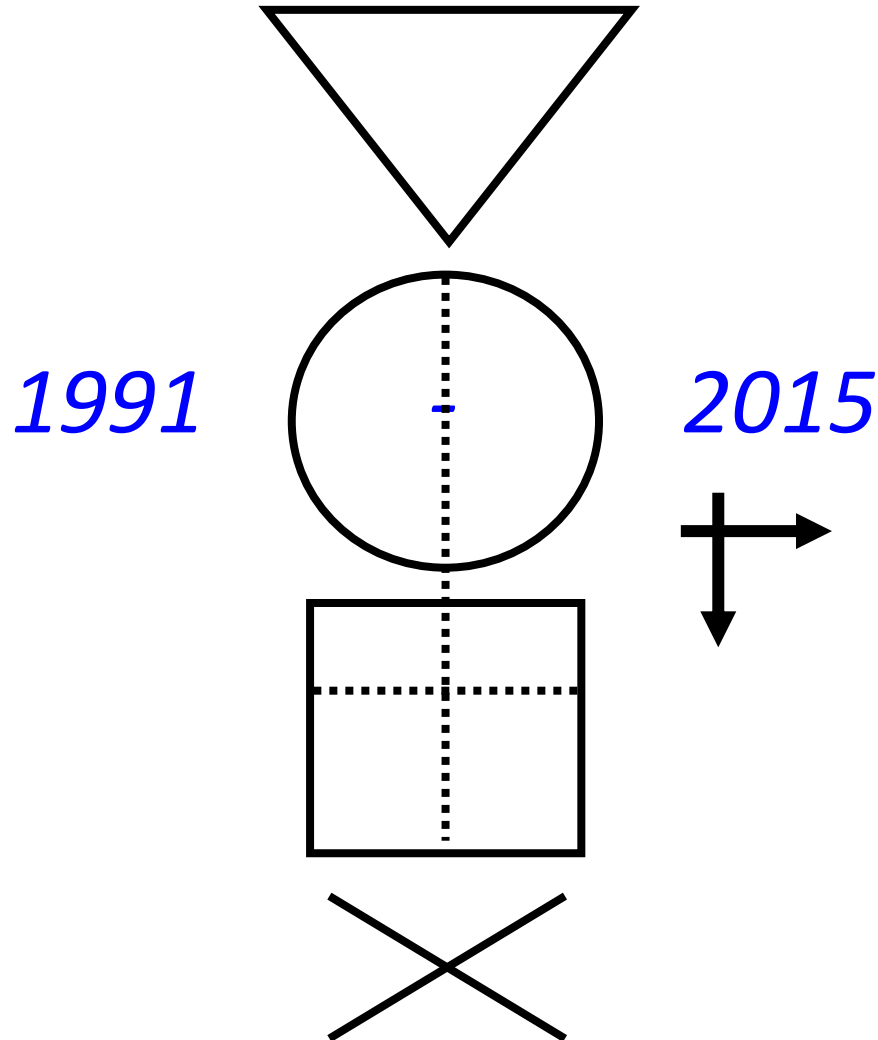
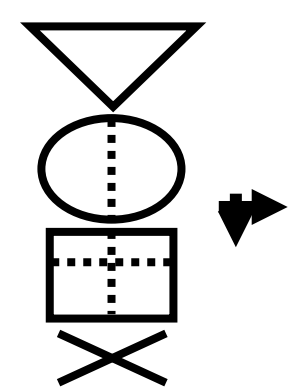


# GATE:

## Graphic Appraisal Tool for Epidemiology



*1 picture, 2 formulas & 3 acronyms*



GATE:

Graphic Appraisal Tool for Epidemiology

Graphic Architectural Tool for Epidemiology

Graphic Approach To Epidemiology

making epidemiology accessible



4<sup>th</sup> year medical students 1991

# Jerry Morris



$$\text{epidemiology} = \frac{\text{numerator}}{\text{denominator}}$$

In: Uses of Epidemiology 1957





# presentation outline

GATE is a framework for:

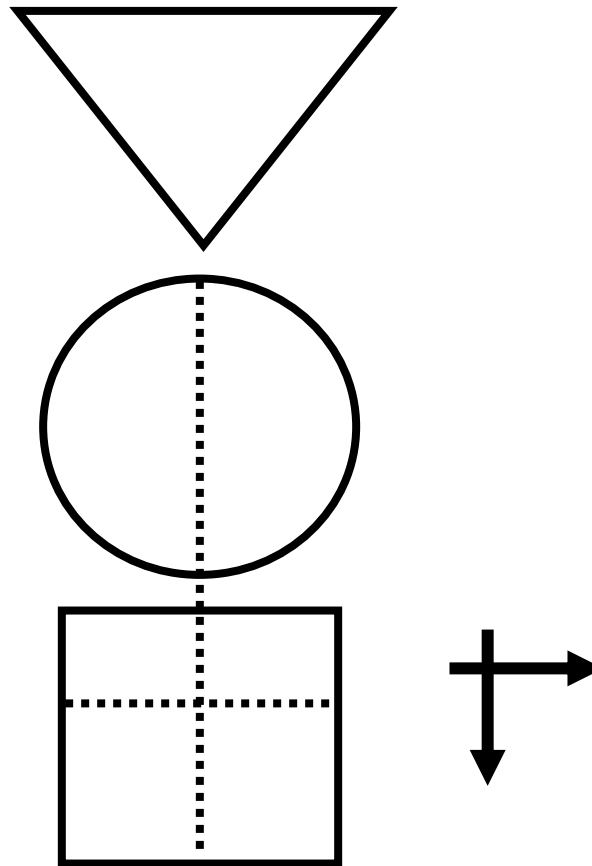
1. study design
2. study analysis
3. study error
4. practicing EBM

**1**



# GATE: a framework for study design

***1 picture***

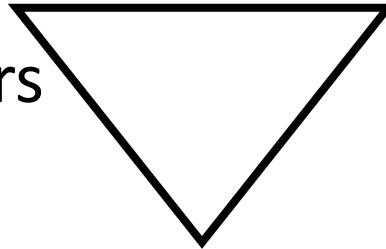


*every epidemiological study can be hung on the GATE frame*

***1 picture, 2 formulas & 3 acronyms***

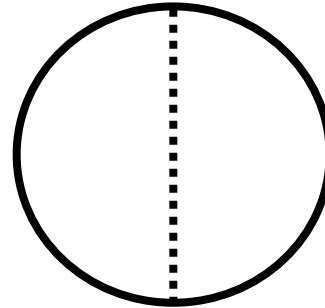
# 1 picture: GATE frame

cohort of British doctors



smoking status allocated by measurement (observation)

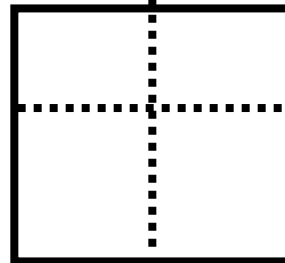
smokers



non-smokers

lung cancer  
events counted

yes  
no

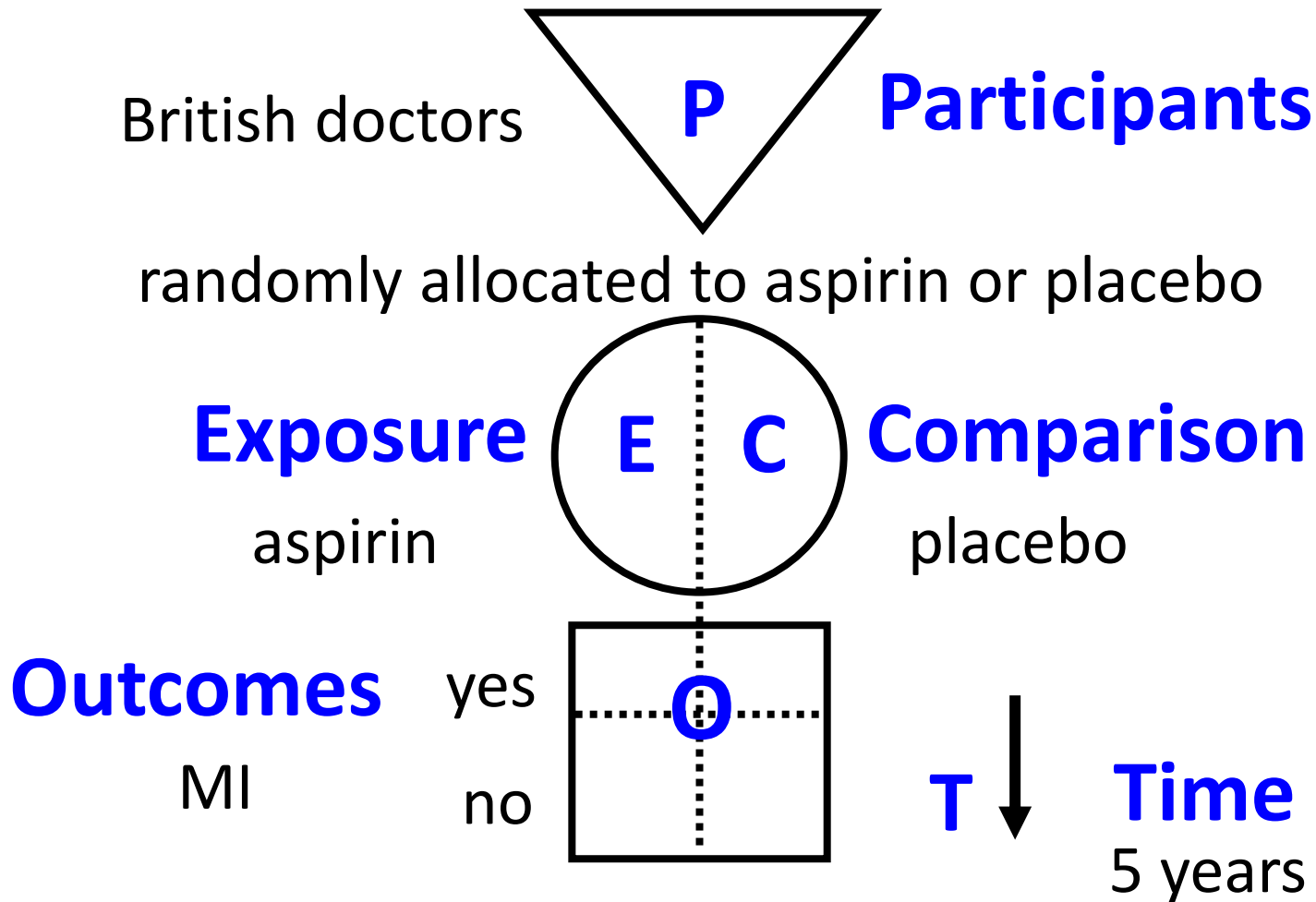


↓ followed for 10  
years

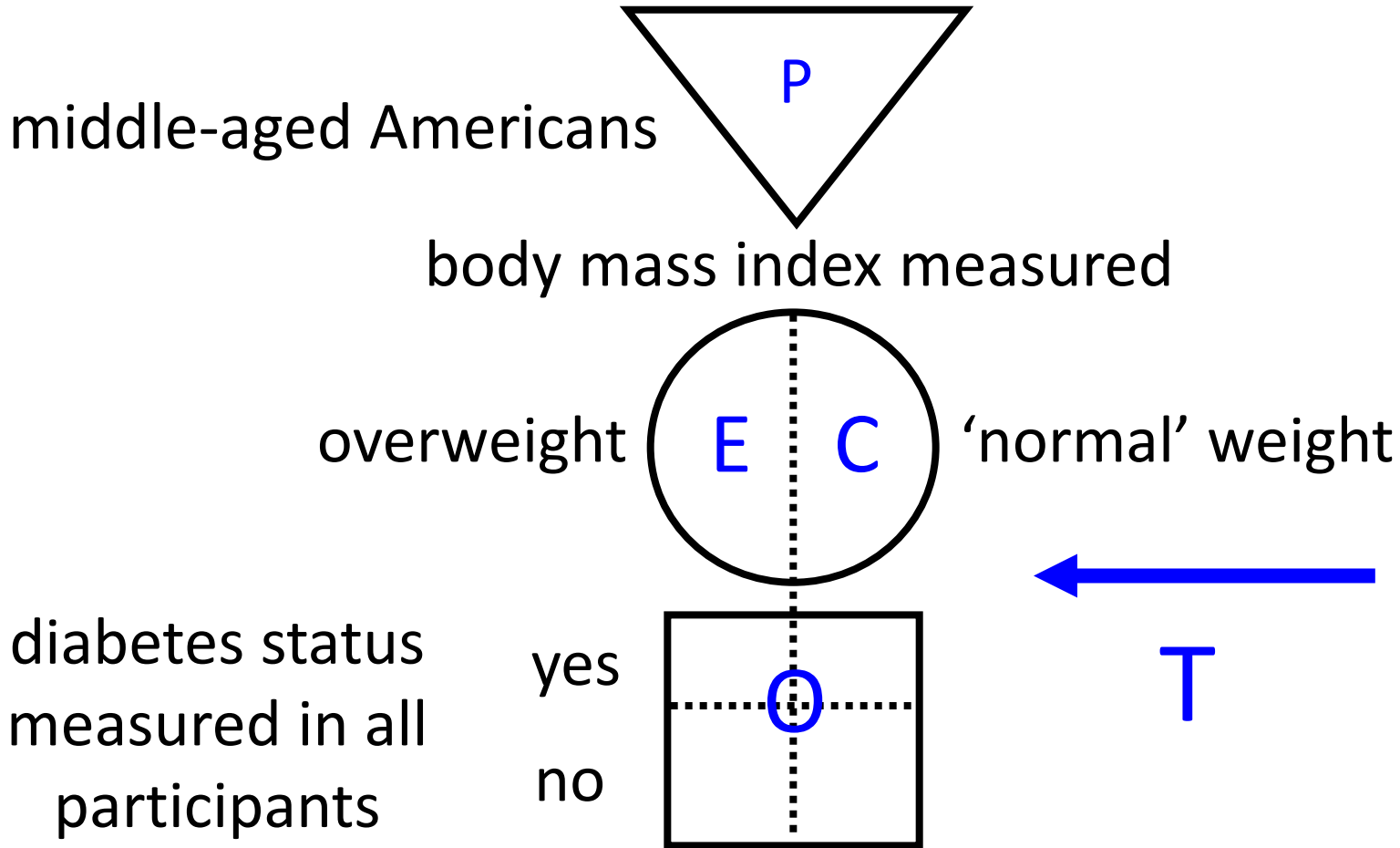
cohort / ↓ longitudinal / follow-up study

