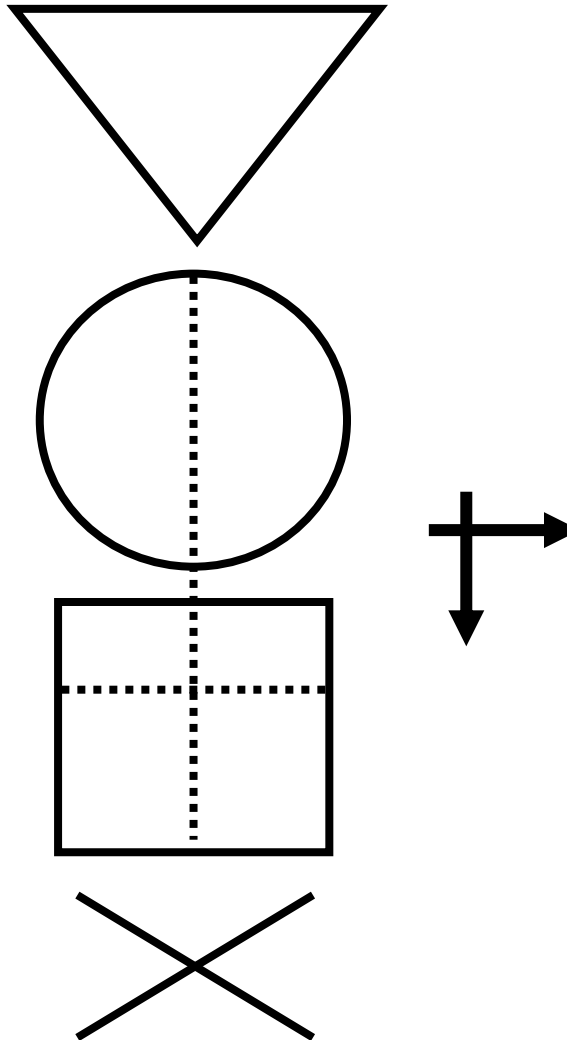


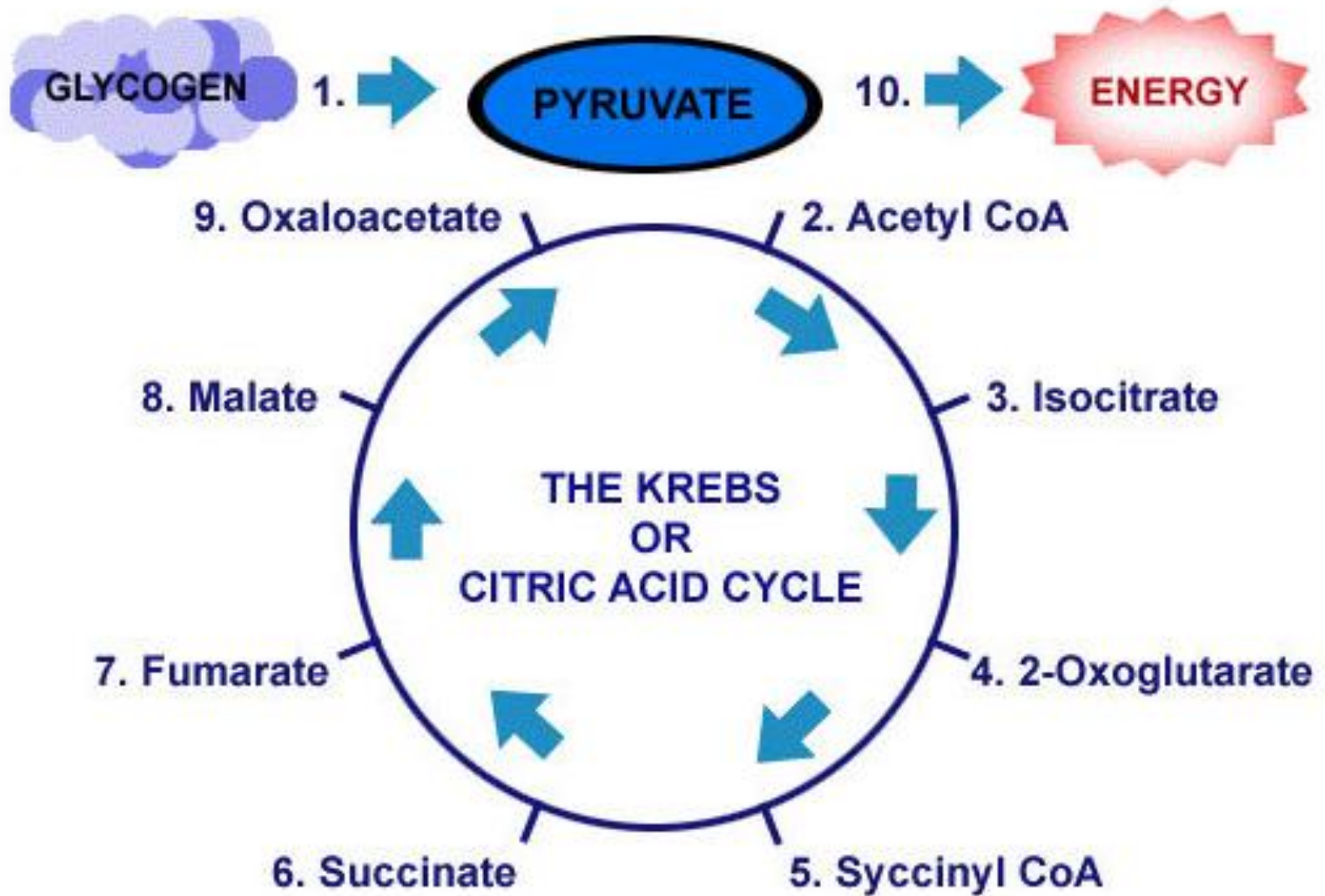
GATE: Graphic Approach To Epidemiology



1 picture, 2 formulas & 3 acronyms

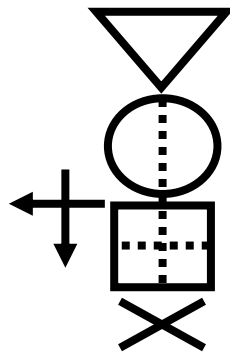


The Krebs Cycle



The GATE frame:

- *Graphic Appraisal Tool for Epidemiological studies* – a framework for appraising studies
- *Graphic Architectural Tool for Epidemiological studies* – a framework for designing studies

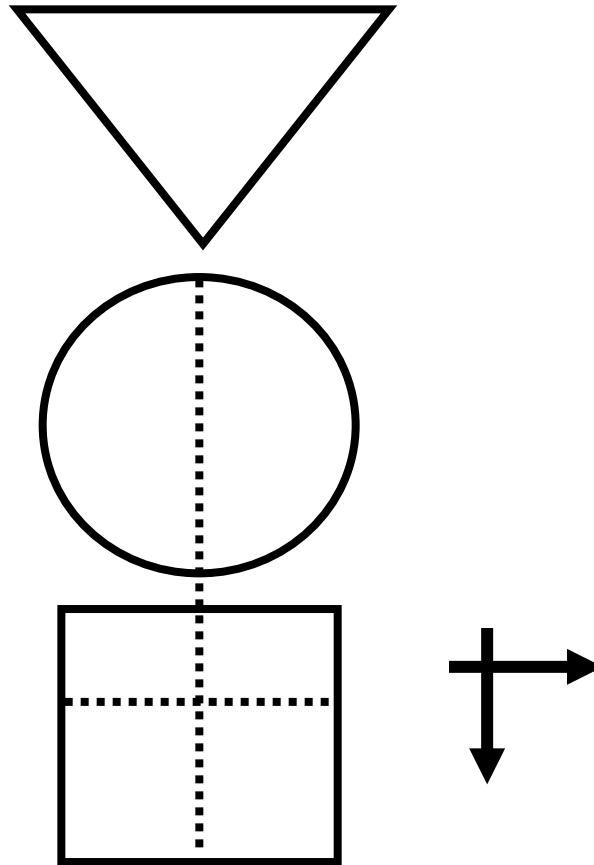


Presentation outline

1. a framework for study design
2. a framework for study analysis
3. a framework for study error
4. a framework for practicing EBP

