randomised?		
	Was randomisation concealed?		
	Was randomisation successful: were exposure & comparison groups similar at start of study?		
	Were all participants analysed in groups to which randomised?		
	Were participants, health workers, researchers blind to interventions?		
	Apart from study interventions, were groups treated equally?		
	Was compliance with interventions measured? Was it sufficient?		
Outcomes	What key outcomes were assessed?		
	Were they well defined? Replicable?		
	How complete was follow up? Was it sufficient? How many dropouts?		
	Was outcome assessment blind to intervention status?		
Time	What was the length of follow up?		
	Was follow up sufficiently long to detect important effects on outcomes?		

QUAQUALITY OF STUDY DESIGN: *How well did the study minimise bias? Very well = +, poorly = okay = ∅, -*

SECTION 2: STUDY RESULTS – MAGNITUDE & PRECISION

What measures of occurrence (incidence / prevalence) & intervention effects (RR /RD /NNTs) were reported?	
What measures of precision of effects were reported (CIs, p-values)?	

THE NUMBERS TABLE: OCCURRENCE, EFFECT ESTIMATES & PRECISION

Outcomes* & Time (T)	Comparison occurrence (CO=[N_C/D_C]/T) or mean*	Exposure occurrence (EO=[N_E/D_E]/T) or mean*	Relative Risk* (RR = EO/CO) ± (95% CI)	Risk difference or mean difference (RD = CO-EO) ± (95% CI)	Number Needed to Treat* (NNT = 1/RD) ± (95% CI)

* *if outcomes continuous, can calculate means, mean differences, but not NNTs (don't usually calculate relative means)*
D_E = Denominator (D) for exposure (intervention) group(s), D_C = D for comparison (control) group
N_E = Numerator (N) for exposure group(s), N_C = N for comparison group

		QUALITY ✓ ± ? X
Could useful effect estimates (e.g. RR, RDs or mean differences, NNTs) be calculated? For benefits & harm?		
What was the magnitude and direction of the effect estimates?		
Was the precision of the effect estimates sufficient?		
If no statistically significant effects detected, was there sufficient power?		
If multi-centred RCT - were the results homogeneous between sites?		
QUALITY OF STUDY RESULTS: *Useful, precise +/or sufficient power? Very good = +, okay = ∅, poor = -*		

SECTION 3: STUDY APPLICABILITY & GENERALISABILITY

study Population	Was the study population appropriate given study question?		
	Was the source population for the study population well described?		
	Was the study population representative of source population?		
	Can the relevance / similarity of the study population to a specific target group(s) be determined?		
Exposures & Comparison	Were the characteristics of the study setting well described? *e.g. rural, urban, inpatient, primary care*		
	Are the interventions feasible?		
	Is the background management (i.e. comparison group management) relevant?		
Outcomes	Were all important outcomes considered: benefits? harms? costs?		
	Are likely benefits greater than potential harms & costs (or vice versa)? In what target group(s)?		
QUALITY OF STUDY APPLICABILITY: *Could applicability be determined? Very well = +, okay = ∅, poorly = -*			