1 picture, 2 formulas & 3 acronyms

# 1<sup>st</sup> acronym: PECOT



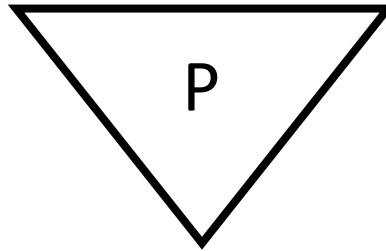
**randomised controlled trial**



## cross-sectional (prevalence) study

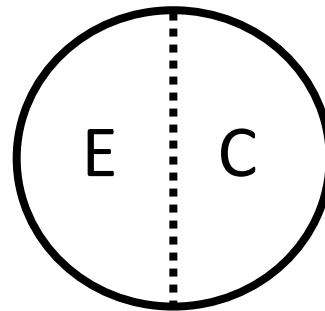


middle-aged American women



receive mammogram screening test

mammogram positive

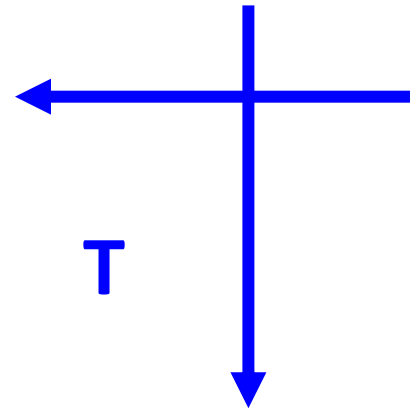
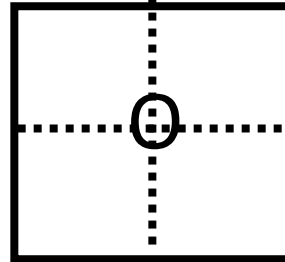


mammogram negative

breast cancer

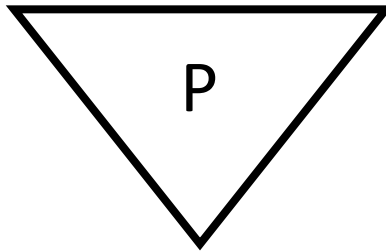
yes

no



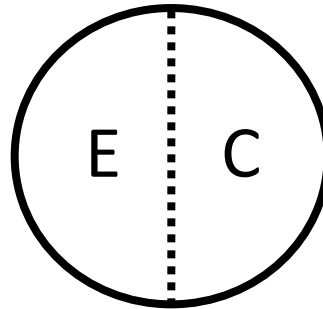
# diagnostic test (prediction) study

middle-aged American women



Gold Standard

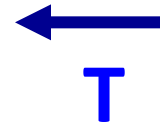
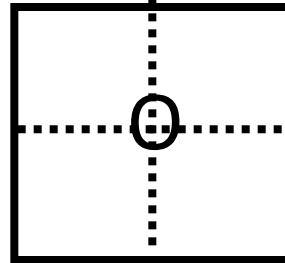
breast cancer



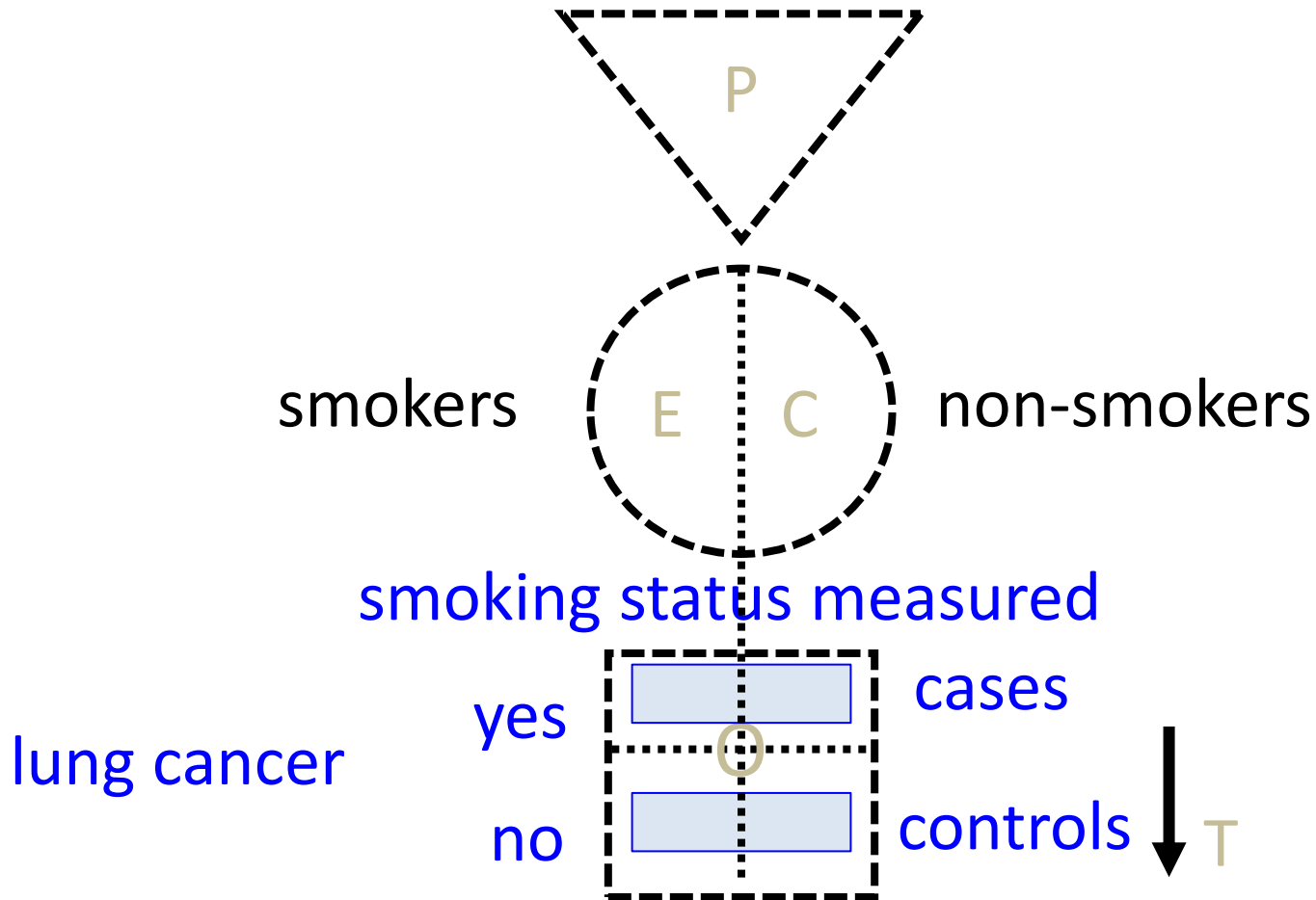
no breast cancer

mammogram test

positive  
negative



# diagnostic (test accuracy) study



## case-control study

(all nested in virtual cohort studies)