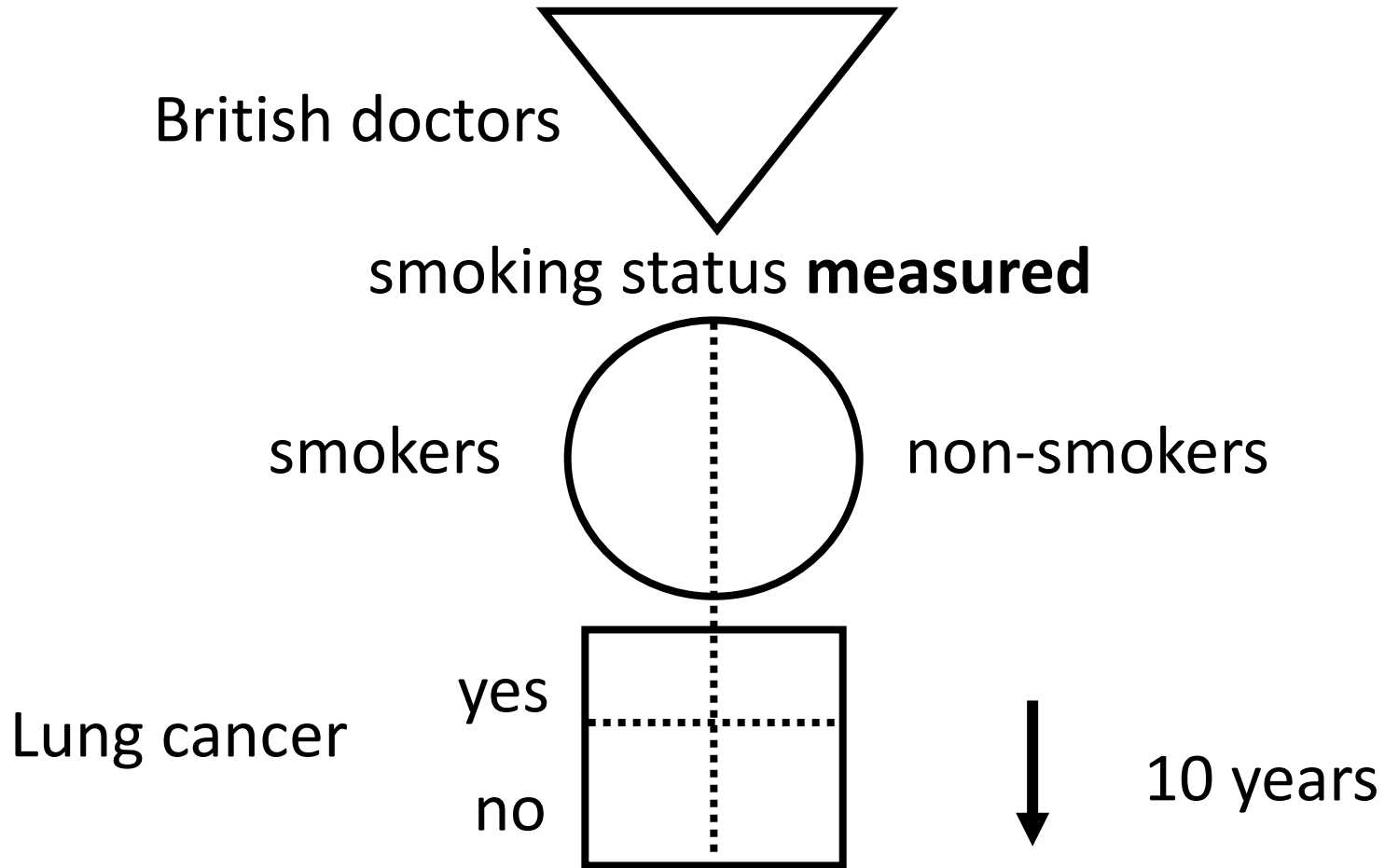
1 picture, 2 formulas & 3 acronyms

1. GATE: design of epidemiological studies:
the picture & 1st acronym: PECOT



every epidemiological study can be hung on the GATE frame₆

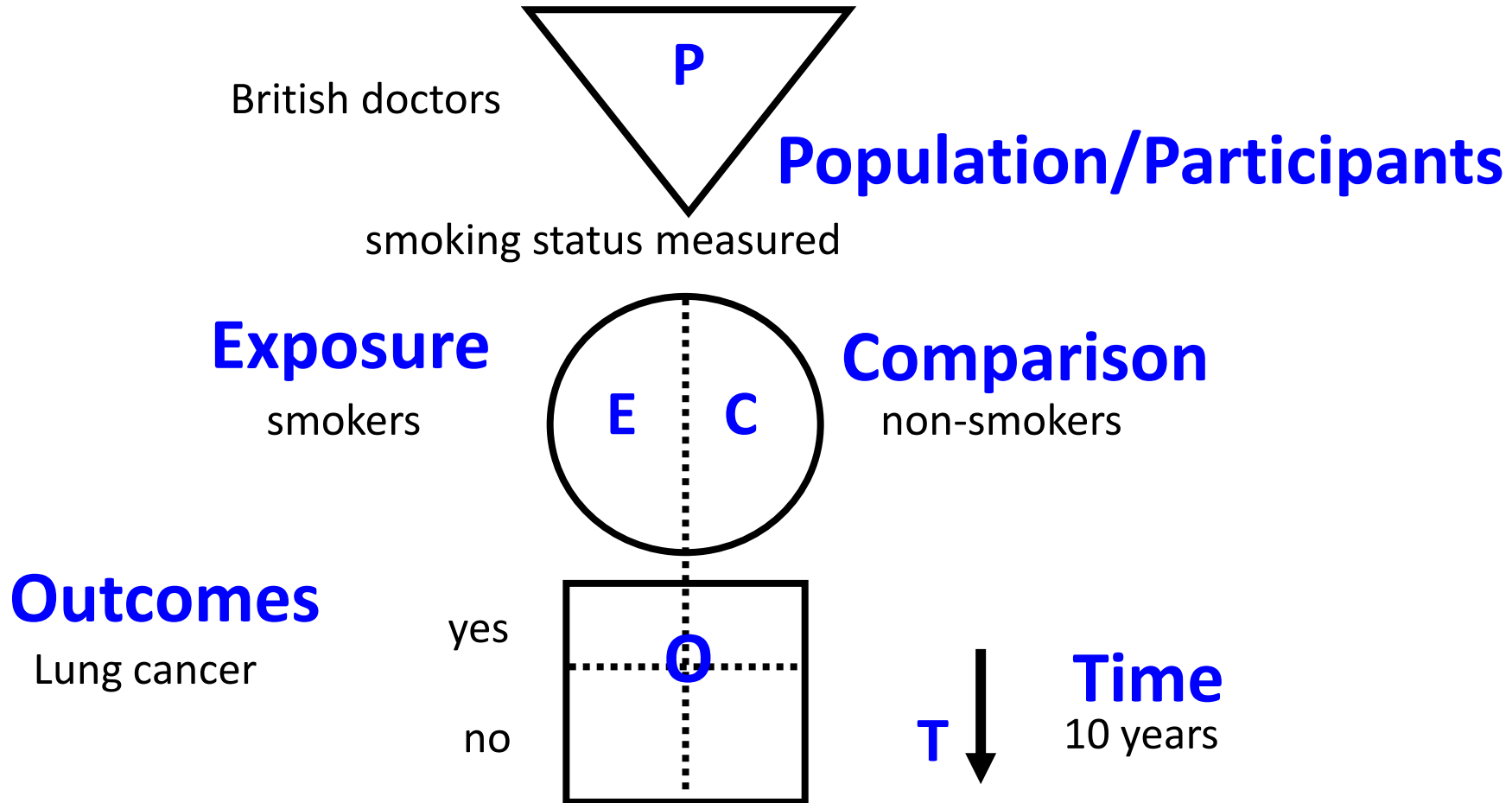
GATE Frame *picture*



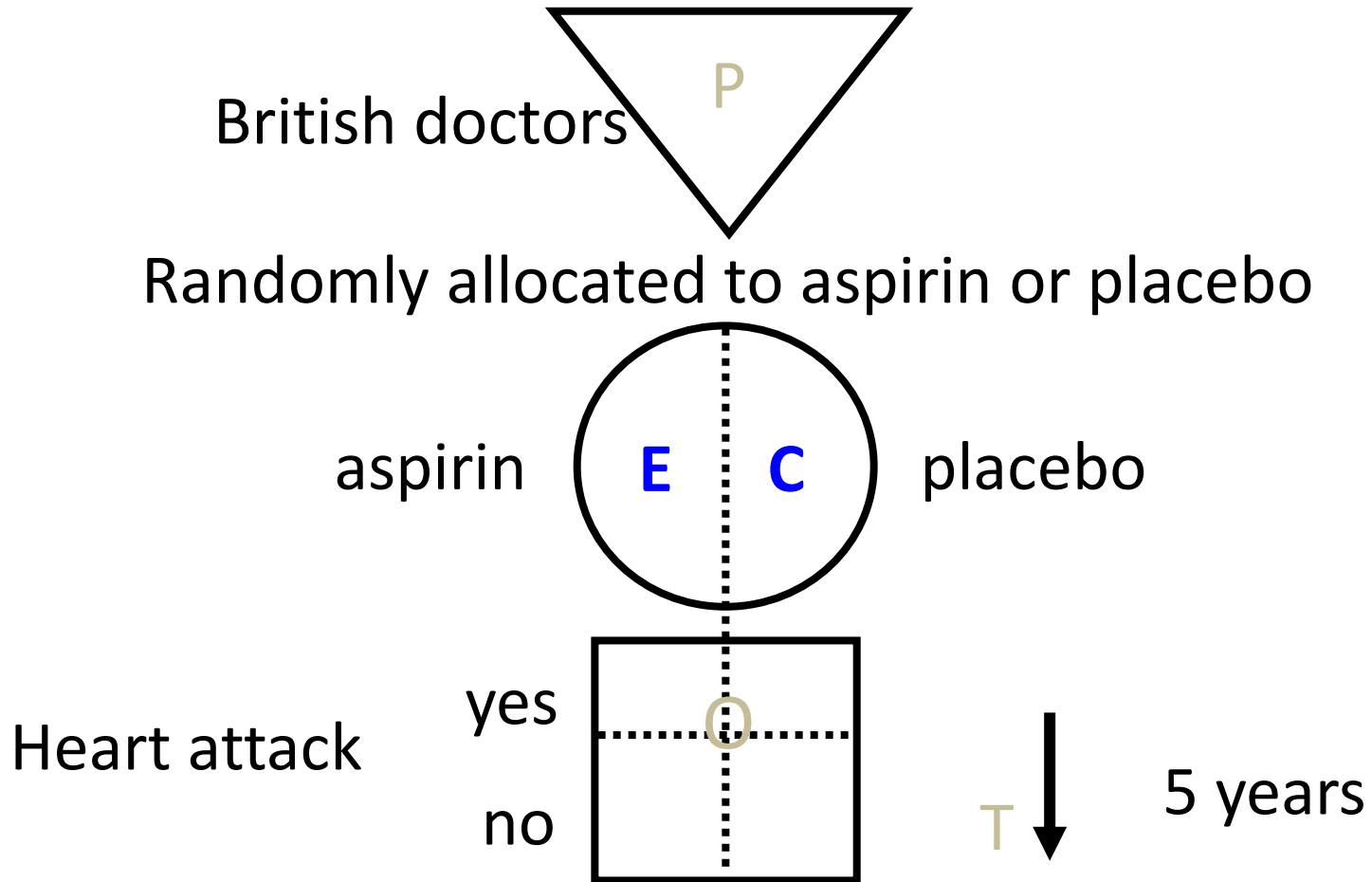
Longitudinal (cohort) study

Observational studies: allocated by measurement

1st acronym: PECOT



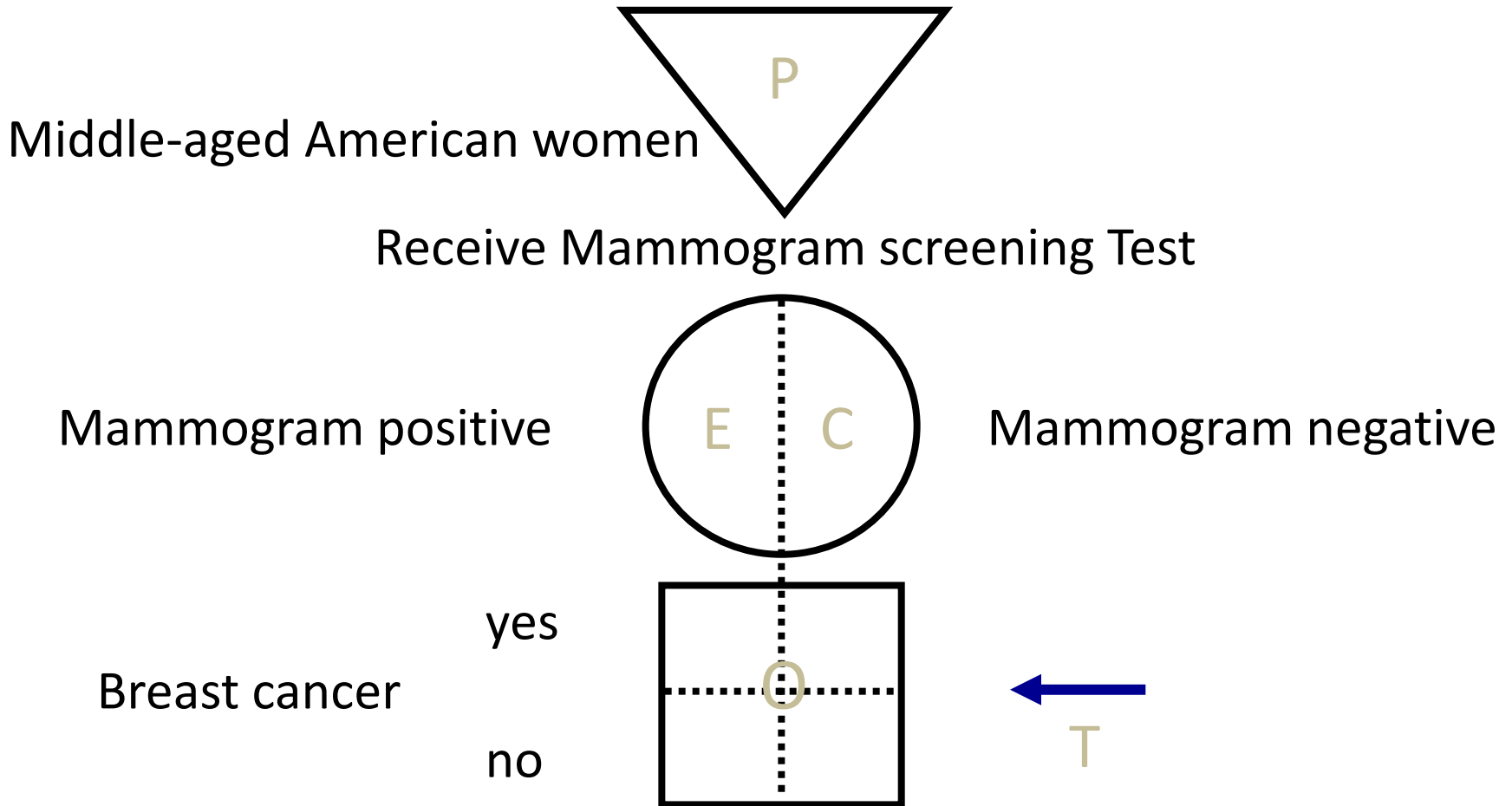
GATE Frame *picture & 1st acronym*



Randomised Controlled Trial

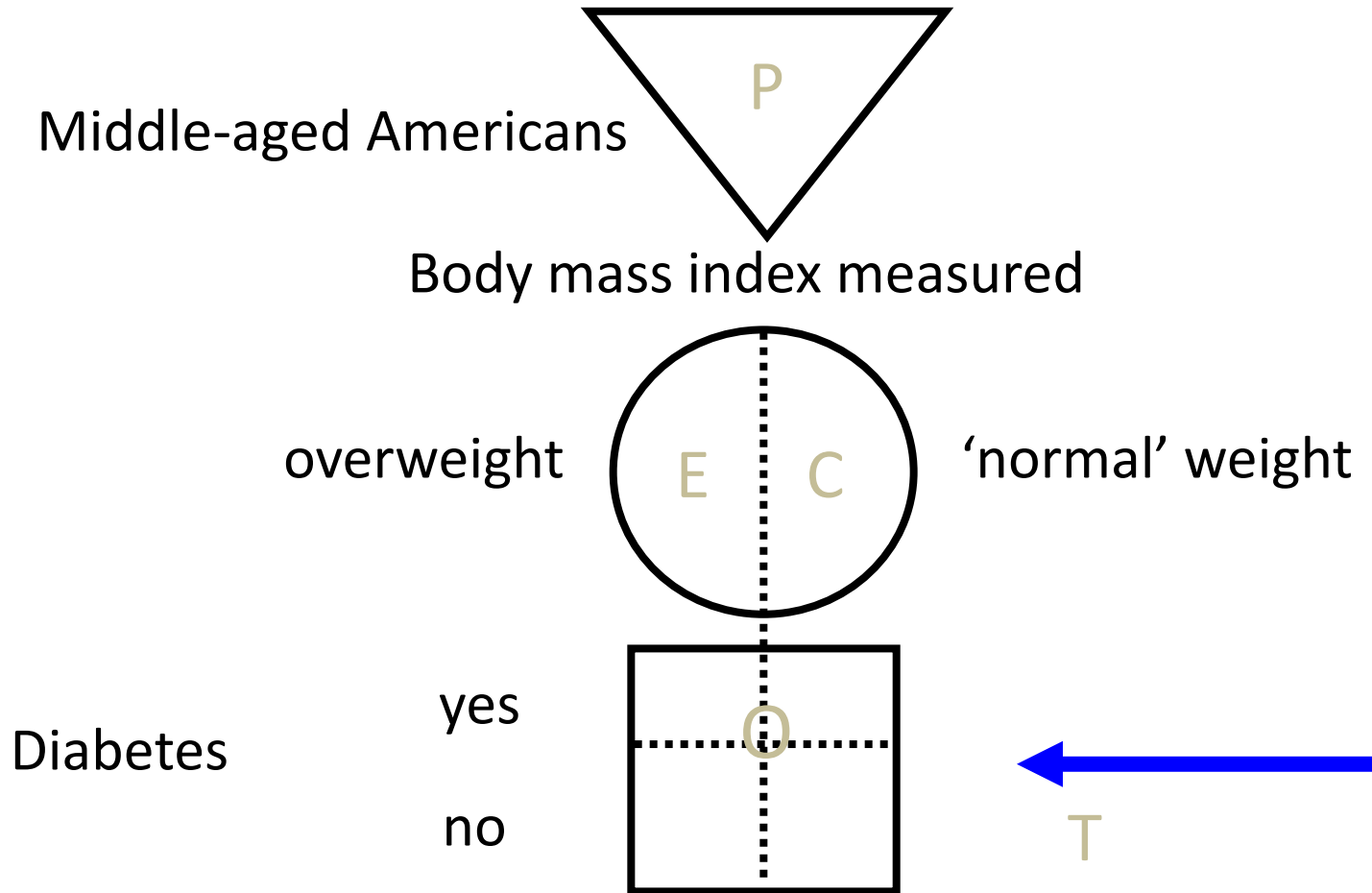
RCT: allocated to E & C by randomisation process