Critical Appraisal Exercise

Pederzoli et al

Ward Round

. 80 yr man with acute severe biliary pancreatitis

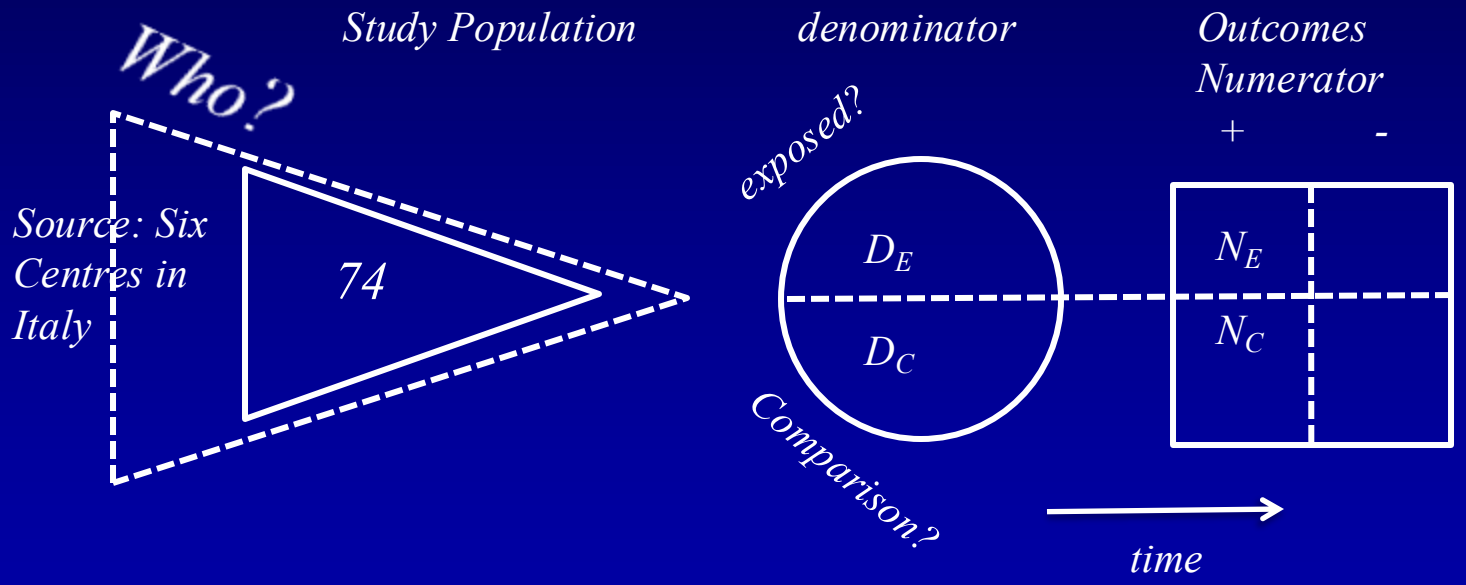
. Glasgow criteria – score of 4

. What is the role of Antibiotic therapy to minimise necrosis

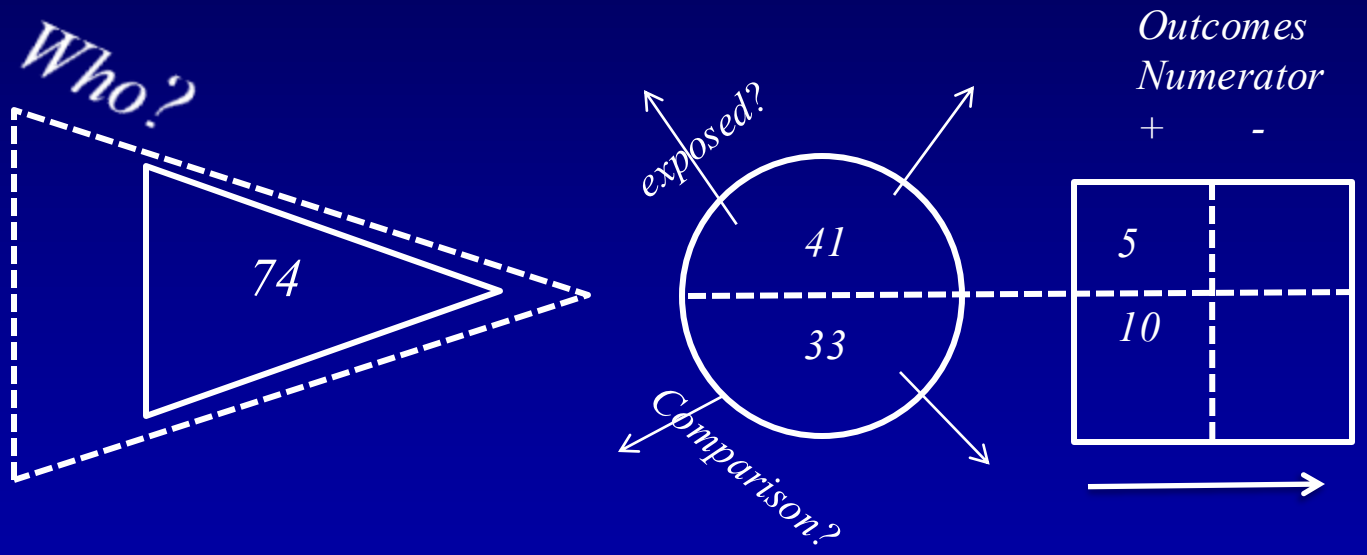
5 Part Question

- 1) In patients with severe pancreatitis
- 2) does the use of antibiotics
- 3) compared to no antibiotics
- 4) reduce the rate of abdominal sepsis
- 5) over the course of the acute illness(3 m)

GATE approach



GATE approach:



Estimating risk/benefit

NNT = 1 ÷ risk difference

= 1 ÷ 0.181 = 5.5

IMARY

In a randomized, multicenter clinical trial, imipenem, a broad-spectrum antibiotic secreted into pancreatic tissue at therapeutical MIC, proved successful in preventing pancreatic sepsis during acute necrotizing pancreatitis.

COMMENTS

- **Randomisation** – not good (more patients with greater necrosis entered into the exposure arm)

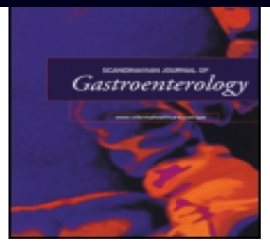
- **No Blinding** by the assessors

- **Difference in production of pancreatic sepsis** did not translate to differences in mortality nor the requirement for operative intervention

ONLY FACT ‘s

- **Antibiotic therapy reduces the risk** of pancreatic sepsis in patients with ANP diagnosed on CT , but no effect on **Mortality** , need for **Surgery**

- **Imipenem is an appropriate antibiotic** for use in acute ANP



Taylor & Francis
Taylor & Francis Group

Scandinavian Journal of Gastroenterology

ISSN: 0036-5521 (Print) 1502-7708 (Online) Journal homepage: https://www.tandfonline.com/loi/igas20

Systematic review and meta-analysis of antibiotic prophylaxis in severe acute pancreatitis

Mathias Wittau, Benjamin Mayer, Jan Scheele, Doris Henne-Bruns, E. Patchen Dellinger & Rainer Isenmann