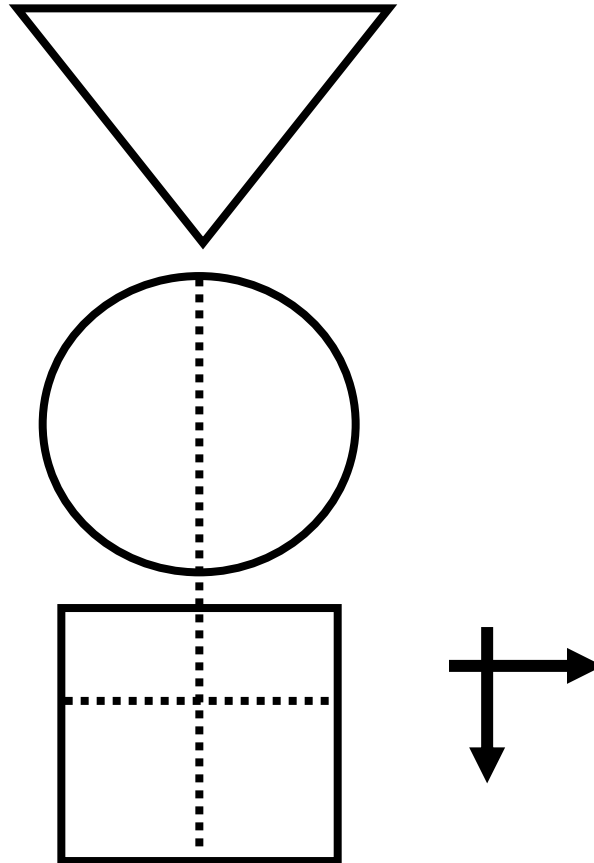
£100



2

# GATE: a framework for study analysis:

***1<sup>st</sup> formula: occurrence = outcomes ÷ population***

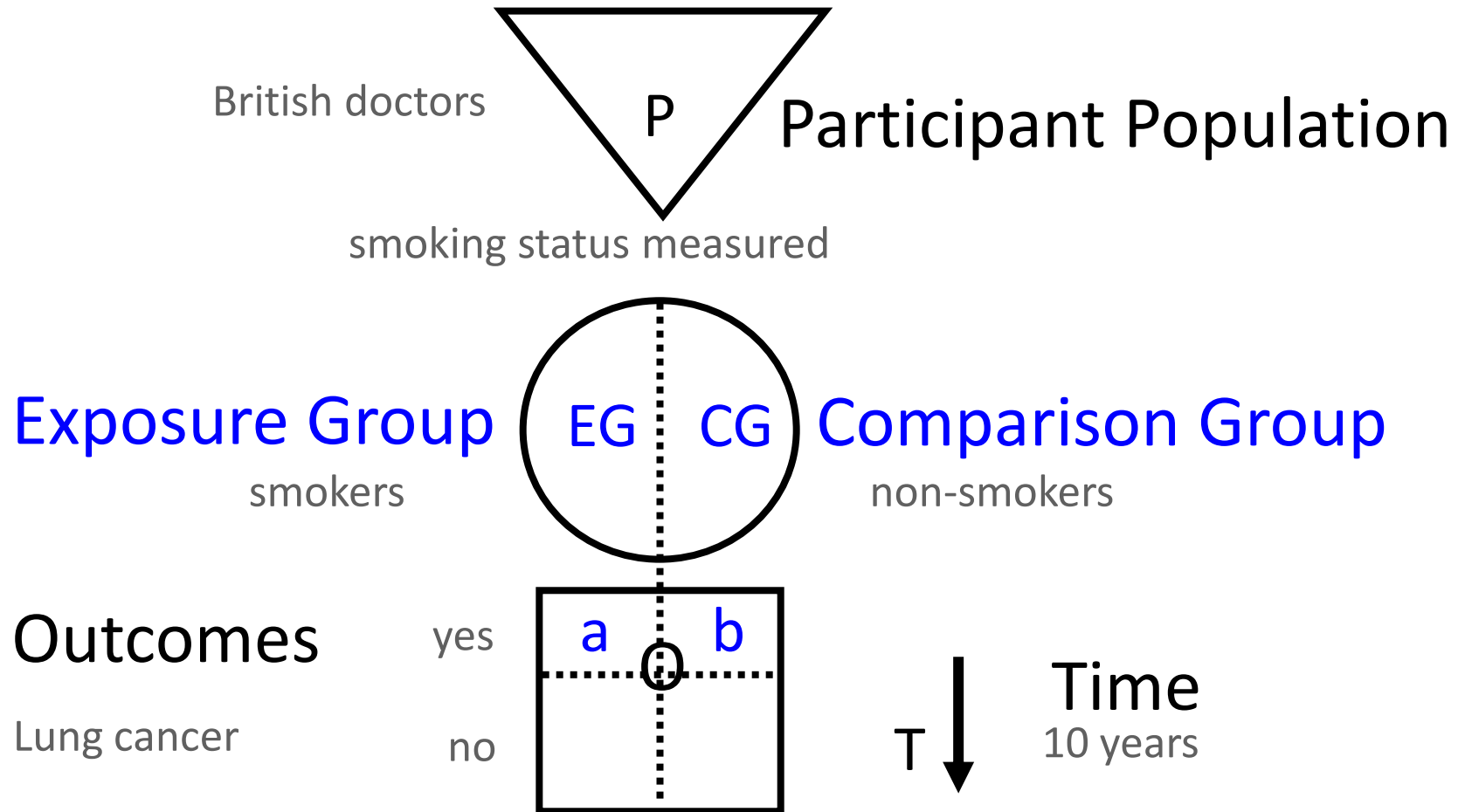


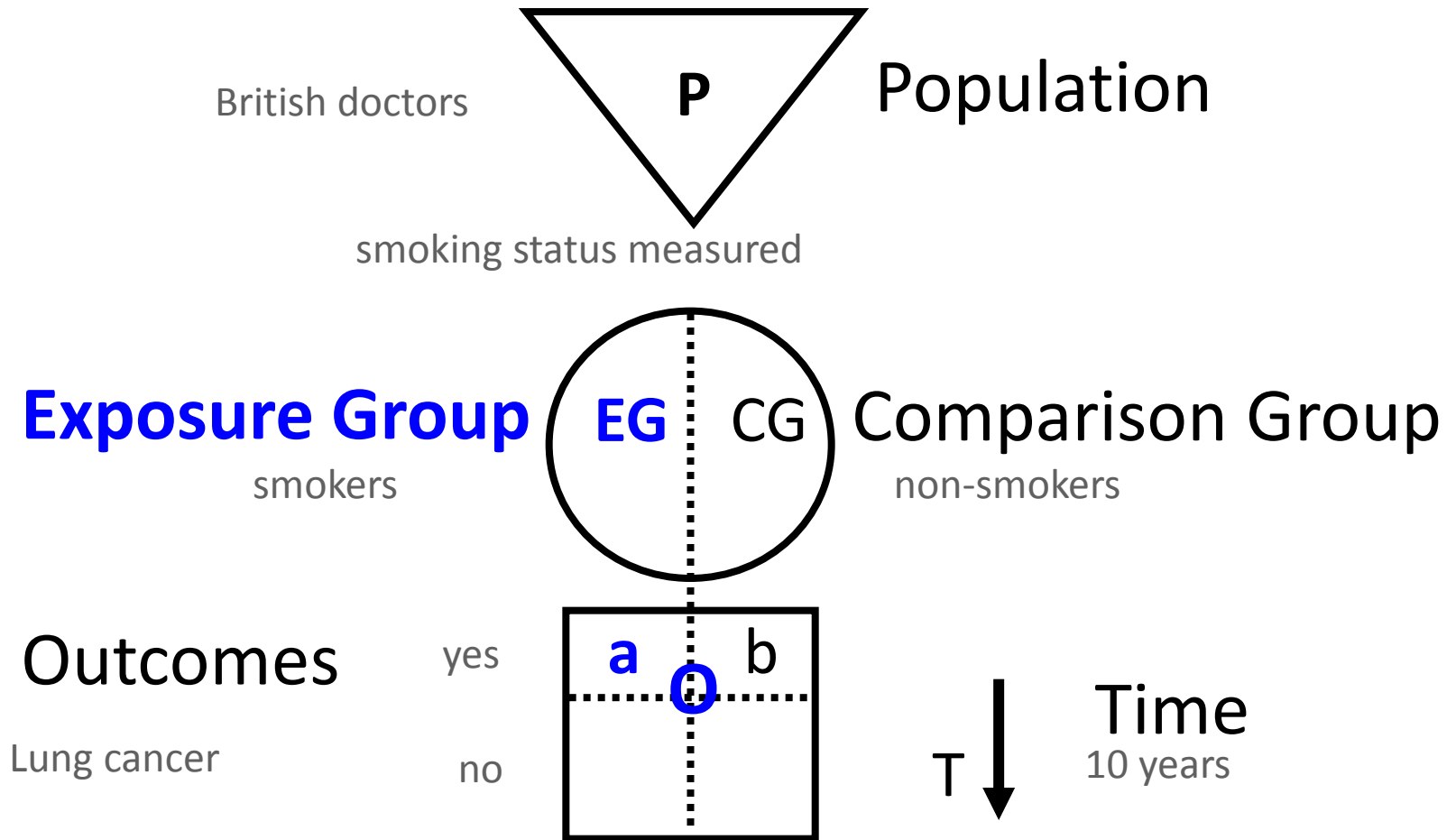
*the numbers in epidemiological studies can be hung on the  
GATE frame*

***1 picture, 2 formulas & 3 acronyms***

***1<sup>st</sup> formula: occurrence of outcomes =***

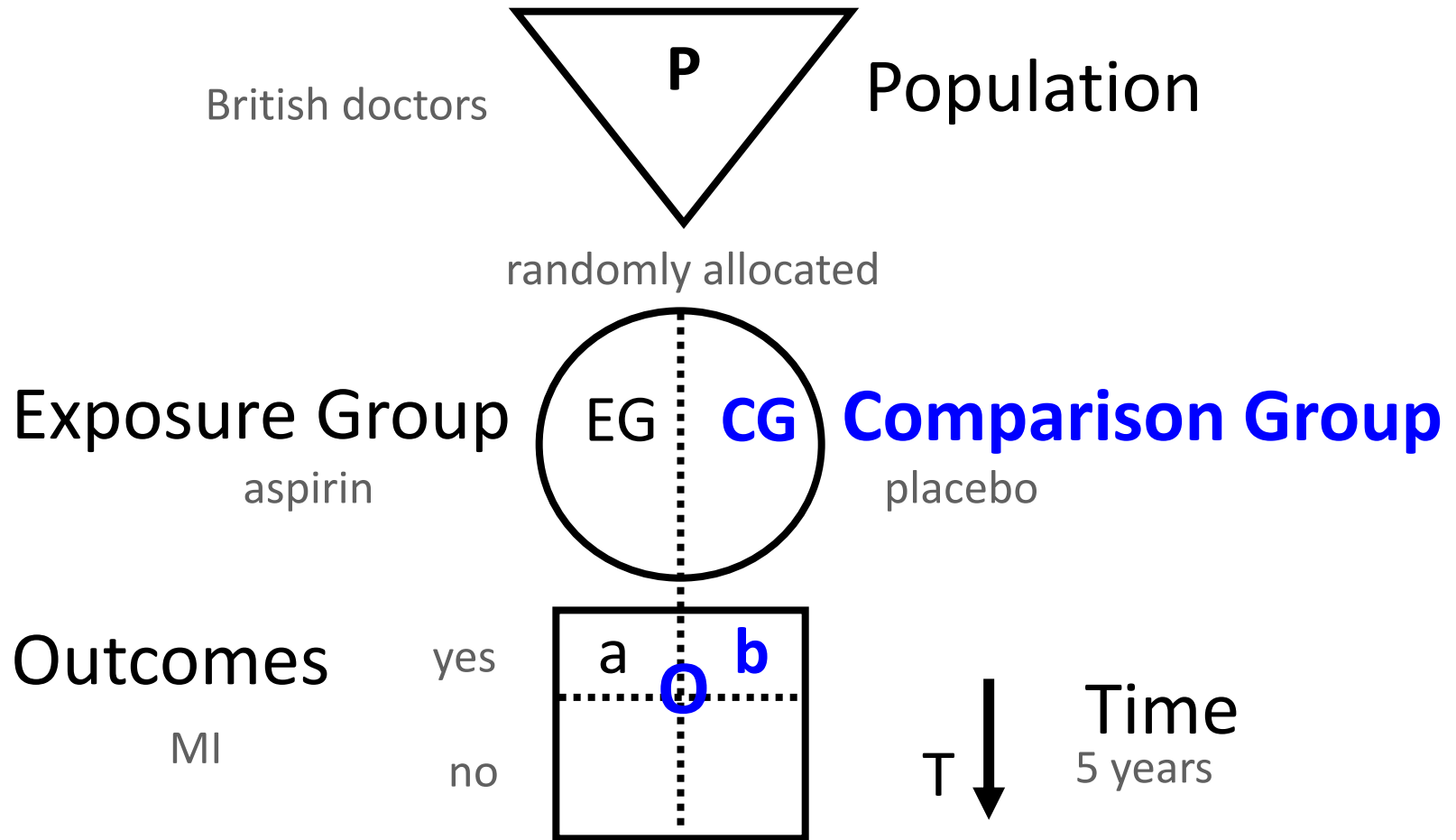
***number of outcomes ÷ number in population/group***





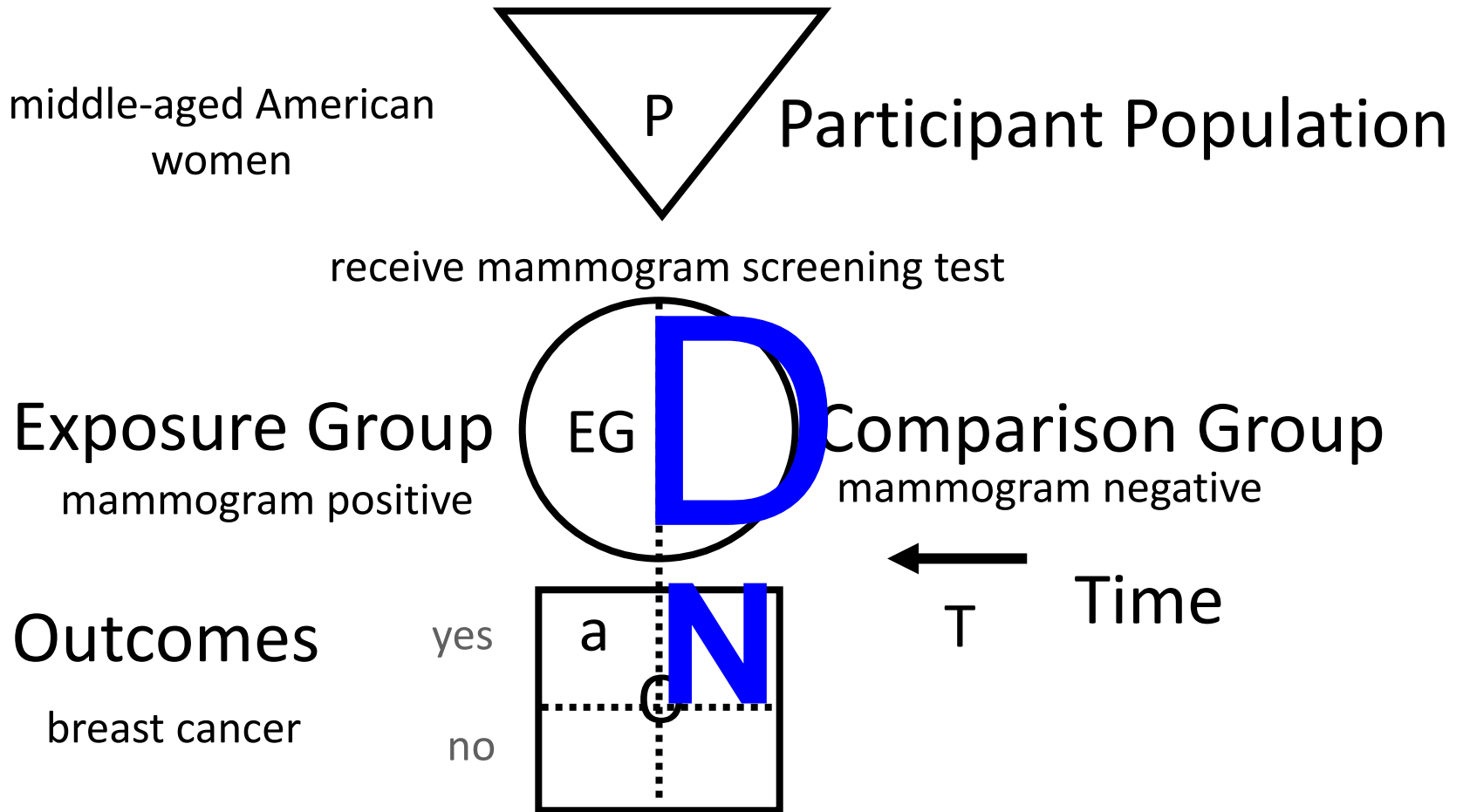
**Exposure Group Occurrence (EGO) =  $a \div EG$**   
**= number of outcomes (a)  $\div$  number in exposed population (EG)**