GATE Frame *picture & 1st acronym*



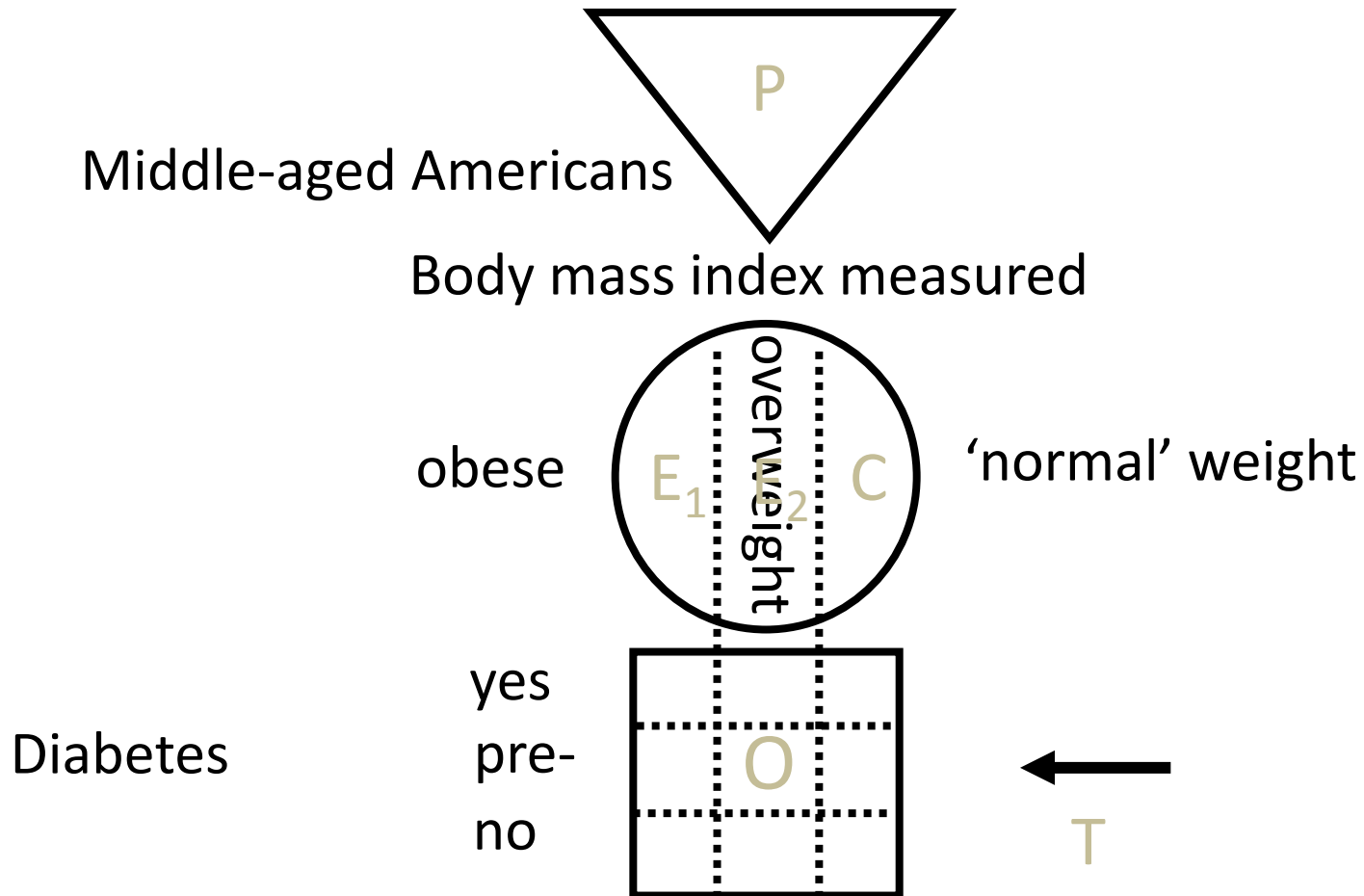
Diagnostic (prediction) study

GATE Frame *picture & 1st acronym*



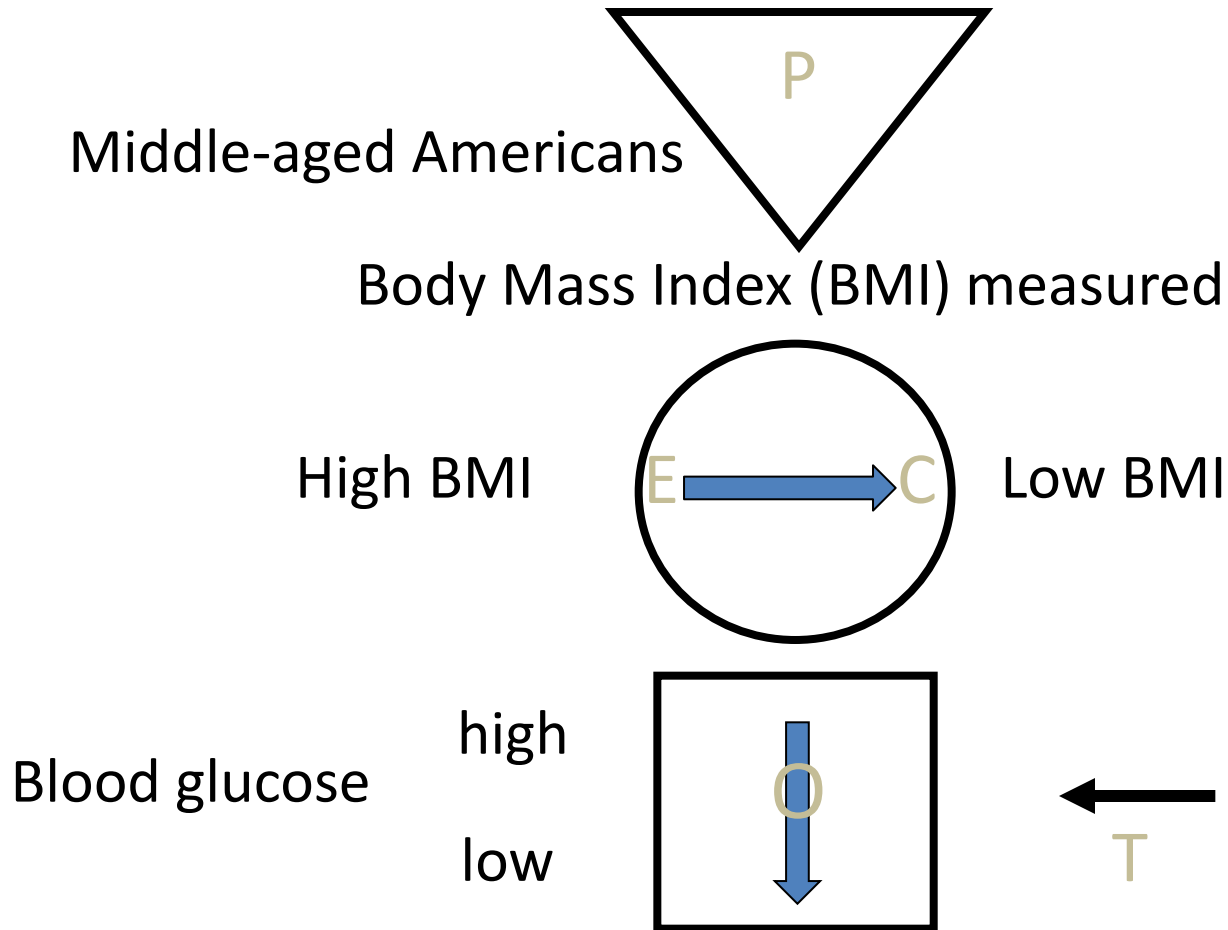
Cross-sectional (prevalence) study

GATE Frame *picture & 1st acronym*



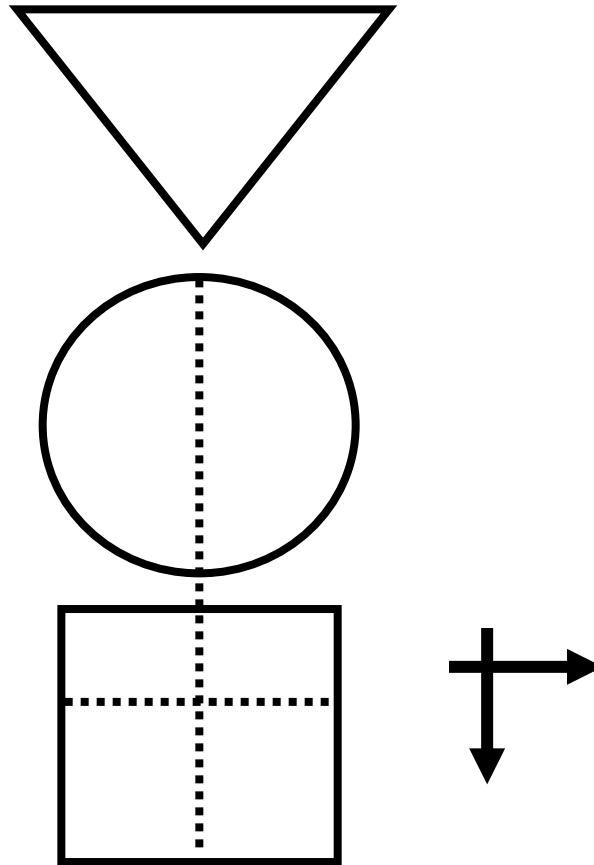
Cross-sectional study

GATE Frame *picture & 1st acronym*



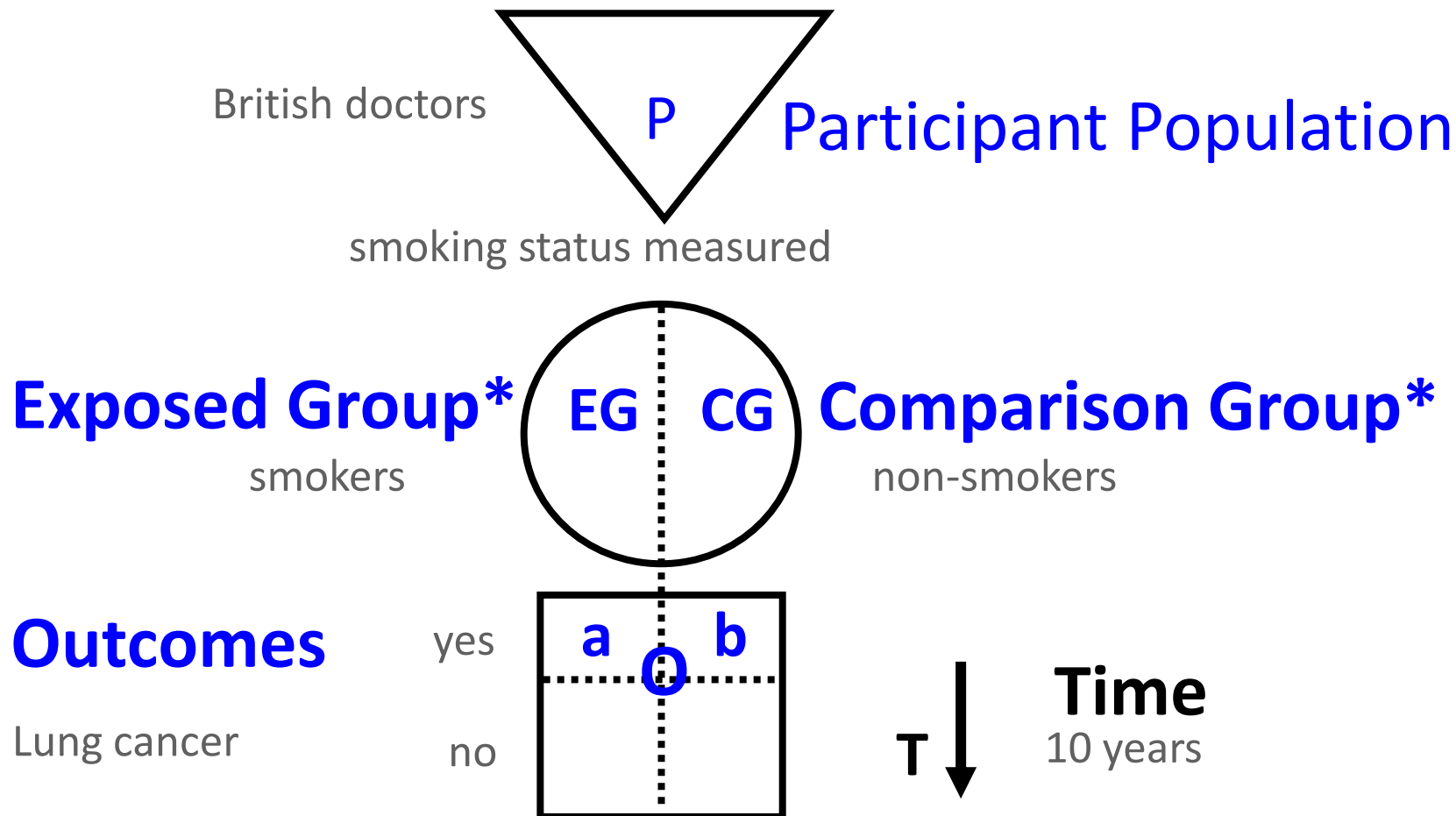
Cross-sectional study

2. GATE: analysis of epidemiological studies: *the 1st formula: outcomes ÷ population*



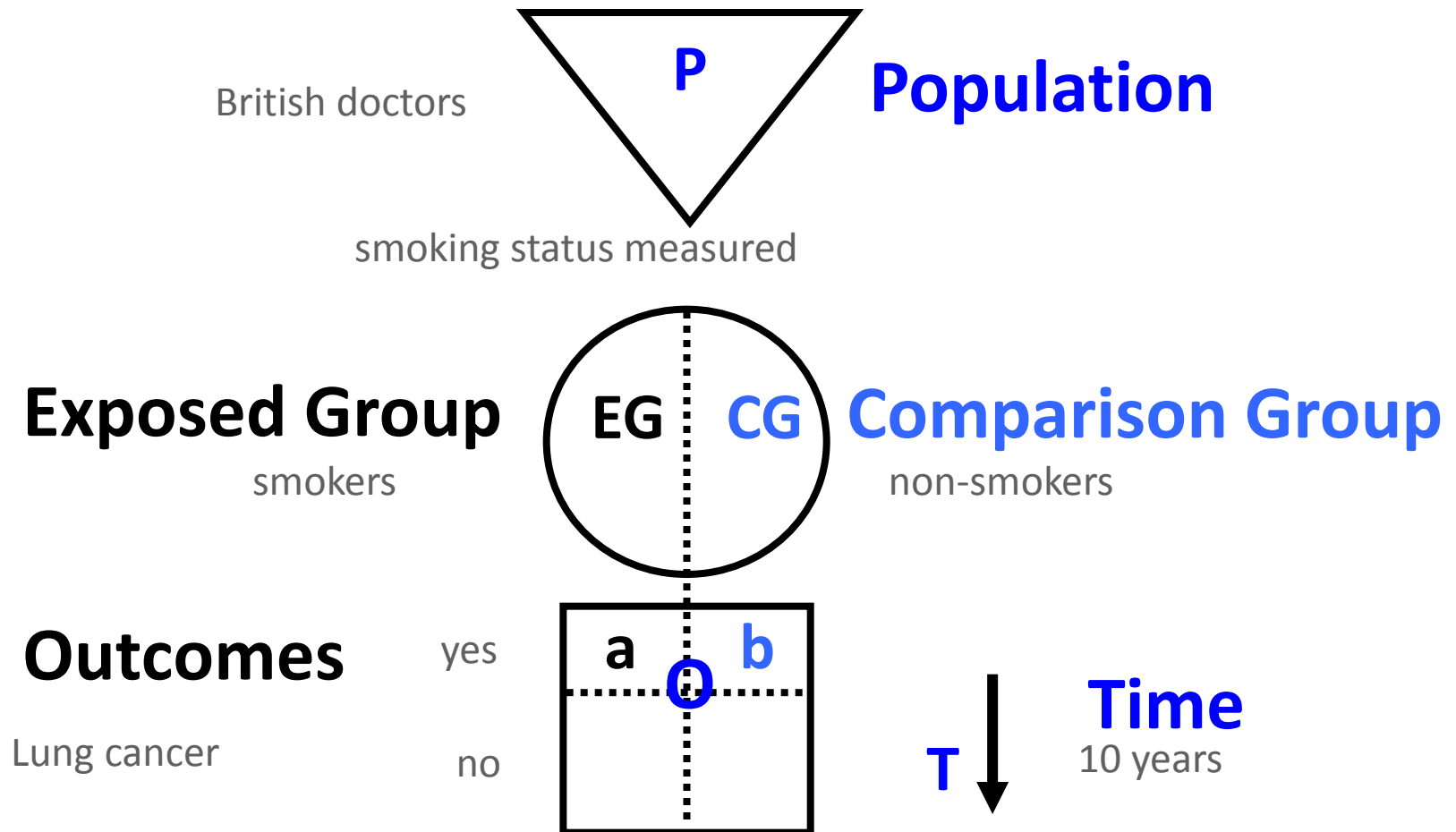
The numbers in every epidemiological study can be hung
on the GATE frame