In summary, to date there is no statistically significant evidence that supports the routine use of antibiotic prophylaxis in SAP. However, in case of newly

J Hepatobiliary Pancreat Surg (2004) 11:381–389
DOI 10.1007/s00534-004-0927-2

Journal of HBP Surgery

Review article

Randomized controlled trials on hepato-biliary-pancreatic surgery

Toshimi Kaido

Department of Surgery, Otsu Municipal Hospital, 2-9-9 Motomiya, Otsu, Shiga 520-0804, Japan

therapy[4,5]. However, RCTs are more challenging in surgical fields because of practical and ethical issues[2,5], so there are fewer surgical RCTs and those that have been published have a lower methodological and reporting quality than non-surgical RCTs. Therefore, only a minor part of surgical decision-making can be based on high-quality evidence from RCTs[6,7].

Despite the increased demand for evidence-based approaches, there is no systematic review of all RCTs published in the field of hepatobiliary surgery. The aim of the present study was to undertake a systematic review of RCTs in

Reasons

- **Small numbers** (especially HPB cancers)
  Multicentre studies – bias
- **Technical Bias**
  Patient variations , Surgical skills
- **Surgeons/ Oncologist** – interest in participating in RCT

Volume 110, Issue 10
October 2023

< Previous Next >

JOURNAL ARTICLE

Evidence mapping of randomized clinical trials in hepatobiliary surgery

Get access >

Ali Majlesara, Ehsan Aminizadeh, Ali Ramouz, Elias Khajeh, Filipe Borges, Gil Goncalves, Carlos Carvalho, Mohammad Golriz, Arianeb Mehrabi ✉

British Journal of Surgery, Volume 110, Issue 10, October 2023, Pages 1276–1278,
https://doi.org/10.1093/bjs/znad125

Published: 01 June 2023 **Article history** ▾

Cite | Permissions | Share ▾

THANK YOU