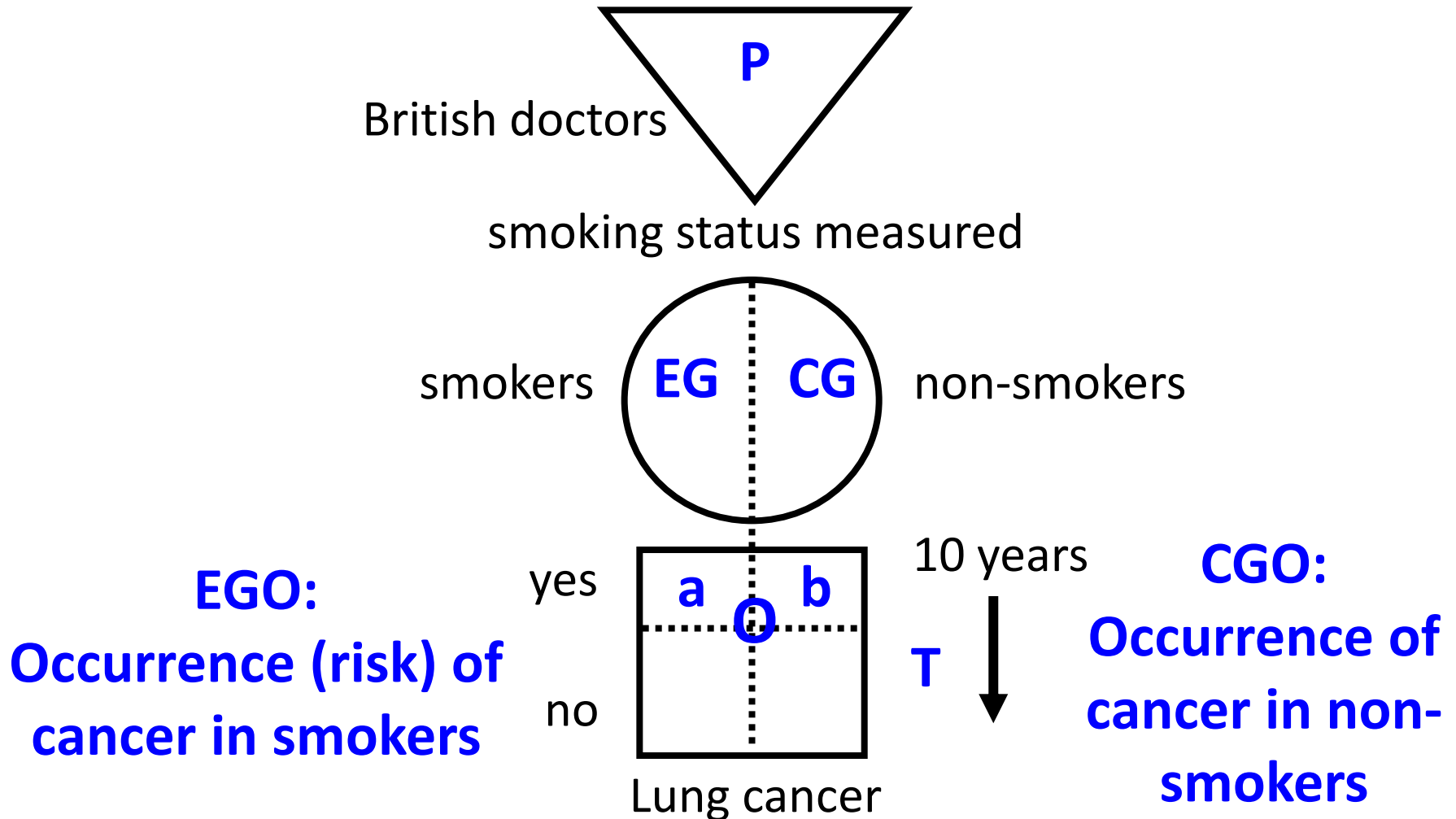


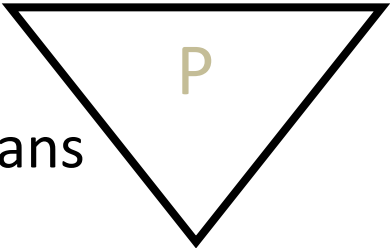
**Comparison Group Occurrence (CGO) =  $b \div CG$**   
**= number of outcomes (b)  $\div$  number in comparison population (CG)**

# *Epidemiology = Numerator ÷ Denominator*



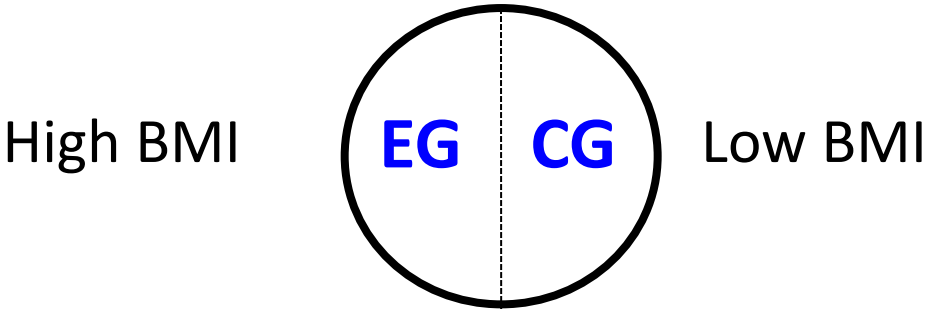
*the goal of all epidemiological studies is to calculate **EGO** and **CGO***





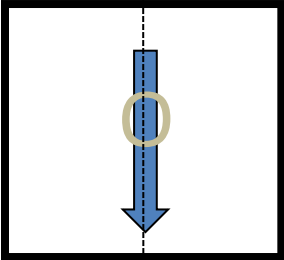
Middle-aged Americans

Body Mass Index (BMI) measured



high

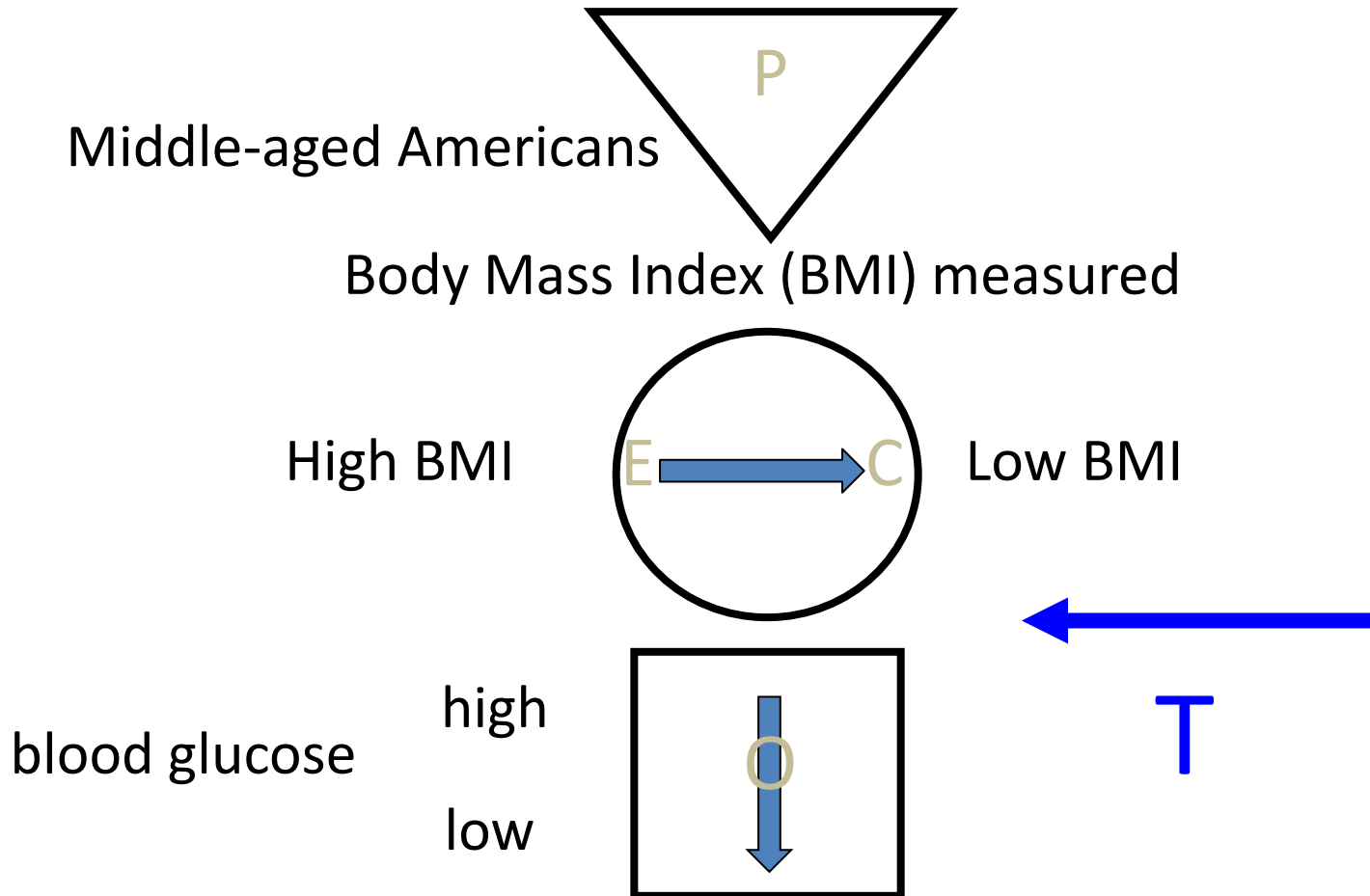
low



**EGO:**  
Average blood  
glucose in EG

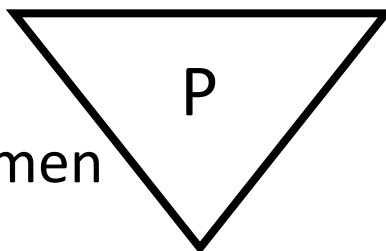
**CGO:**  
Average blood  
glucose in CG





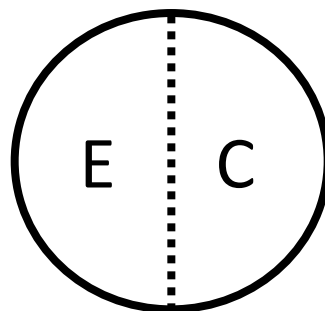
**cross-sectional study with numerical measures**

Middle-aged American women



Gold Standard

Breast cancer

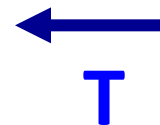
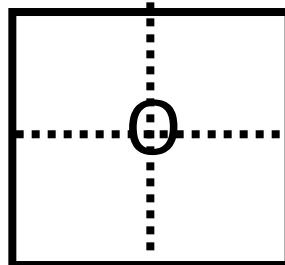


no Breast cancer

mammogram

positive

negative



**EGO:**

**likelihood of a positive  
mammogram if breast  
cancer**

**CGO:**

**likelihood of a positive  
mammogram if no  
breast cancer**

***1<sup>st</sup> formula:***

***occurrence = outcomes ÷ population***

**its all about EGO and CGO**

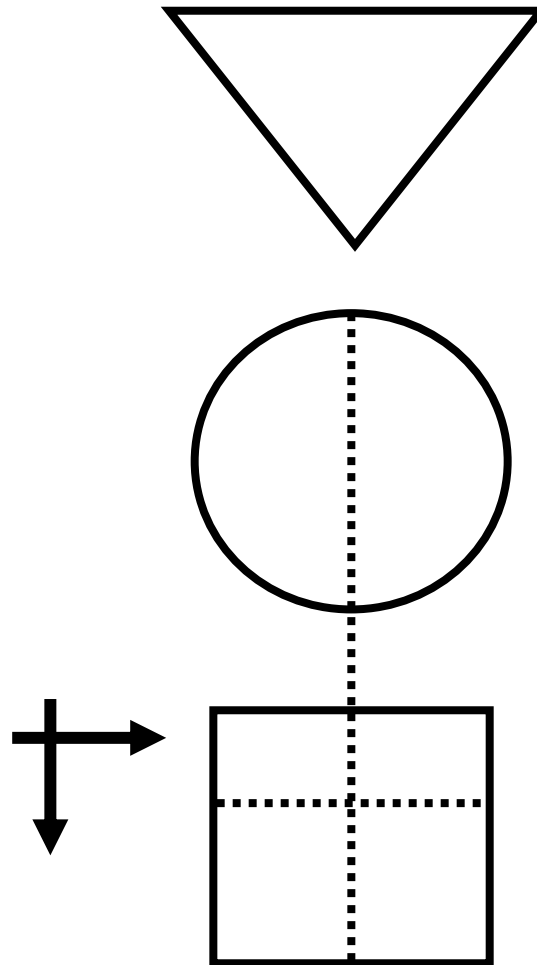
- **EGO ÷ CGO = Relative Risk (RR)**
- **EGO – CGO = Risk Difference (RD)**