**1st formula: the Occurrence of outcomes =
number of outcomes ÷ number in the population**



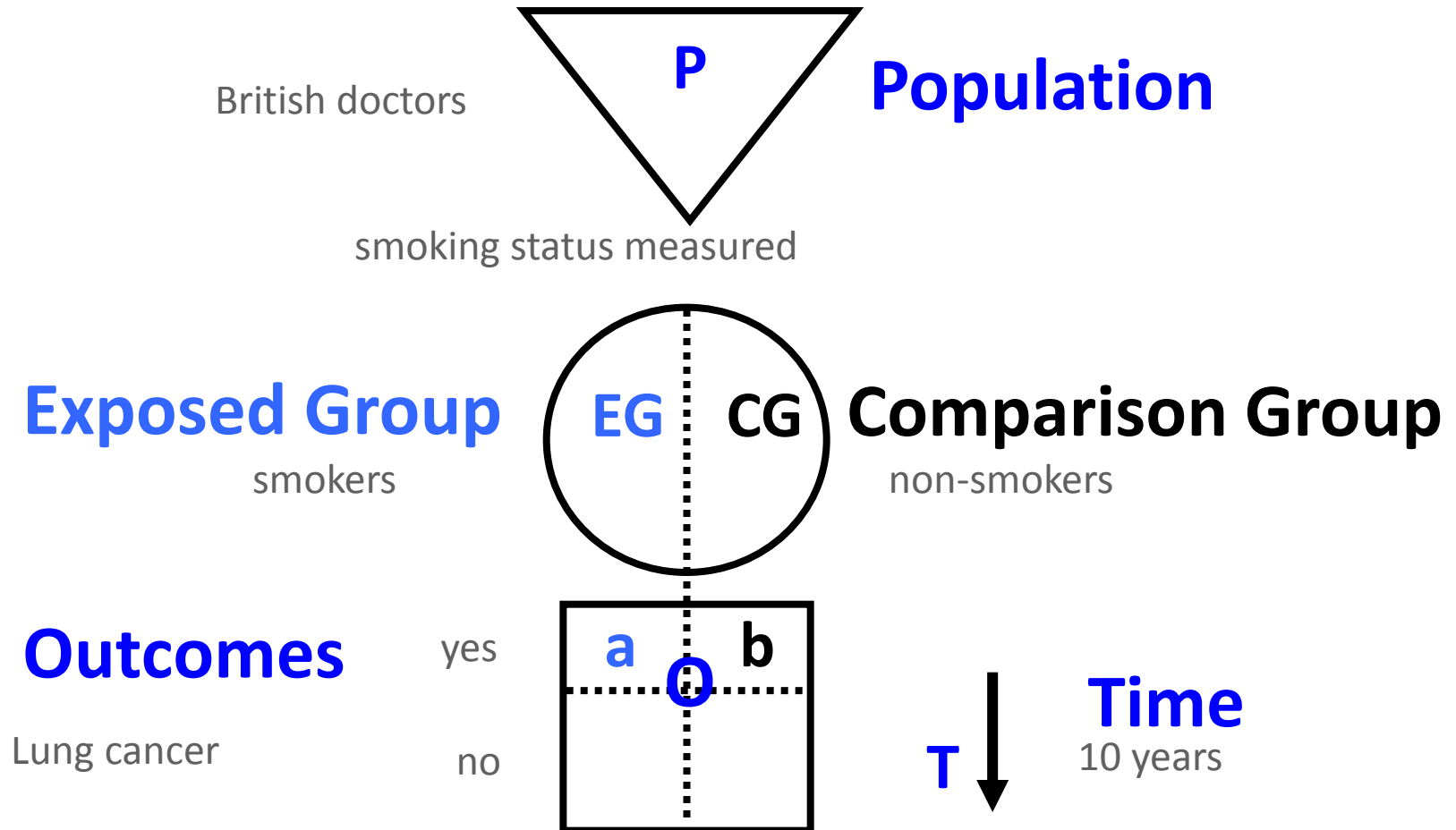
* a Group is a sub-population

1st formula: occurrence = outcomes ÷ population



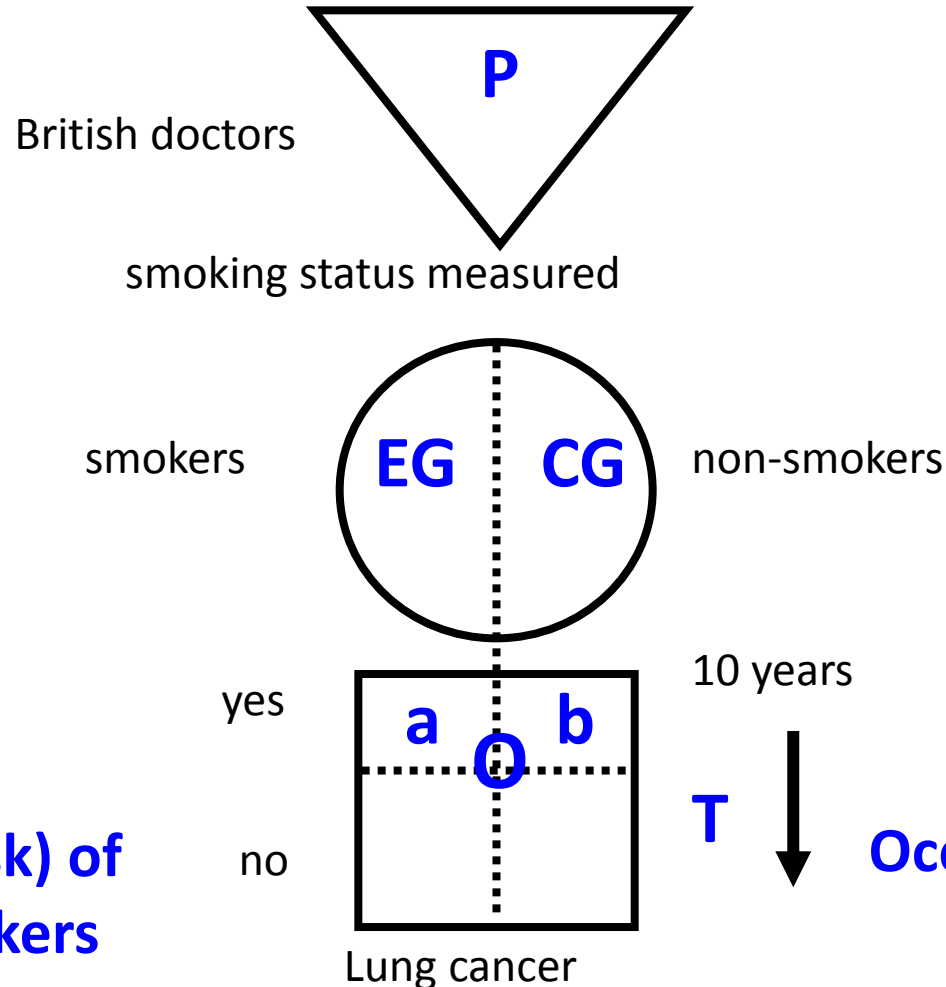
Exposed Group Occurrence (EGO) = a/EG
= number of outcomes (a) ÷ number in exposed population (EG)

1st formula: occurrence = outcomes ÷ population



Comparison Group Occurrence (CGO) = b/CG
= number of outcomes (b) ÷ number in comparison population (CG)

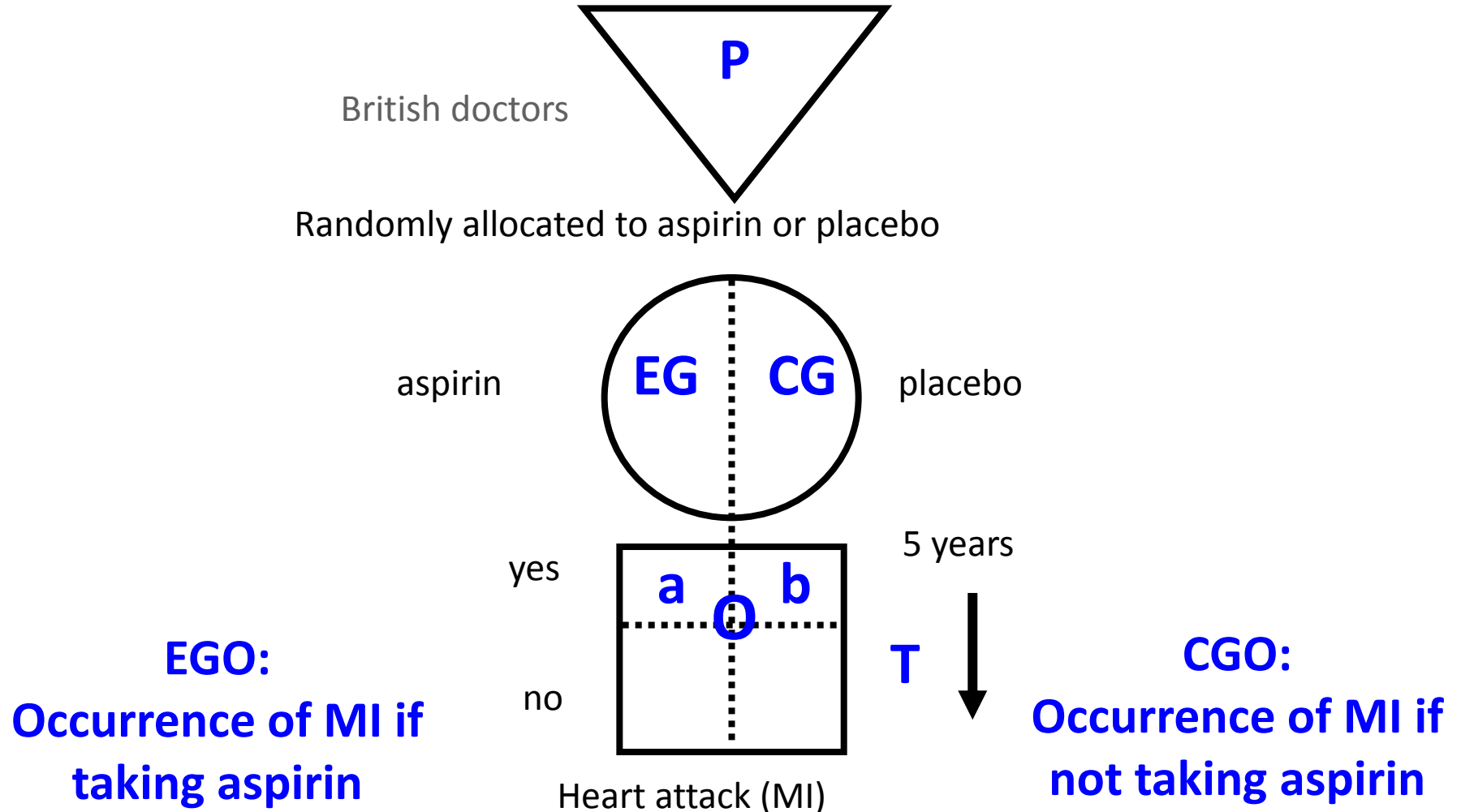
The goal of all epidemiological studies is to measure (& compare) the occurrence of outcomes in (different) populations (EGO compared with CGO)



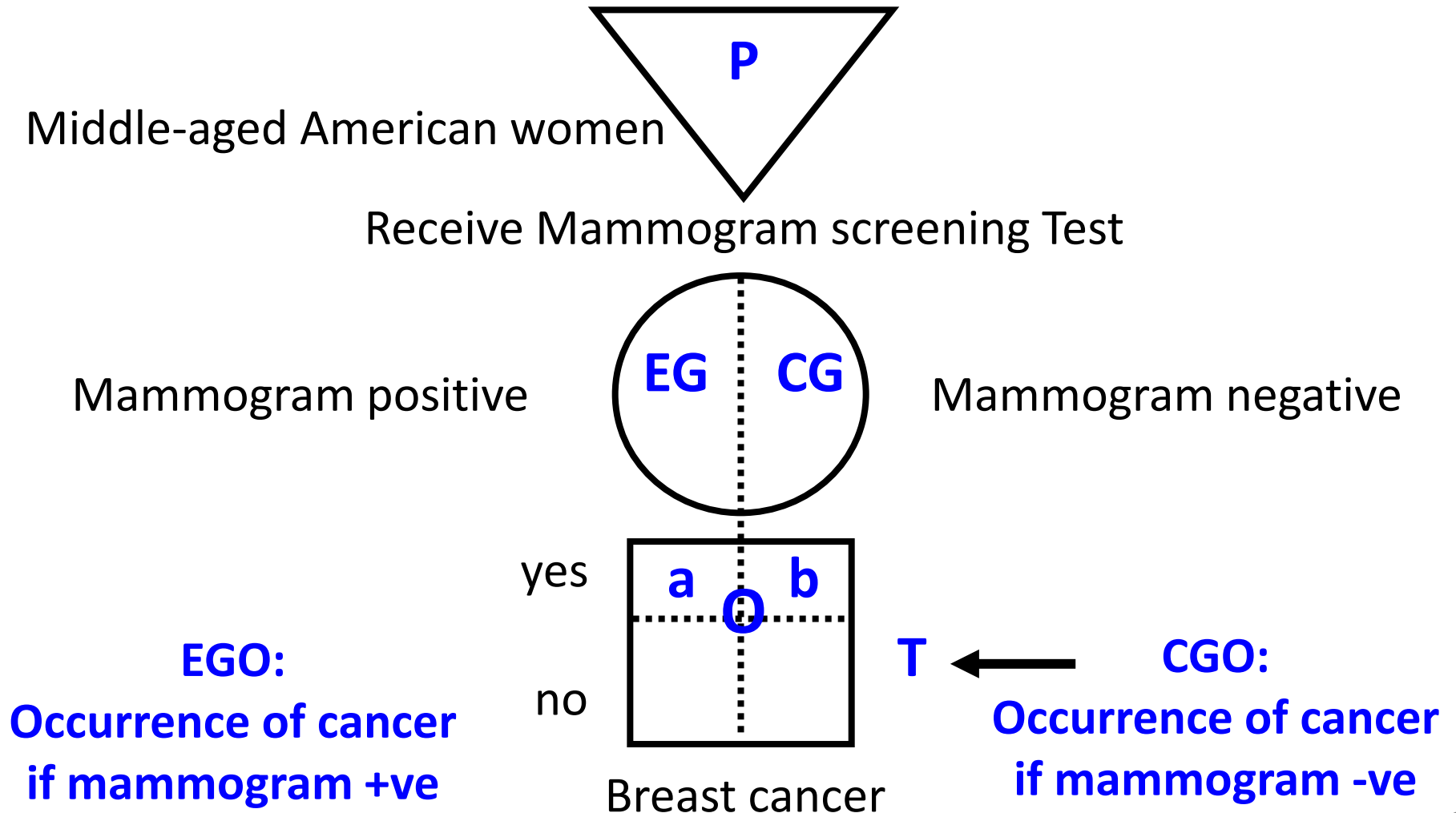
EGO:
Occurrence (risk) of
cancer in smokers

CGO:
Occurrence of cancer
in non-smokers

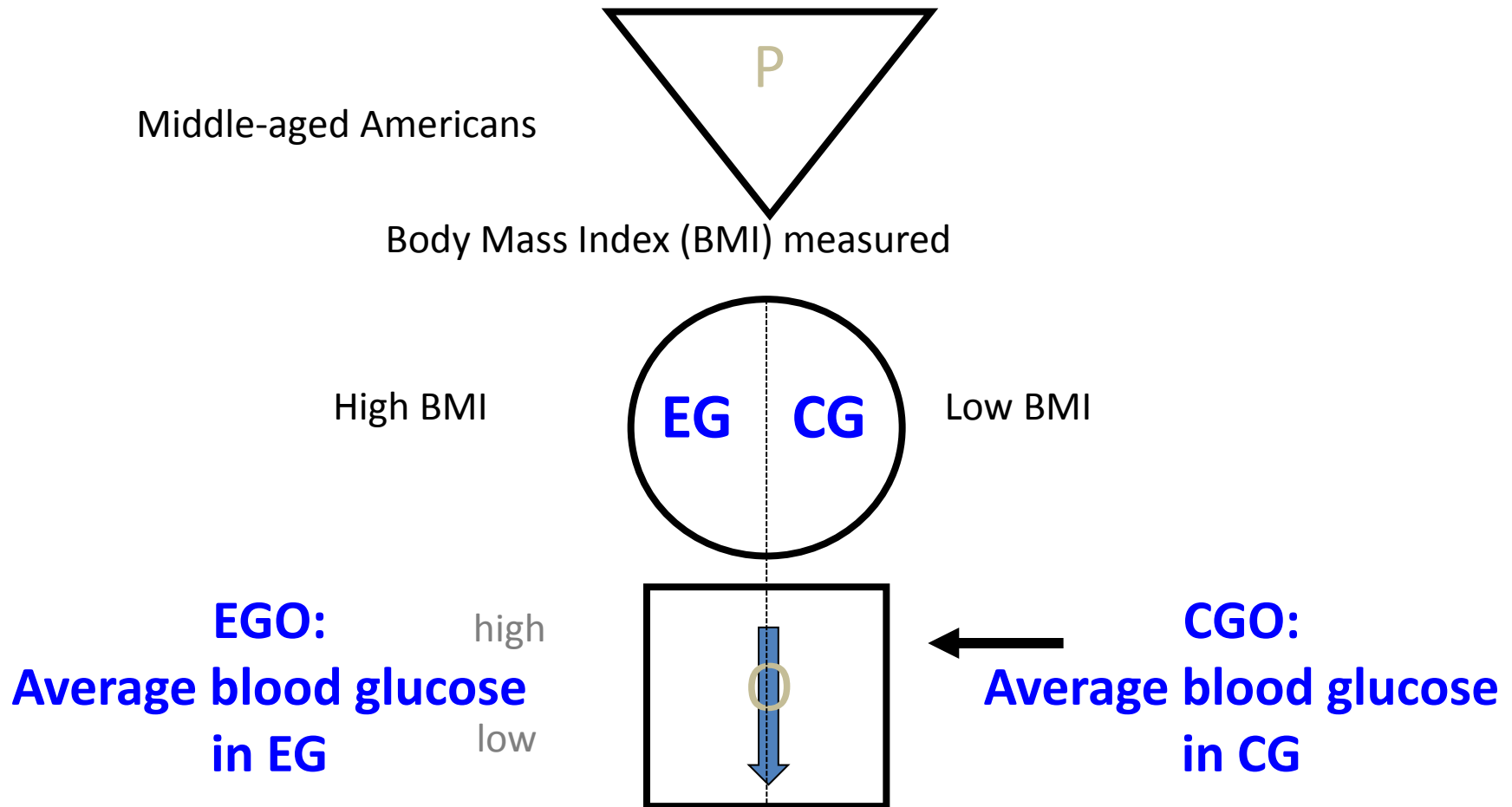
*The goal of all epidemiological studies is to measure (& compare) the occurrence of outcomes in (different) populations (**EGO** compared with **CGO**)*



The goal of all epidemiological studies is to measure (& compare) the occurrence of outcomes in (different) populations (EGO compared with CGO)



The goal of all epidemiological studies is to measure (& compare) the occurrence of outcomes in (different) populations (EGO compared with CGO)



EGO = sum of all glucose levels in EG ÷ number in EG

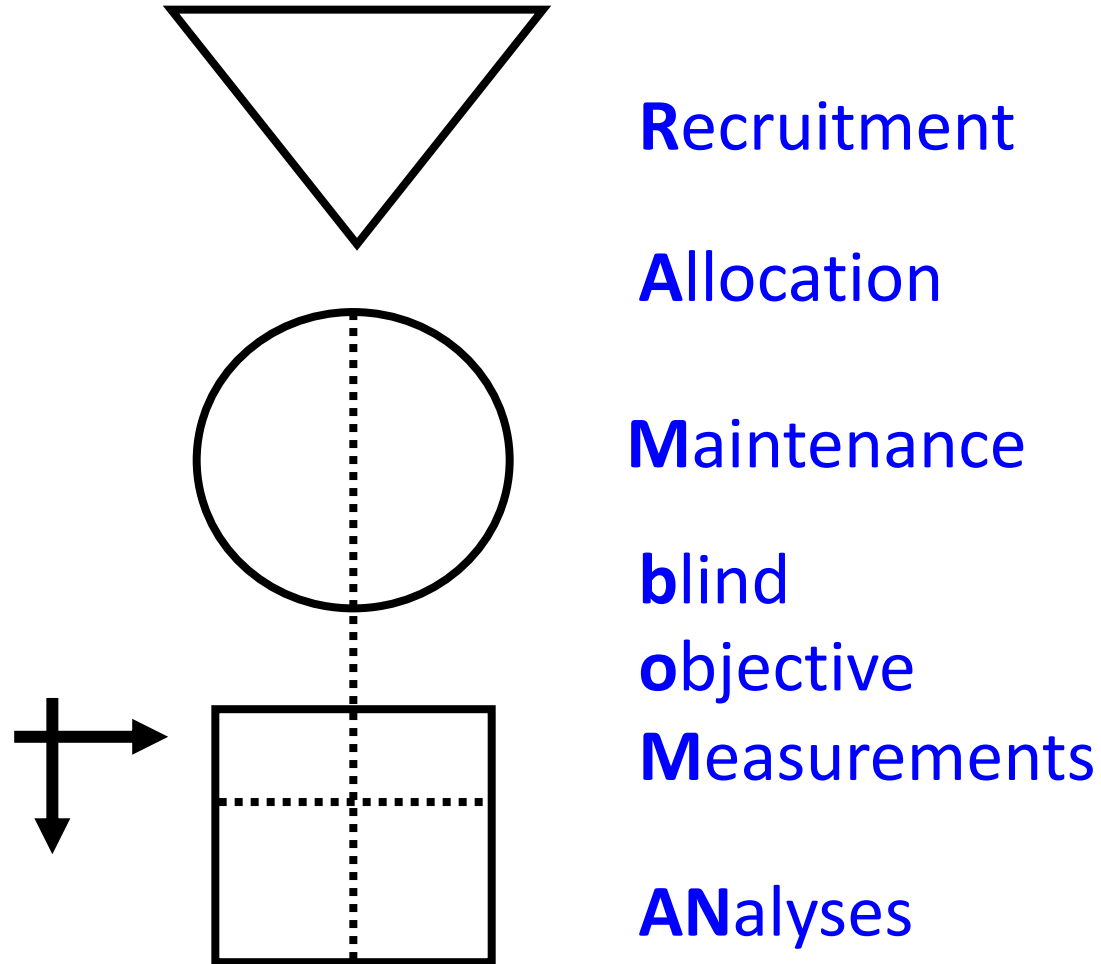
Comparing EGO & CGO

- Risk Ratio or Relative Risk (RR) = $EGO \div CGO$
- Risk Difference (RD) = $EGO - CGO$
- Number Needed to Treat/'expose' (NNT) = $1 \div RD$

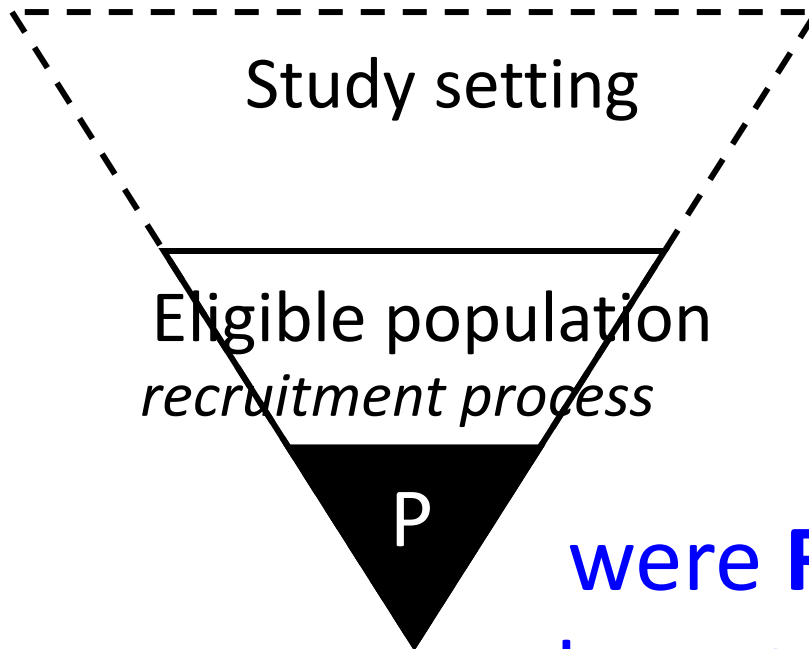
its all about EGO and CGO

Measures of occurrence include: risk; rate; likelihood; probability; average; incidence; prevalence

3. GATE: identifying where errors occur in epi studies: *the 2nd acronym: RAMboMAN*



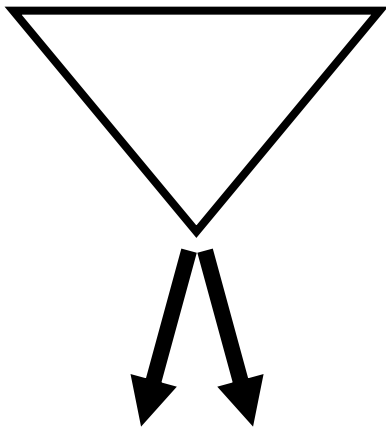
the GATE frame with RAMboMAN can be used to identify risk of error in most/all epidemiological studies



RAMboMAN

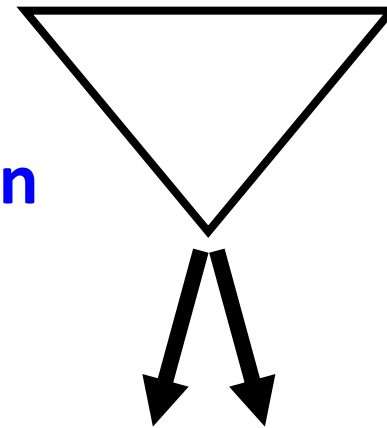
were **Recruited** participants
relevant to the study objectives?
who are the findings applicable to?