**measures of occurrence:** risk; rate; likelihood; probability;  
average; incidence; prevalence

3

# GATE: framework for nonrandom error

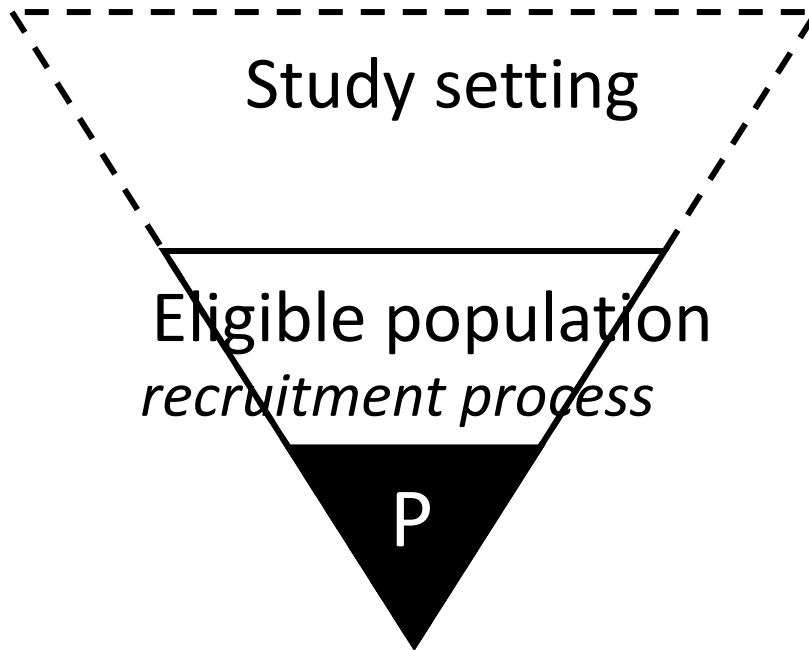
**2<sup>nd</sup> acronym: RAMBOMAN**



Measurements

ANalyses

**1 picture, 2 formulas & 3 acronyms**

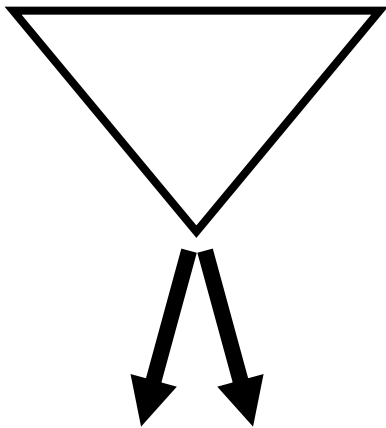


**R**AMBOMAN

**Recruitment of participants**  
*‘who are the findings applicable to?’*

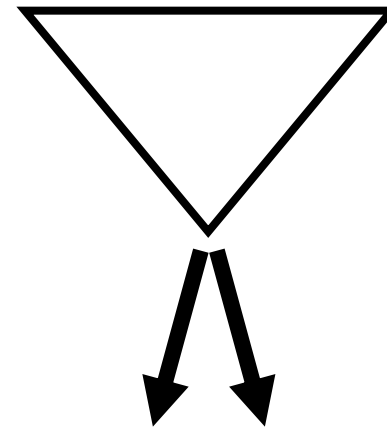


# RAMBOMAN: 'were participants well **Allocated** to exposure & comparison groups?'



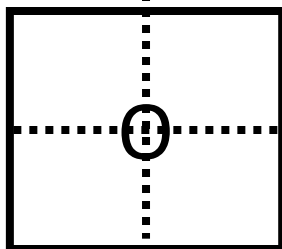
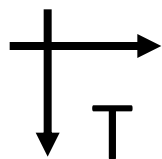
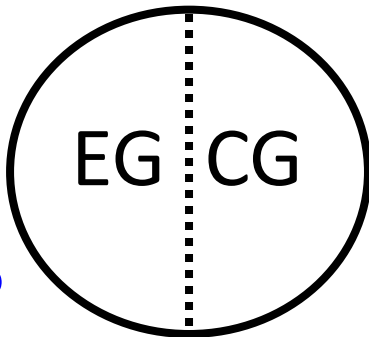
was **Allocation**  
to EG & CG  
successful?

RCT: allocated by **randomisation**  
(e.g to drugs)

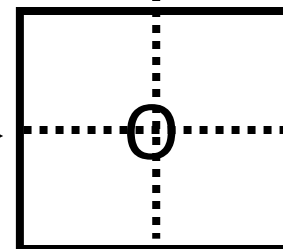
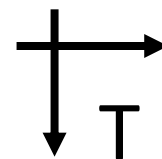
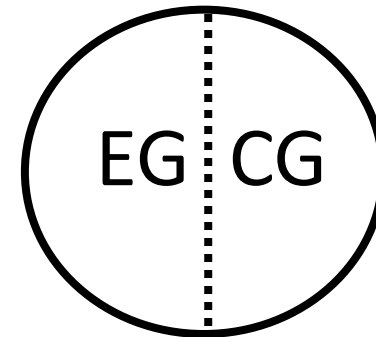


Cohort: allocated **by measurement** (e.g. smoking)

EG & CG  
similar at  
baseline?

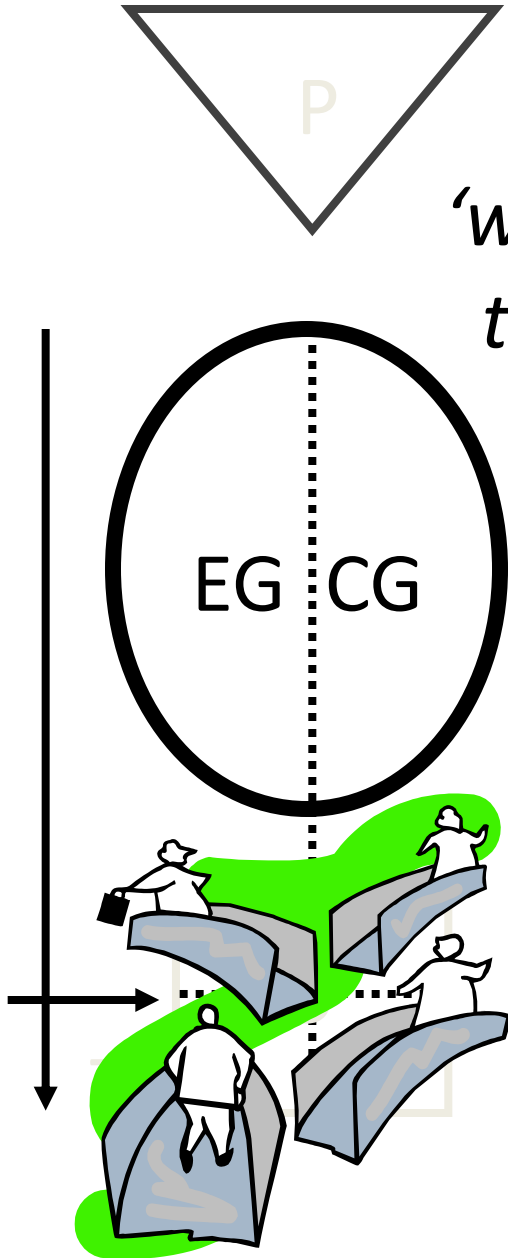


E & C  
measures  
accurate?



# RAMBOMAN

*'were Participants well **Maintained** in the groups they were allocated to?'*

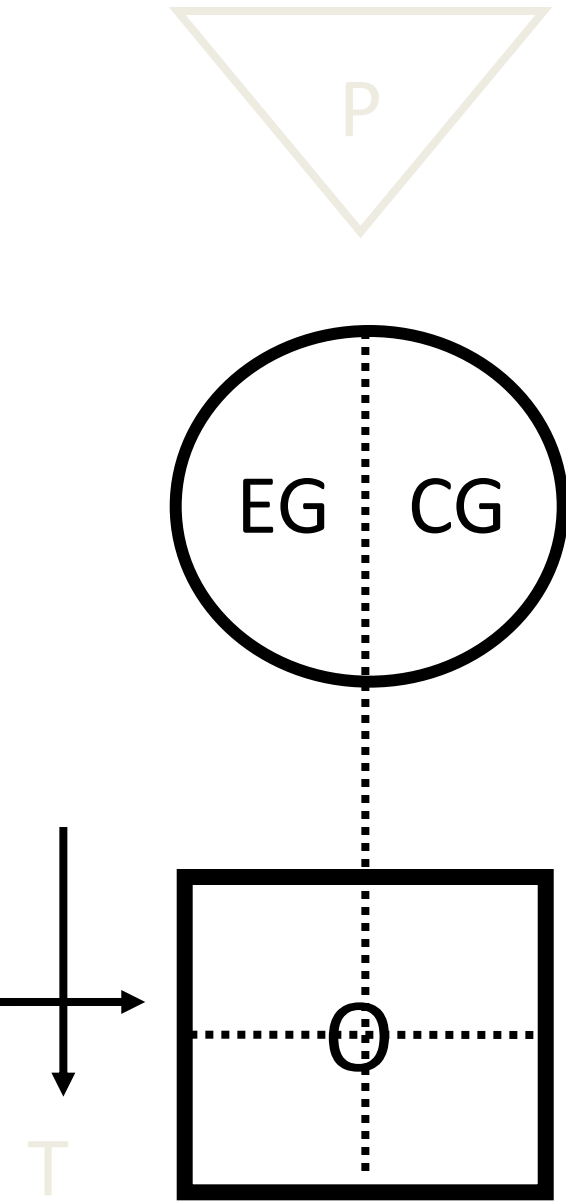


**completeness of follow-up**  
**compliance**  
**contamination**  
**co-interventions**

# RAMBOMAN

*'were outcomes well **Measured**?'*

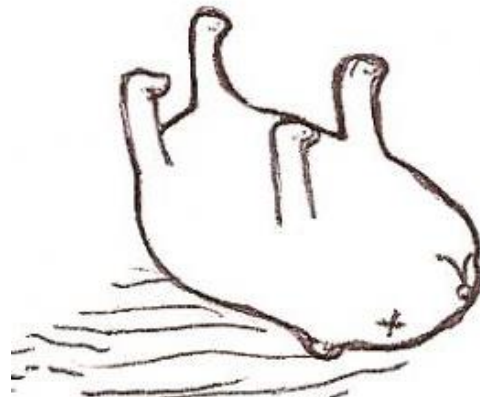
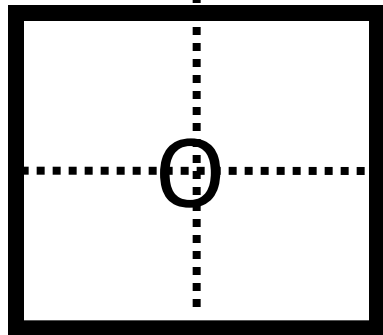
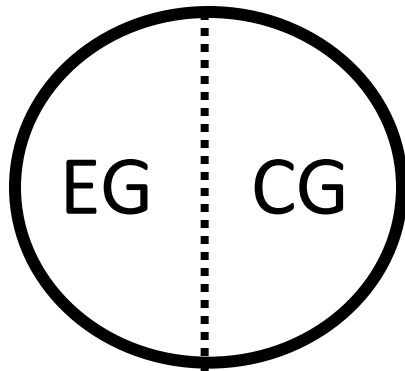
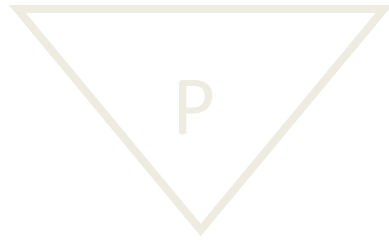
were they measured **Blind** to whether participant was in EG or CG ?