RAMboMAN: how well were participants **Allocated** to exposure & comparison groups?



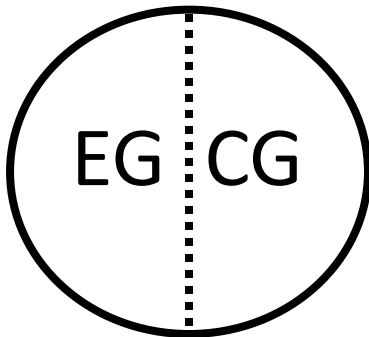
RCT: Allocated by **randomisation**
(e.g to drugs)

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

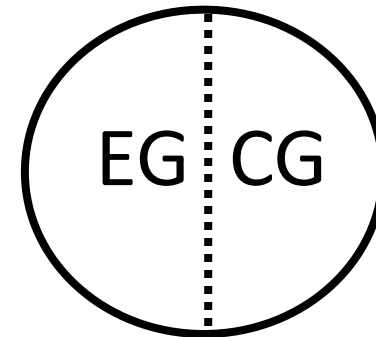


Cohort: Allocated **by measurement** (e.g. smoking)

EG & CG
similar?

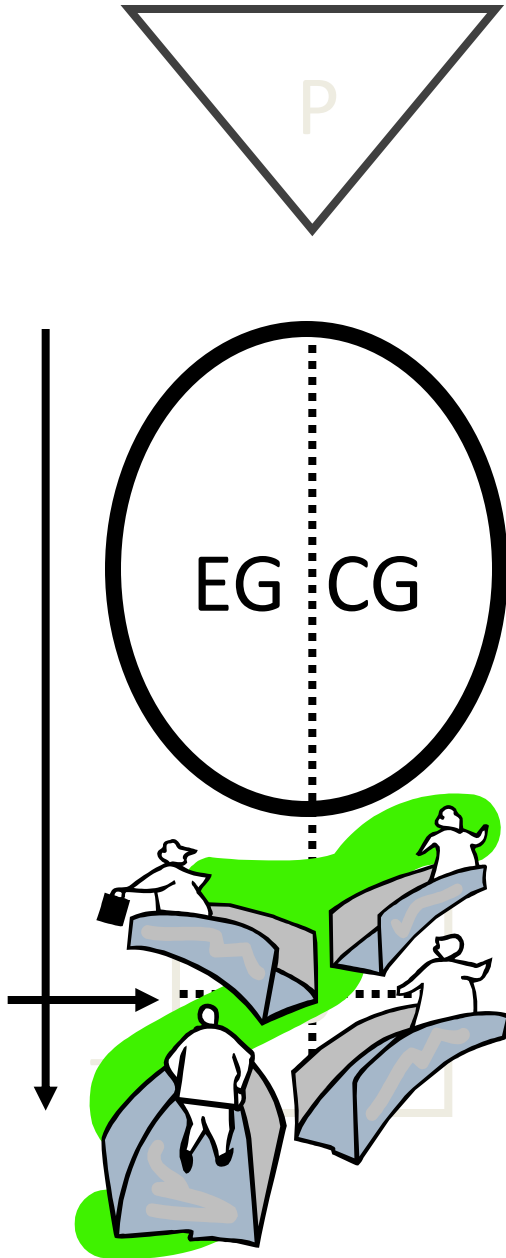


E & C
measures
accurate?



RAMboMAN

How well were Participants
Maintained in the groups they were
allocated to (i.e. to EG & CG)
throughout the study?



Compliance

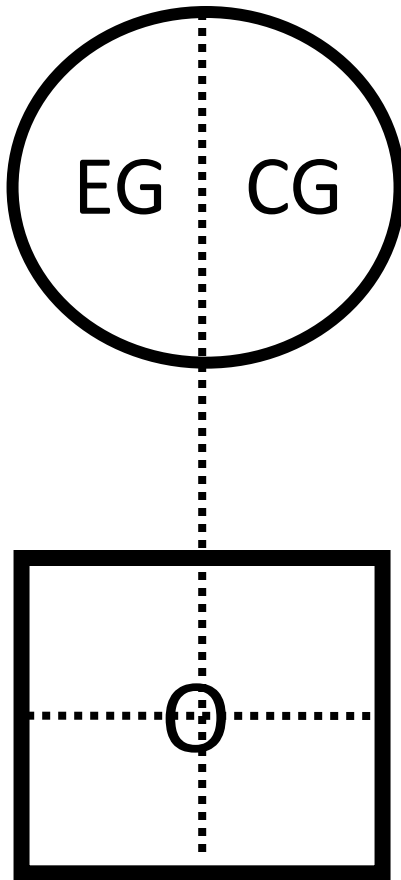
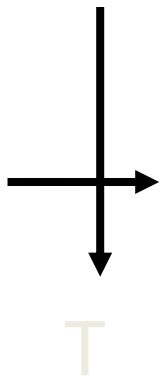
Contamination

Co-interventions

Completeness of follow-up

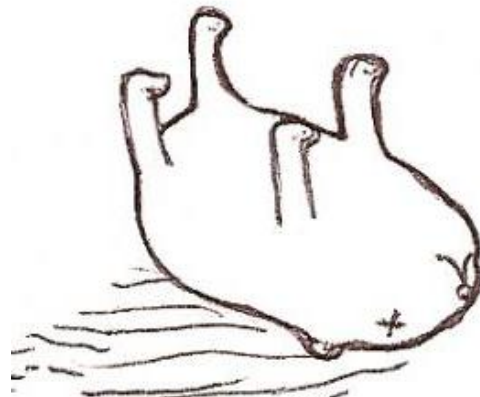
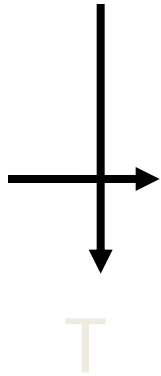
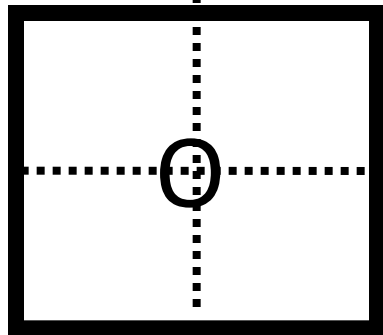
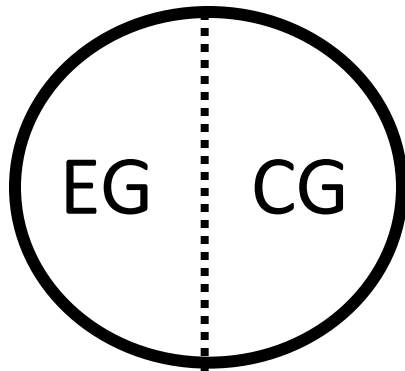
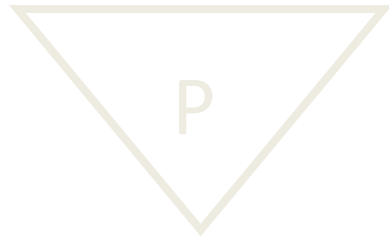
RAM**b**o**M**AN

Were outcomes measured
blind to whether participant
was in EG or CG ?



RAMbOMAN

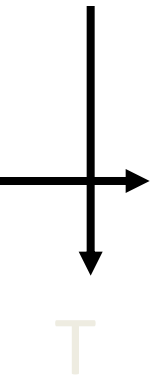
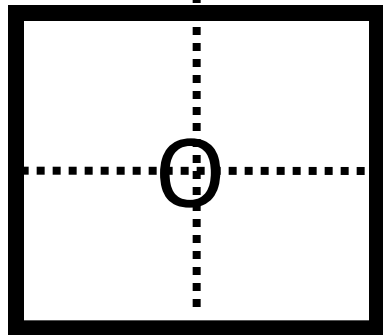
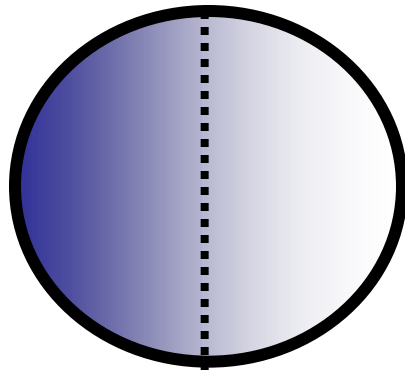
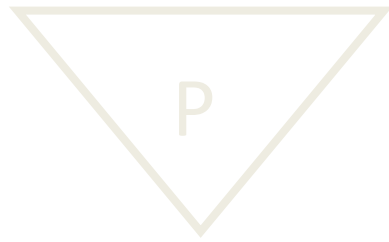
Were outcomes measured
Objectively?



RAMBOMAN

Were the **Analyses** done appropriately?

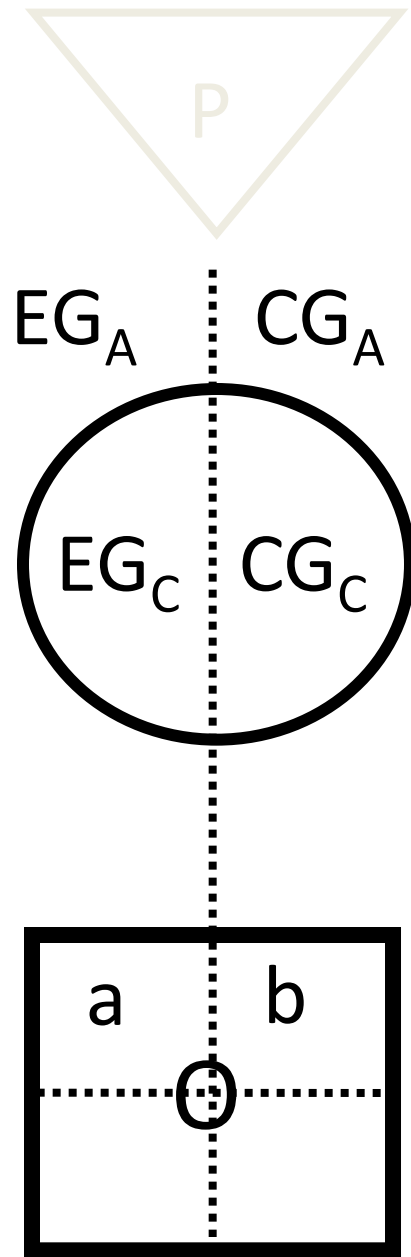
Adjustment for confounding



RAMBOMAN

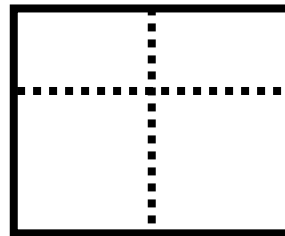
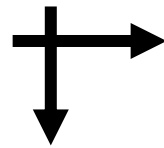
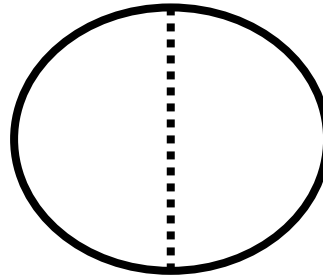
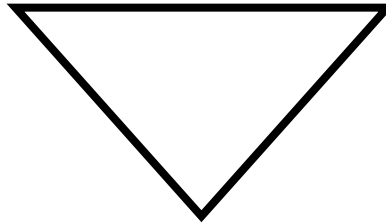
Were the **Analyses** done appropriately?

Intention to treat?



the 2nd formula:

random error = 95% confidence interval



EGO \pm 95% CI

CGO \pm 95% CI

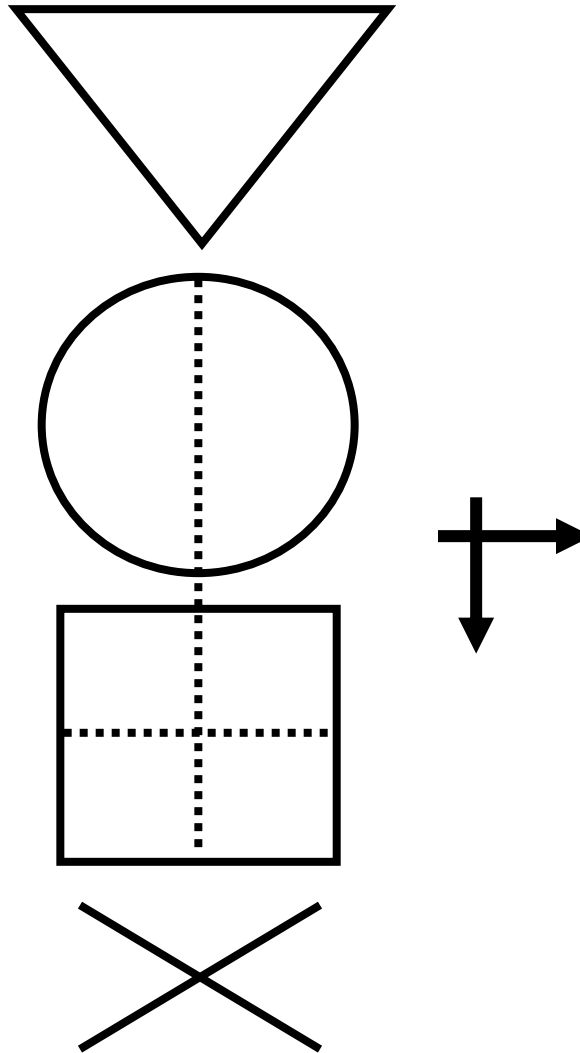
There is about a 95% chance that the true value of EGO & CGO (in the underlying population) lies somewhere in the 95% CI (assuming no non-random error)

the 3rd acronym: FAITH

Critically appraising a systematic review

- **Find** – were all potentially relevant studies found?
- **Appraise** – were studies appraised for validity?
- **Include** – were only appropriate studies included in the final analyses?
- **Total-up** – were studies pooled appropriately?
- **Heterogeneity** – were studies too heterogeneous (i.e. too different) to pool?

4. GATE : a framework for the 4 steps of EBP



The steps of EBP:

1. Ask

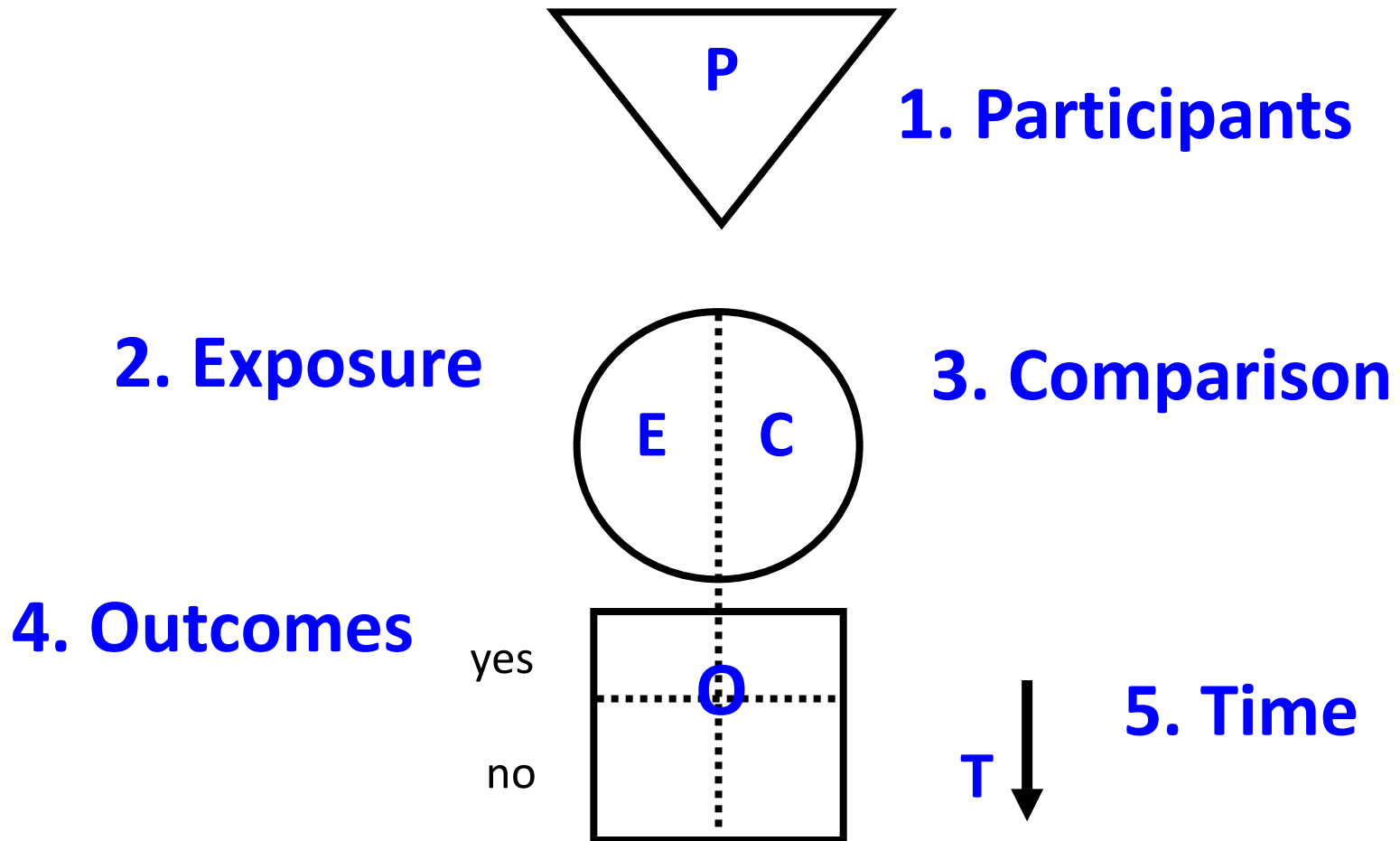
2. Acquire

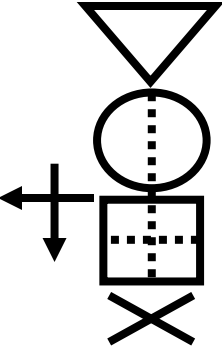
3. Appraise

4. Apply

[5. AUDIT your practice]

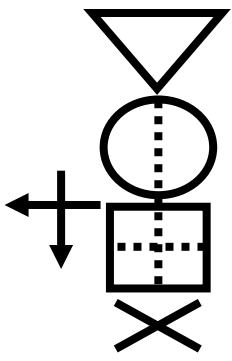
EBP Step 1: ASK - turn your question into a focused 5-part **PECOT** question



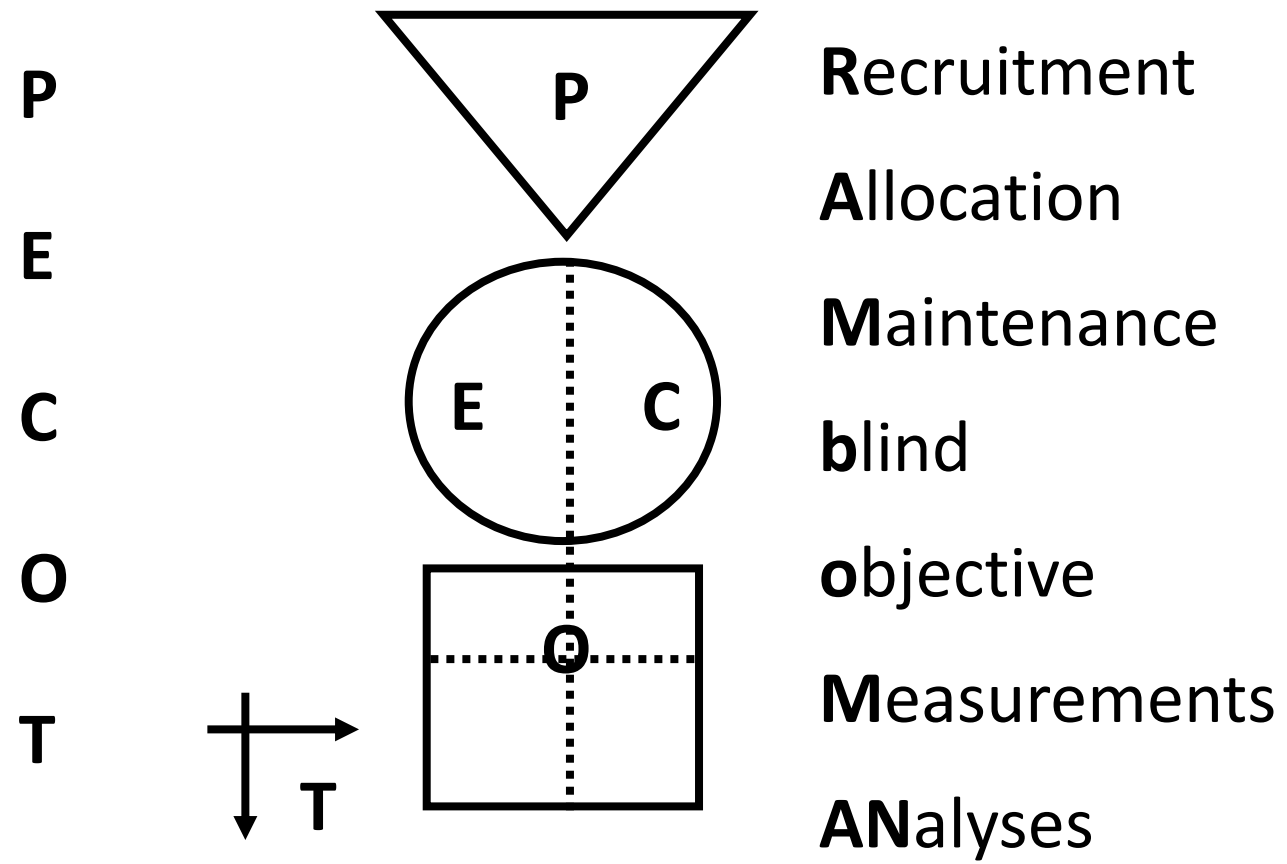


EBP Step 2: **ACQUIRE** the evidence – use **PECOT** to help choose search terms

1. **Participants**
2. **Exposure**
3. Comparison
4. **Outcome**
5. Time frame



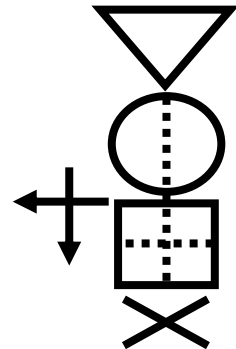
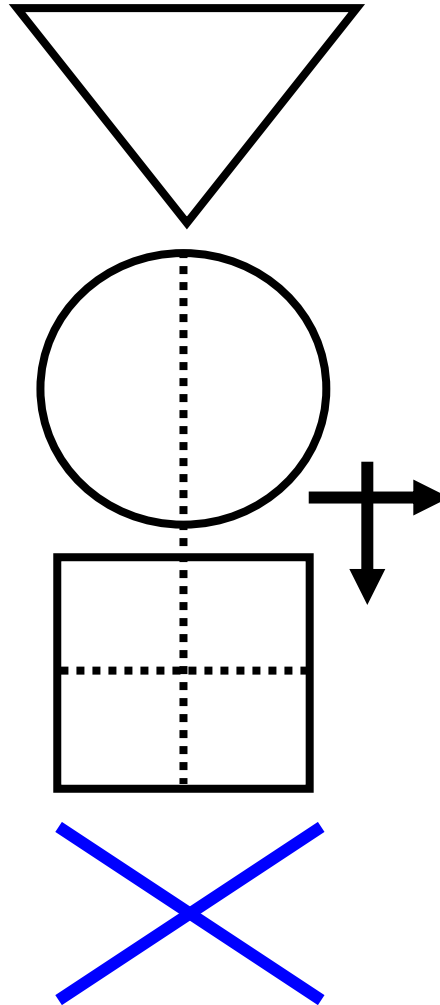
EBP Step 3: **APPRAISE** the evidence – with the picture, acronyms & formulas



Occurrence = outcomes ÷ population

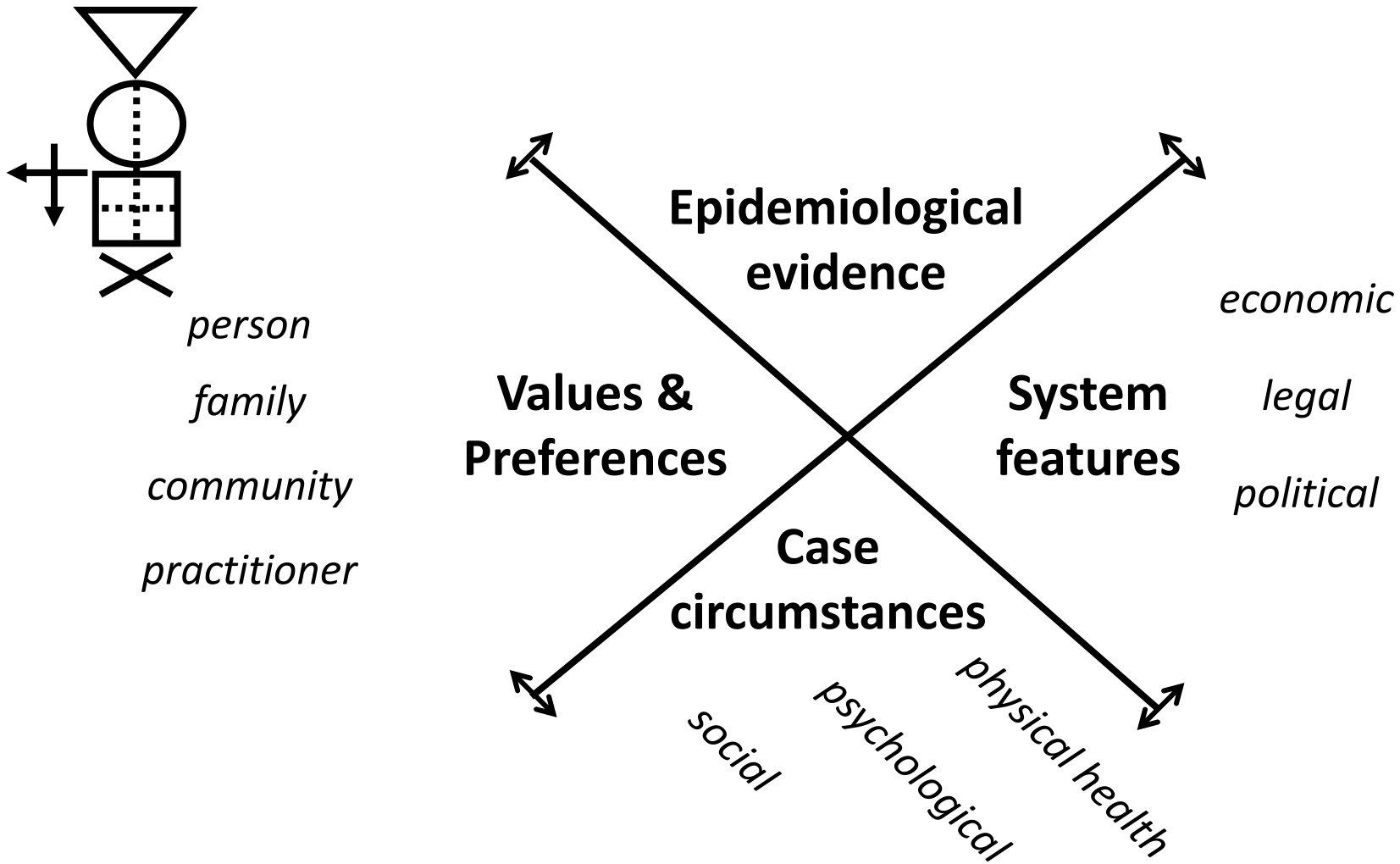
Random error = 95% Confidence Interval

EBP Step 4: **APPLY** the evidence by
AMALGAMATING the relevant information &
making an evidence-based decision: **the X-factor**