# RAMBOMAN

*'were outcomes well **Measured?**'*

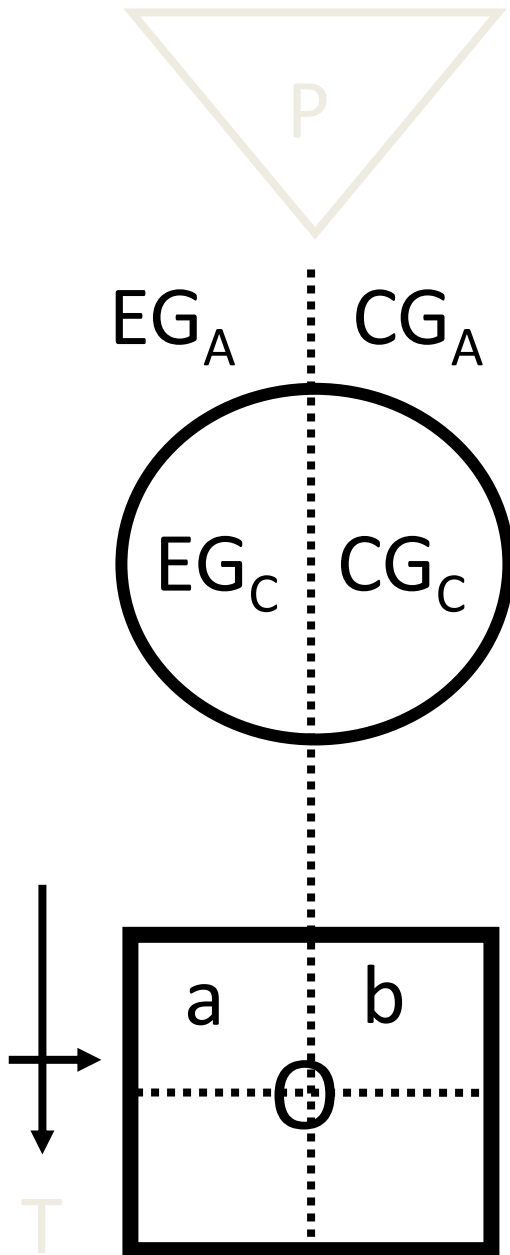
were they measured **Objectively?**



# RAMBOMAN

*'were the **ANalyses** done well?'*

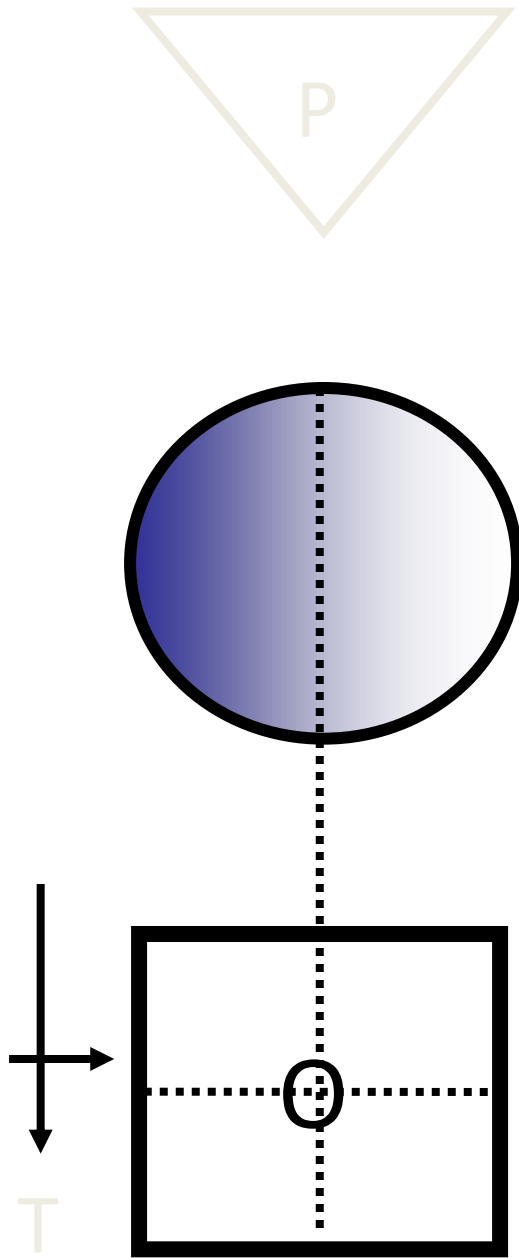
If RCT were **Intention To Treat (ITT)** analyses done?



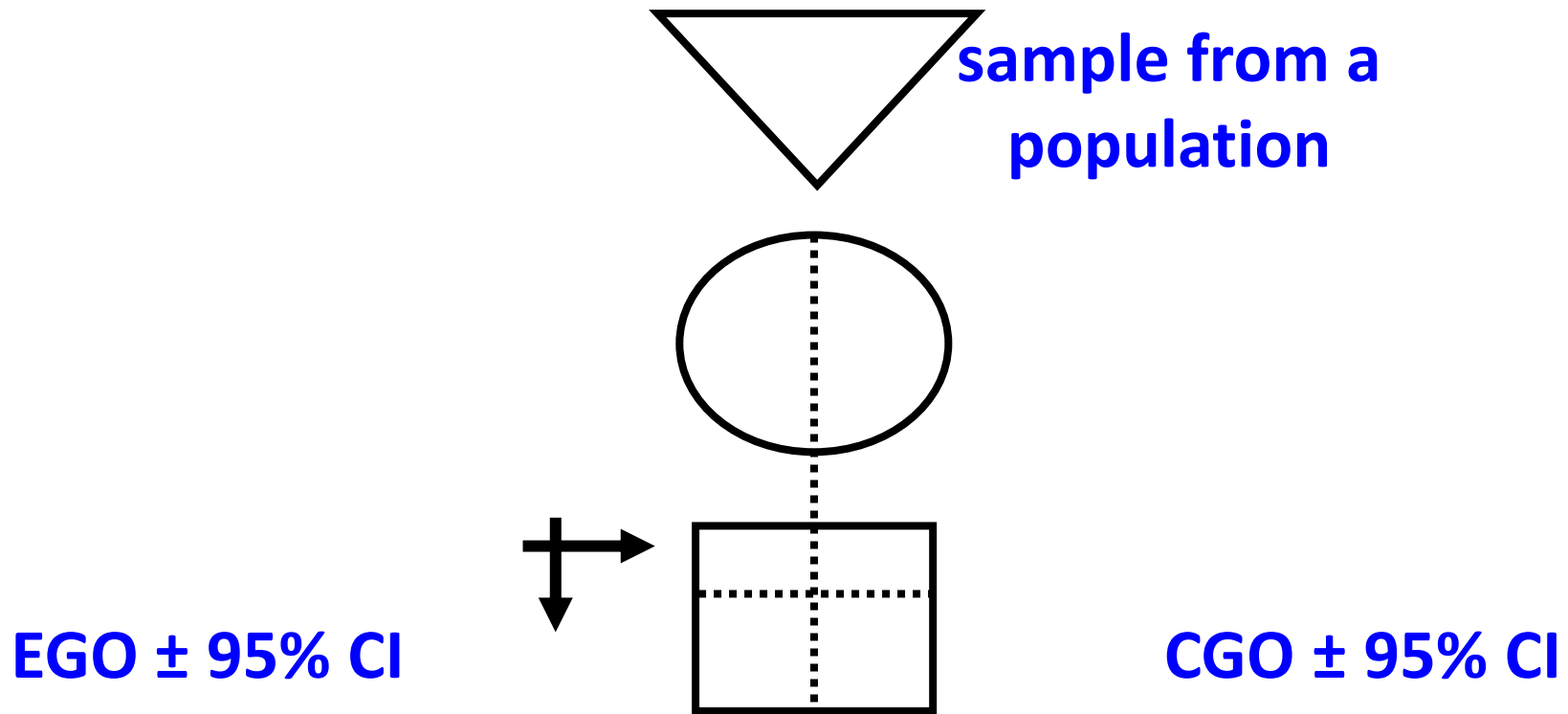
# RAMBOMAN

*'were the **ANalyses** done well?'*

**adjustment for baseline differences /  
confounding?**



GATE: random error: **2<sup>nd</sup> formula:**  
**random error = 95% confidence interval**



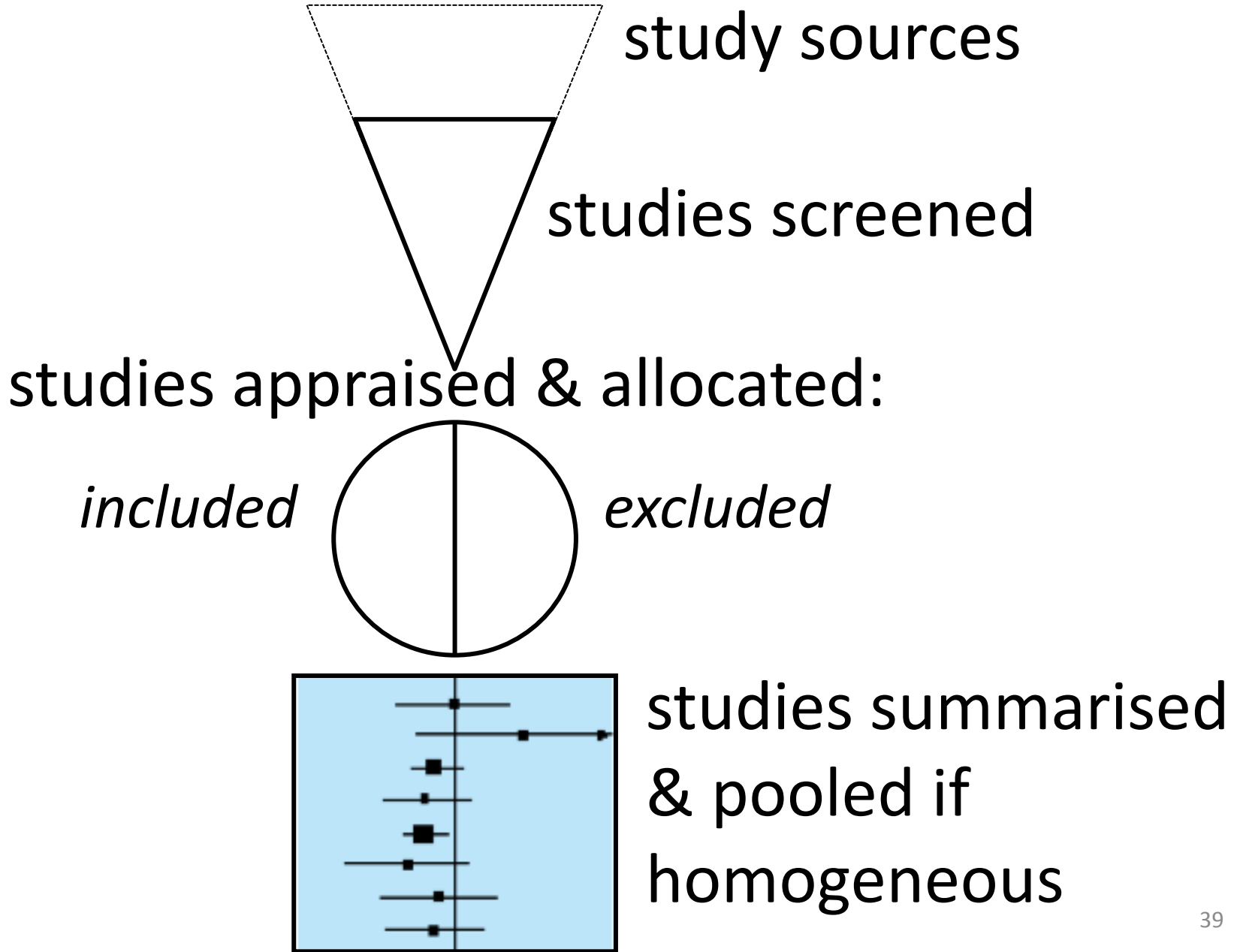
*There is about a 95% chance that the true value in the underlying population lies within the 95% CI (assuming no non-random error)*

GATE: a framework for error in  
systematic reviews & meta-analyses:

***3<sup>rd</sup> acronym: FAITH***

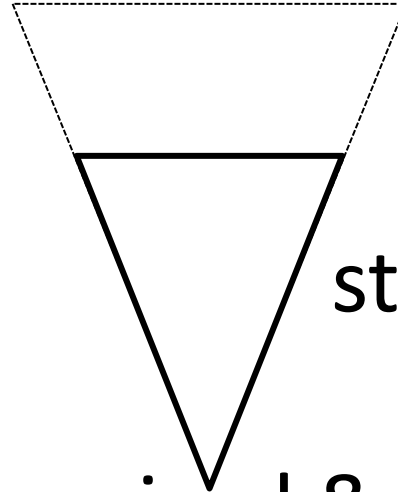


# systematic review: a study of studies



# critical appraisal of SR: **FAITH**

**Find**



study sources

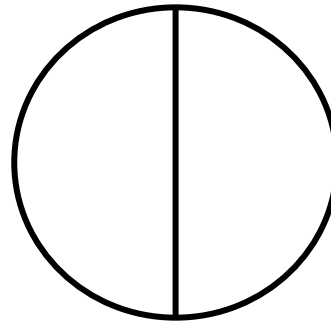
studies screened

**Appraise**

studies appraised & allocated:

**Include**

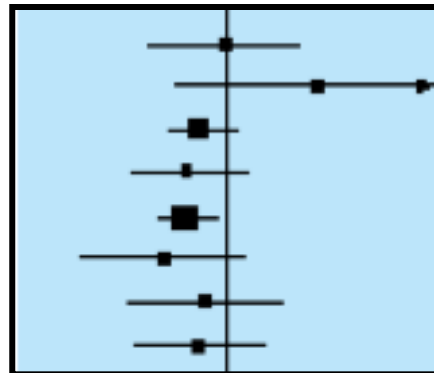
*included*



*excluded*

**Total**

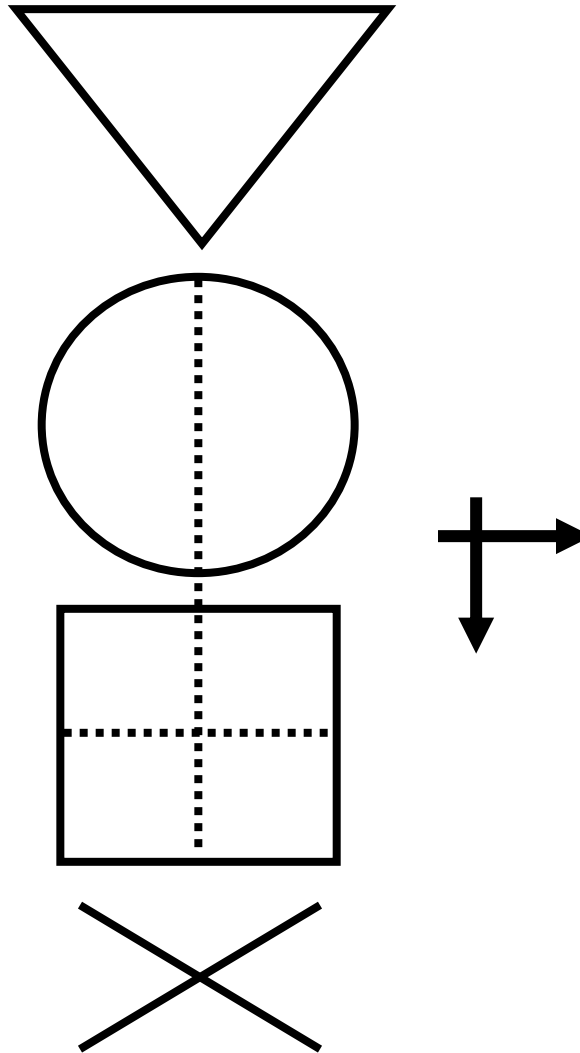
**Heterogeneity?**



studies summarised  
& pooled if  
homogeneous

4

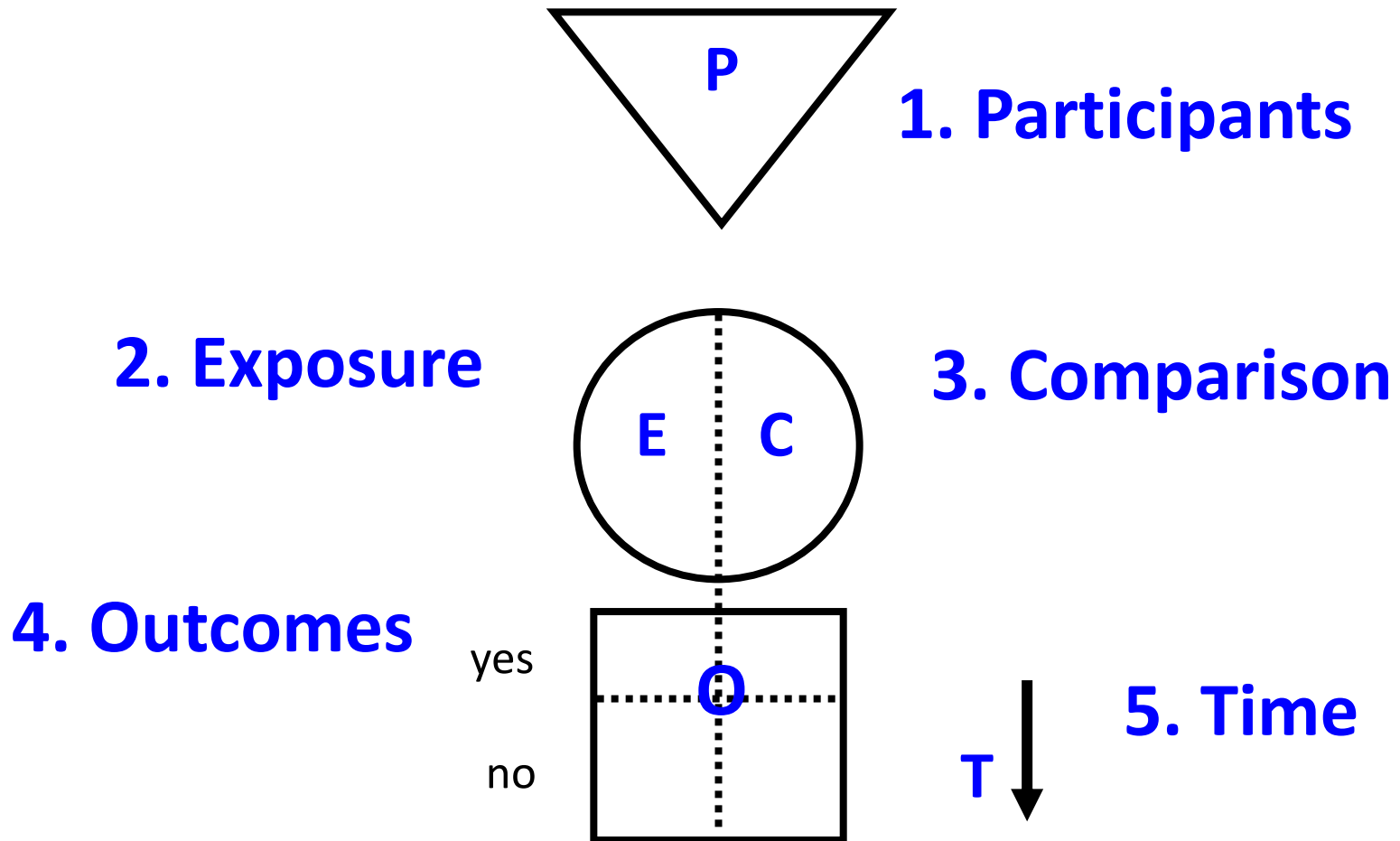
# GATE: framework for the 4 steps of EBP



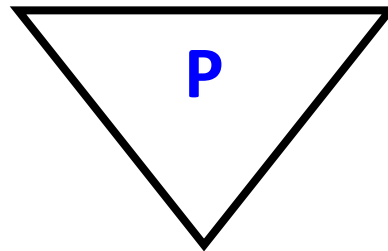
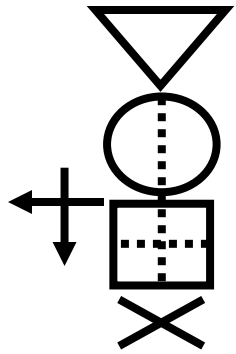
# the steps of EBP:

- 1. Ask**
- 2. Acquire**
- 3. Appraise**
- 4. Apply & Act**

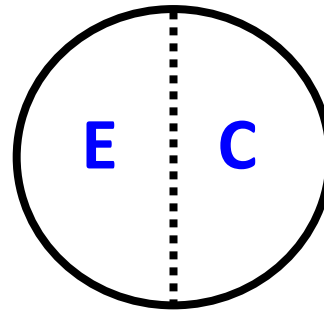
# EBP Step 1: **ASK** - turn your question into a focused 5-part PECOT question



EBP Step 2: **ACQUIRE** the evidence – use **PECOT** to help choose search terms



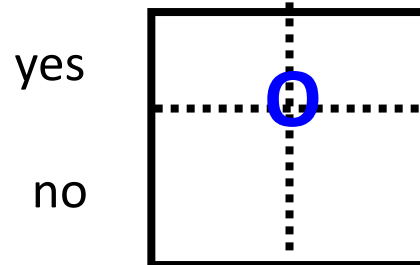
**Participants**



**Exposure**

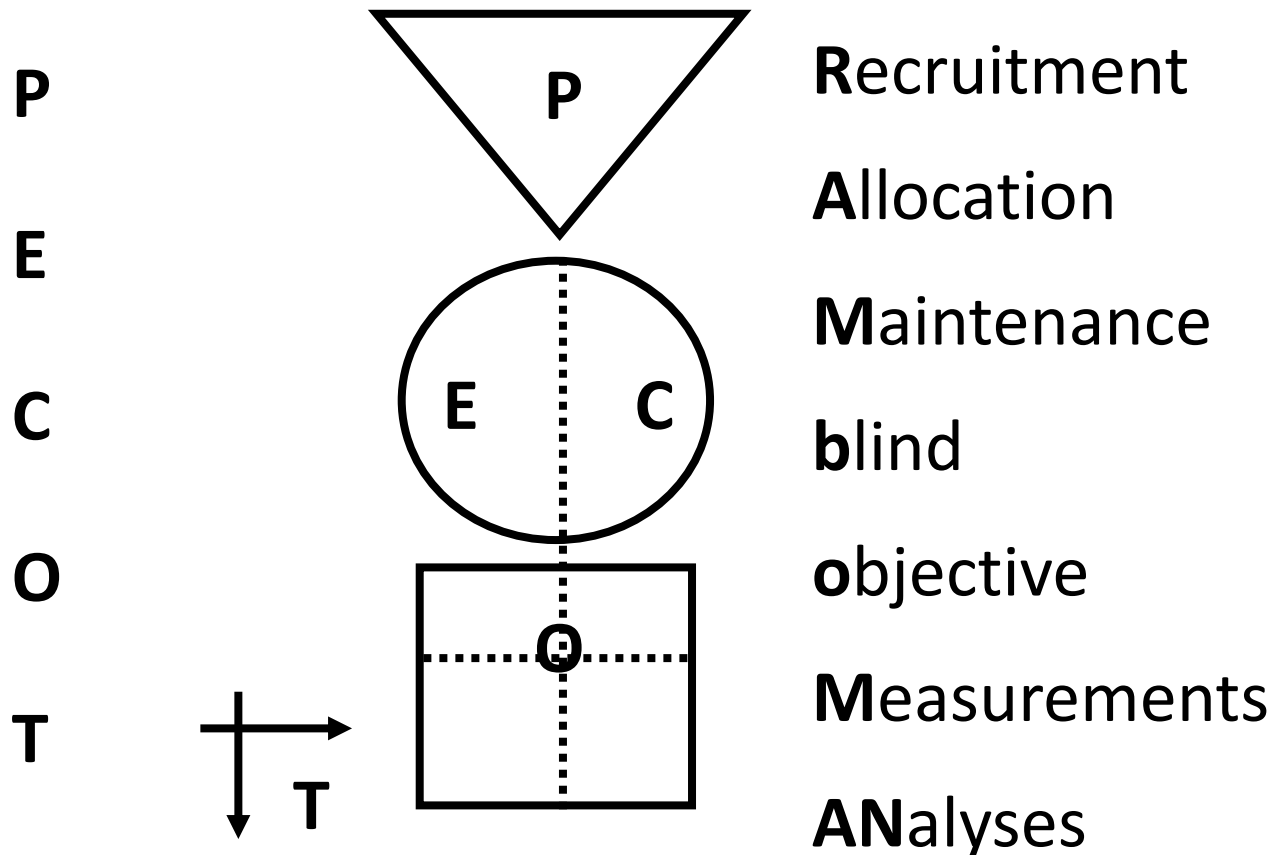
**Comparison**

**Outcomes**



**Time**

# EBP Step 3: **APPRAISE** the evidence – with the picture, acronyms & formulas

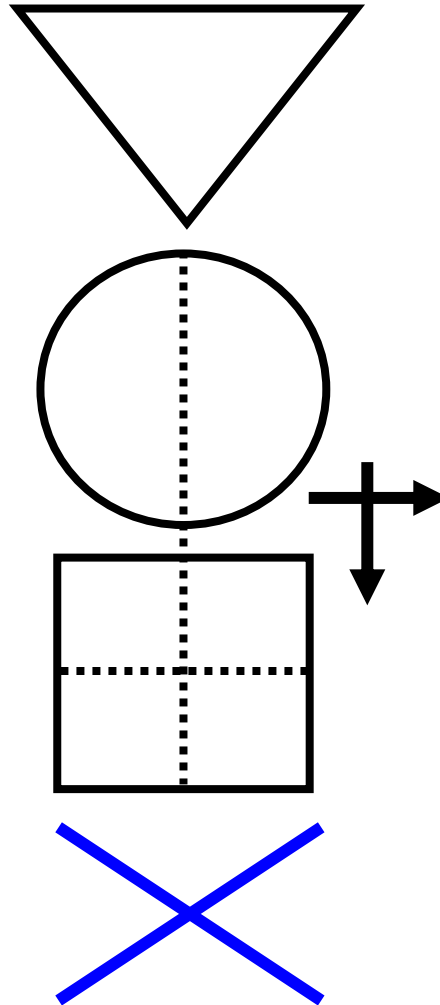


Occurrence = outcomes ÷ population

Random error = 95% Confidence Interval

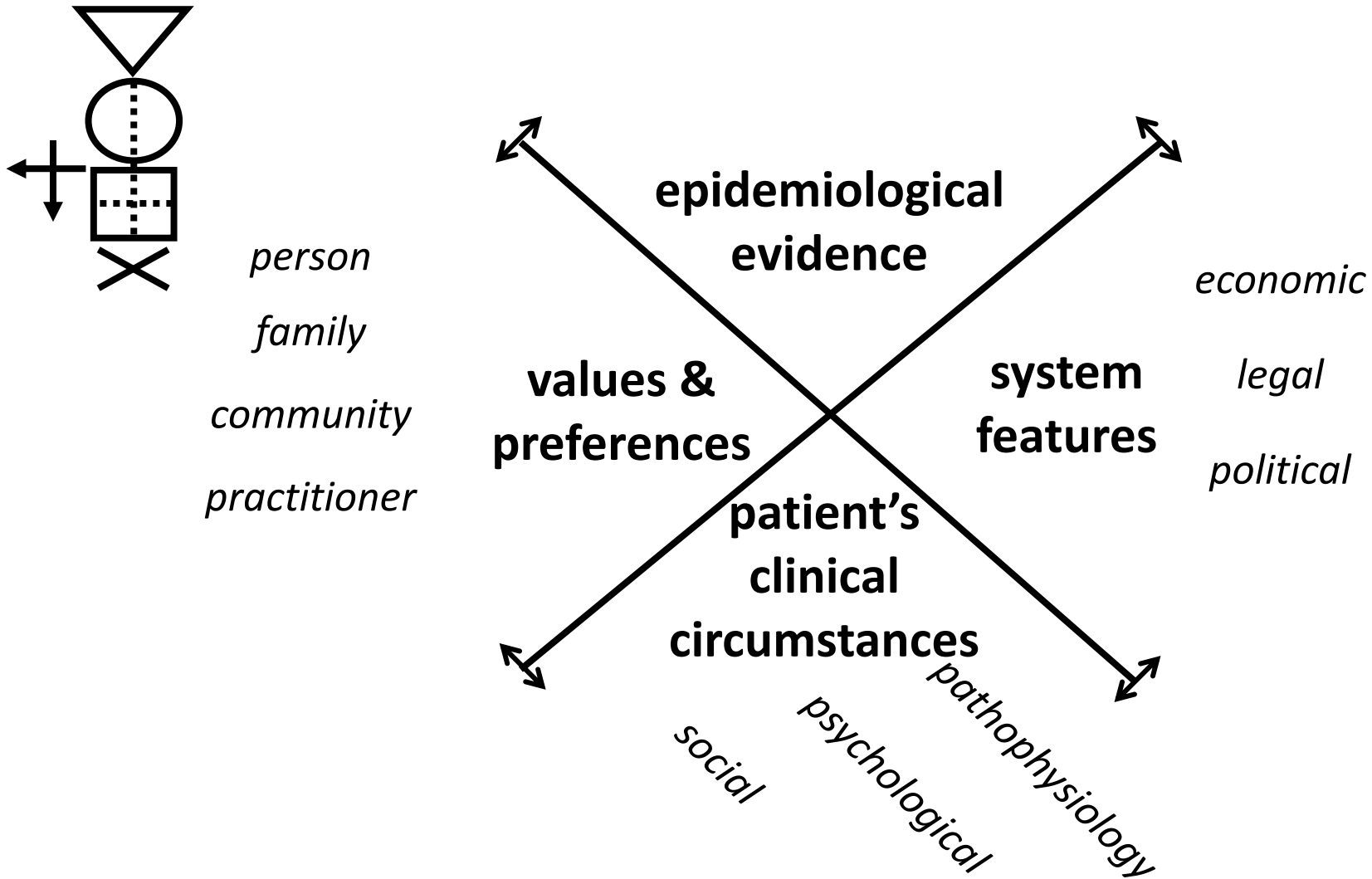


**APPLY** the evidence by AMALGAMATING the relevant information & making an evidence-based decision: **the X-factor**





# X-factor: making evidence-based decisions



GATE critically appraised topic  
(CATs) forms

find these at:  
[www.epiq.co.nz](http://www.epiq.co.nz)

# GATE CAT – 4-sheet workbook (in Excel)

## sheet 1: GATE-Ask & Acquire

GATE Ask & Access - for all study types						
Notes for use: Enter text in yellow areas, replacing current text. Help notes appear in movable boxes						
Assessed by:					Date:	
Problem						
Describe the problem that led you to seek an answer from the literature						
Step 1: Ask a focused 5-part question using PECOT framework (EITHER 'your question' OR 'the study's question') note: question doesn't need to be grammatically correct sentence; main aim is to identify key terms for search (Step 2)						
Population / patient / client		Specify the relevant patient/client/population group (be reasonably specific about: medical condition, age group, sex, etc.)				
Exposure (intervention/ target disorder/risk or prognostic factor)		Specify: the intervention(s) you want to find out about for <b>RCTs</b> & other intervention studies; OR the Target disease/condition to be diagnosed for <b>diagnostic test accuracy studies</b> ; OR the risk/intervention factor for <b>case-control studies</b> ; OR the risk/prognostic factor for <b>cohort studies</b> . Be reasonably specific				
Comparison (Control)		Specify the alternative intervention (e.g. nothing or usual care); the typical health status of those without the target disease/condition (e.g. disease free or other comorbidities) for <b>diagnostic test accuracy studies</b> ; the comparison factor you want to compare it with for <b>case-control studies</b> and <b>cohort studies</b> ? Be reasonably specific				
Outcomes		Specify: the relevant health/disease-related outcomes you would like to prevent/reduce for <b>RCTs</b> ; the relevant test for <b>diagnostic test accuracy studies</b> ; the relevant health/disease related outcome/s for <b>case-control studies</b> and <b>cohort studies</b>				
Time		if appropriate, specify a relevant time period over which outcomes likely to occur				
Step 2: Access (Search) for the best evidence using the PECOT framework						
PECOT item	Primary Search term		Synonym 1		Synonym 2	
Population / Participants / patients / clients	Enter key search terms Use MESH terms (from PubMed) if available, then text words.	OR	Include relevant synonym	OR	Include relevant synonym	AND
Exposure (Interventions)	As above	OR	As above	OR	As above	AND
Comparison (Control)	As above	OR	As above	OR	As above	AND
Outcomes	As above	OR	As above	OR	As above	AND
Time	Entry generally not required for search					
Limits & Filters:						
PubMed has <b>Limits</b> (e.g. age, English language, years) & PubMed Clinical Queries has <b>Filters</b> (e.g. study type) to help focus your search. List if used.						
Databases searched:						
List data bases searched						
Evidence Selected						
Enter full citation of publication you have selected/or been given to evaluate						
Justification for selection						
State main objectives of the study.						
Explain why you chose this publication for evaluation.						
Please contribute your comments and suggestions on this form to: <a href="mailto:t.jackson@euc.ox.ac.uk">t.jackson@euc.ox.ac.uk</a>						

# GATE CAT – 3-sheet workbook (in Excel)

## sheet 2: GATE-Appraise (with calculator)

GATE Appraise - Intervention Studies RCT/Cohort & Risk/Cross-sectional Studies								
Notes for use: Enter study numbers in yellow areas. Help notes appear in movable boxes. Enter study descriptions in orange areas. The form calculates results and displays them in the green areas. Use the overflow tab to provide more detail if allocated space is insufficient.								
Assessed by:		Assessed when:		Publication details:				
STUDY DESIGN (PECOT)		STUDY NUMBERS - hang on GATE frame		STUDY ERRORS (RAMBOMAN)				
Population	Study type:	Study Setting		Recruitment: able to define who findings applicable to?				
	Describe Setting:	Eligible population		Setting & eligible population appropriate?				
	Describe Eligibility:	Participant population		Participants similar to all Eligibles?				
	Describe Recruitment:			Risk/prognostic profiles sufficiently described to determine who findings applicable to?				
Exposure & Comparison	% eligibles participated:							
	Describe Exposure / Intervention	(EG) EG allocated	(CG) CG allocated	Allocation to EG & CG allocated randomly or by done well?				
	Describe Comparison / Control	dropped pre-intervention (RCT only) completed follow-up prior intervention drop-outs / lost during post-intervention Percentage lost to follow-up		if randomised, done well? concealed? EG & CG similar at baseline? if allocated by measurement: done well? done before outcomes? differences between EG & CG documented?				
				Maintenance in allocated groups & on allocated interventions/exposures during study sufficient? Completeness of follow-up high & similar in EG & CG?				
Outcomes & Time	Describe Outcomes & Time:	Categorical outcomes		Compliance high enough? Contamination low enough? Co-interventions similar enough in EG & CG? Participants/Investigators blind to EG/CG status?				
		Numerical outcomes		Blind & Objective Outcome measures? Outcomes measured accurately enough? Follow-up time similar in EG & CG and sufficient to be meaningful?				
Report results per (e.g. per 100): .../1000 persons								
Calculated Results (unadjusted) as % confidence intervals								
Classified in GATE type	Outcome	Occurrence per 1000 persons	in exposure group (EG)	in comparison group (CG)	Relative effect (EG/CG)	Absolute effect (EG-CG)	Z-score: 1.96	Number needed to treat (NNT) to prevent/cure 1 event
	Categorical outcome							
	Intention to treat analysis							
	95% CIs							
Categorical outcome								
OR-treatment								
95% CIs								
Numerical outcome								
Analysis of mean								
95% CIs								
Reported Results								
Analysis								
intention to treat if RCT?		Adjusted if EG & CG different?		95% CIs or p-values given?				
Summary								
1. Study design (AMBOM): non-random error/bias sufficiently low for study to be valid? - consider amount & direction of bias.								
2. Study analyses (AN): analytical error sufficiently low for results to be valid? - were ITT analyses done? were adjusted analyses done if EG & CG different at baseline?								
3. Study numbers: random error sufficiently low (95% CI narrow) for results to be meaningful? if no statistically significant effects, was study power/sample size sufficiently high?								
4. Study effect size: RD +/- or RR sufficiently large to be real and meaningful?								
5. Applicability (R): if 1-4 ok, are findings likely to be applicable in practice?								

# GATE CAT – 3-sheet workbook (in Excel)

## sheet 3: GATE-Apply

GATE Apply - for all study types	
Notes for use: Enter text in yellow areas	
Assessed by:	Date:
<b>Step 4: Apply. Consider/weigh up all factors &amp; make (shared) decision(s) to act</b>	
<p><b>The X-Factor</b></p>	
<p><b>Epidemiological evidence:</b> are the results of this study consistent with other epidemiological evidence relevant to the decision(s) (e.g. ideally from systematic reviews)?</p>	<p>What <b>Case circumstances</b> (e.g. disease process/ co-morbidities /social situation) specifically related to the problem may impact on the decision(s)?</p>
<p><b>System features:</b> are there any system constraints or enablers that may impact on the decision(s)?</p>	<p>What <b>Values &amp; Preferences</b> may need to be considered in making the decision(s)?</p>
<p><b>Decision(s):</b> taking into account all the factors above what is the best decision(s) for this problem?</p>	
<b>Step 5: What are the implications of this decision(s) for practice?</b>	
<p>What are the wider considerations of this decision(s) for usual practice? Should it change usual practice in any way?</p>	
Please contribute your comments and suggestions on this form to: <a href="mailto:t.jackson@stard.ac.nz">t.jackson@stard.ac.nz</a>	









Wahana  
Kediri

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Kediri

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Kediri

HAPPY 50<sup>th</sup> RGD



GATE - Way to the future!