X-factor: making evidence-based decisions



Practitioner eXpertise: 'putting it all together' - the art of practice

Excel CATs & pdf Gate-lites

GATE-LITE critical appraisal: RCTs, Cohort & Cross-sectional Studies 29/01/10

Step 3: Appraise the study using the **PECOT** framework
 a. "hang" the study on the **GATE** (Graphic Appraisal Tool for Epidemiology) Frame

Assessed by:	RJ	Assessed when?	1-Apr-06	Publication details:	Hulley et al. JAMA 1998;280:605-1	
Populations			Source Population	Women from 20 outpatient centres & from community settings in the US. 68,561 screened	Eligible Population 1. Sampling frames: cardiac lists, mass mailing lists, direct advertising (see ref 16). 2. Inclusion criteria: post-menopausal, <80 years, established CHD. 3. Exclusion criteria: MI in last 6 months, TG>3.39mg/dL, HRT in last 3 mths.	
Exposures & Comparison			Exposure Group (EG)	1380	Comparison Group (CG)	1383
Outcomes			Outcomes: ...primary	Primary outcome was CHD events (nonfatal MI - either silent or symptomatic - and fatal CHD). Assessed by independent Morbidity and Mortality Committee following detailed classification criteria. 2 reviewers assessed each event.	...secondary	Secondary CVD outcomes included CABG, PCTA, hospitalisation for unstable angina, CHF, stroke, TIA, PVD. Changes in lipids (Total, LDL & HDL cholesterol, triglycerides)
Time			Unit of time (e.g. year) if rate wanted:	year	Time	Average follow-up 4.1 years after starting HRT or placebo. Follow-up visits every 4 months.
Results (unadjusted) with 95% confidence intervals			Intention to treat analyses	30.40	Relative risk (95% CI)	0.98
Calculated in GATE frame			On-treatment analyses	31.01	Relative risk (95% CI)	0.98
Reports			Analysis of means	1.40	Relative risk (95% CI)	1.10

STUDY QUESTION: describe using PECOT	STUDY DESIGN: hang on GATE frame using numbers	STUDY BIAS: assess using RAMMbo												
<p>P = Participants:</p> <p>SS: _____</p> <p>EP: Inclusion/Exclusion criteria: _____</p> <p>Method by which EP identified from SS: _____</p> <p>Method by which P recruited from EP: _____</p>	<p>Random Allocation OR Allocated by Measurement</p> <table border="1"> <tr> <td>EG Allocated</td> <td>CG Allocated</td> </tr> <tr> <td>_____</td> <td>_____</td> </tr> </table> <p>EG completed follow-up: _____</p> <p>CG completed follow-up: _____</p> <p>EG incomplete follow-up: _____</p> <p>CG incomplete follow-up: _____</p>	EG Allocated	CG Allocated	_____	_____	<p>R = were P Recruited appropriately?</p> <p>SS & Incl./Excl. criteria appropriate to study goals?</p> <p>P representative of EP?</p> <p>P risk/prognostic factor profile appropriate to study goals?</p> <p>A = how well were P Allocated to EG & CG?</p> <p>If by random allocation: was it done well, was it concealed? EG & CG similar at baseline?</p> <p>If by measurement: done well, same for EG & CG, done before outcomes occurred & measured?</p> <p>M = were EG&CG Maintained as allocated?</p> <p>P & Investigators blind to Exposure status?</p> <p>Compliance high, Contamination low?</p> <p>Co-interventions similar in EG & CG?</p> <p>Completeness of follow-up high?</p> <p>Mbo = were Measurements of Outcomes blind or objective?</p> <p>Outcomes measured well?</p>								
EG Allocated	CG Allocated													
_____	_____													
<p>EG = Exposure Group [Intervention]</p> <p>Description of E (& how measured if not RCT): _____</p>	<p>CG = Comparison Group [Control]</p> <p>Description of C (& how measured if not RCT): _____</p>	<p>O = Primary (& 2° incl. adverse) Outcome</p> <p>T = Time when outcomes counted</p> <p>Description of O & how / when measured: _____</p>												
<table border="1"> <thead> <tr> <th>Outcome & Time</th> <th>EGO = a/EG</th> <th>CGO = b/CG</th> <th>RR = EGO/CGO</th> <th>RD = EGO-CGO</th> <th>NNT = 1/RD</th> </tr> </thead> <tbody> <tr> <td>_____</td> <td>_____</td> <td>_____</td> <td>_____</td> <td>_____</td> <td>_____</td> </tr> </tbody> </table>	Outcome & Time	EGO = a/EG	CGO = b/CG	RR = EGO/CGO	RD = EGO-CGO	NNT = 1/RD	_____	_____	_____	_____	_____	_____		
Outcome & Time	EGO = a/EG	CGO = b/CG	RR = EGO/CGO	RD = EGO-CGO	NNT = 1/RD									
_____	_____	_____	_____	_____	_____									
<p>ANALYSES</p> <p>Intention to treat (ITT) analyses: Adjusted for confounding if EG & CG unbalanced? Was random error (95% CI) able to detect a difference?</p> <p>On-treatment analyses: Adjusted for confounding if EG & CG unbalanced? Was random error (95% CI) able to detect a difference?</p> <p>Analysis of means: Adjusted for confounding if EG & CG unbalanced? Was random error (95% CI) able to detect a difference?</p>														
<p>Key outcome & analysis method, as published: _____</p> <p>Key results: _____</p>														

There is a GATE for every study design

www.epiq.co.nz

& an on-line post-grad course in EBP

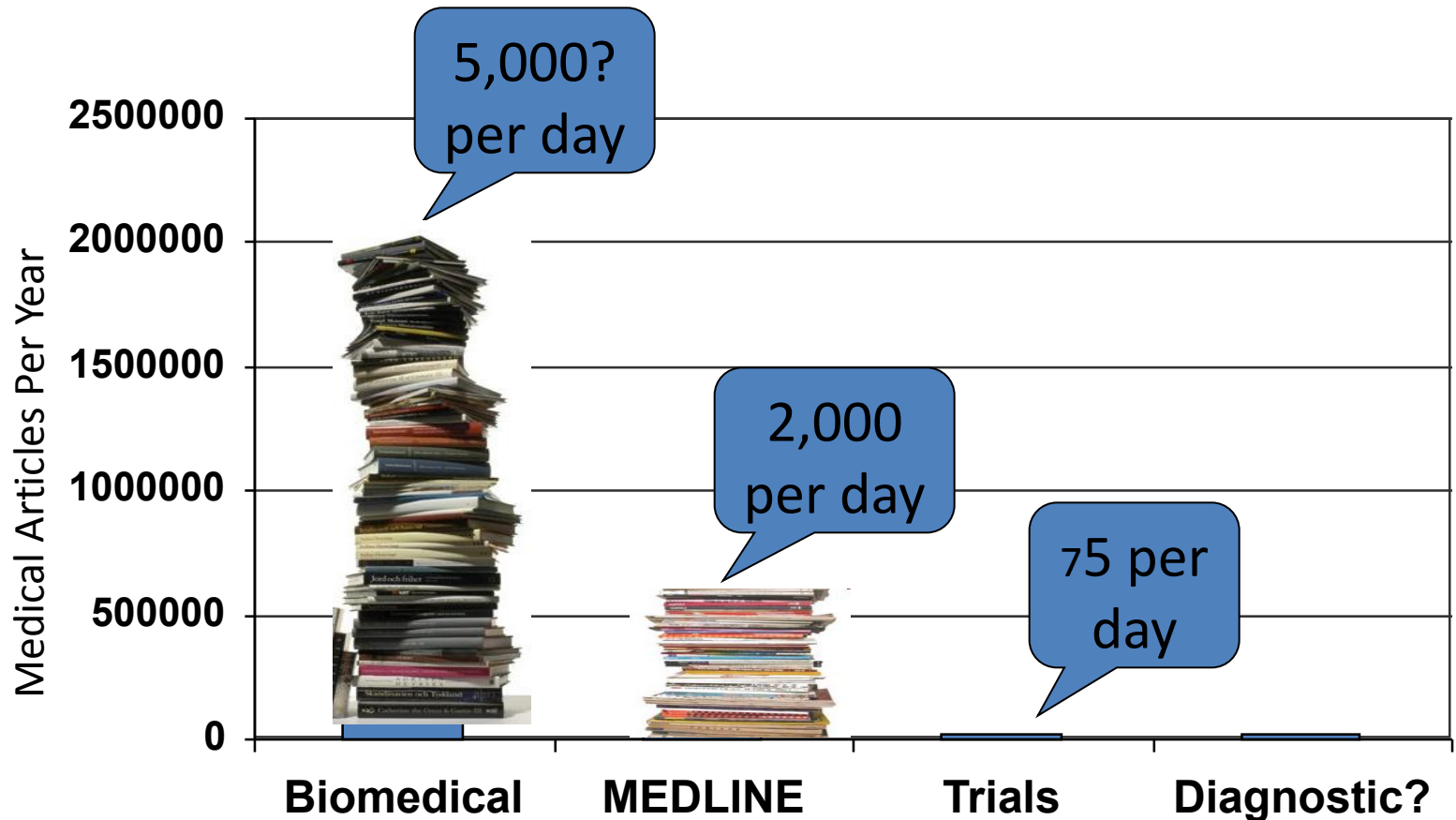
HAPPY 50th ROD



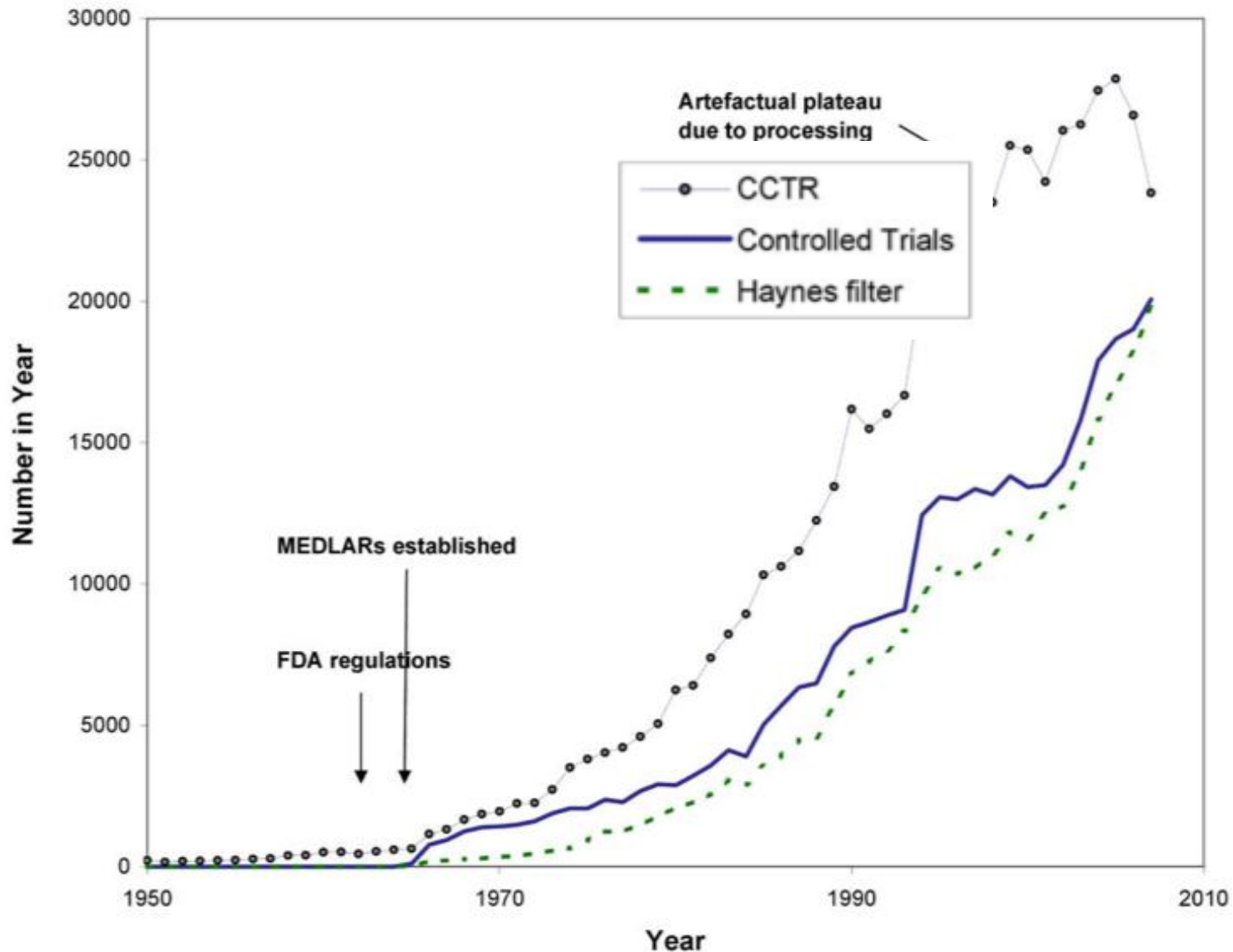
GATE - Way to the future!

Extra slides

Why do we need to use evidence efficiently?



The epidemic of evidence



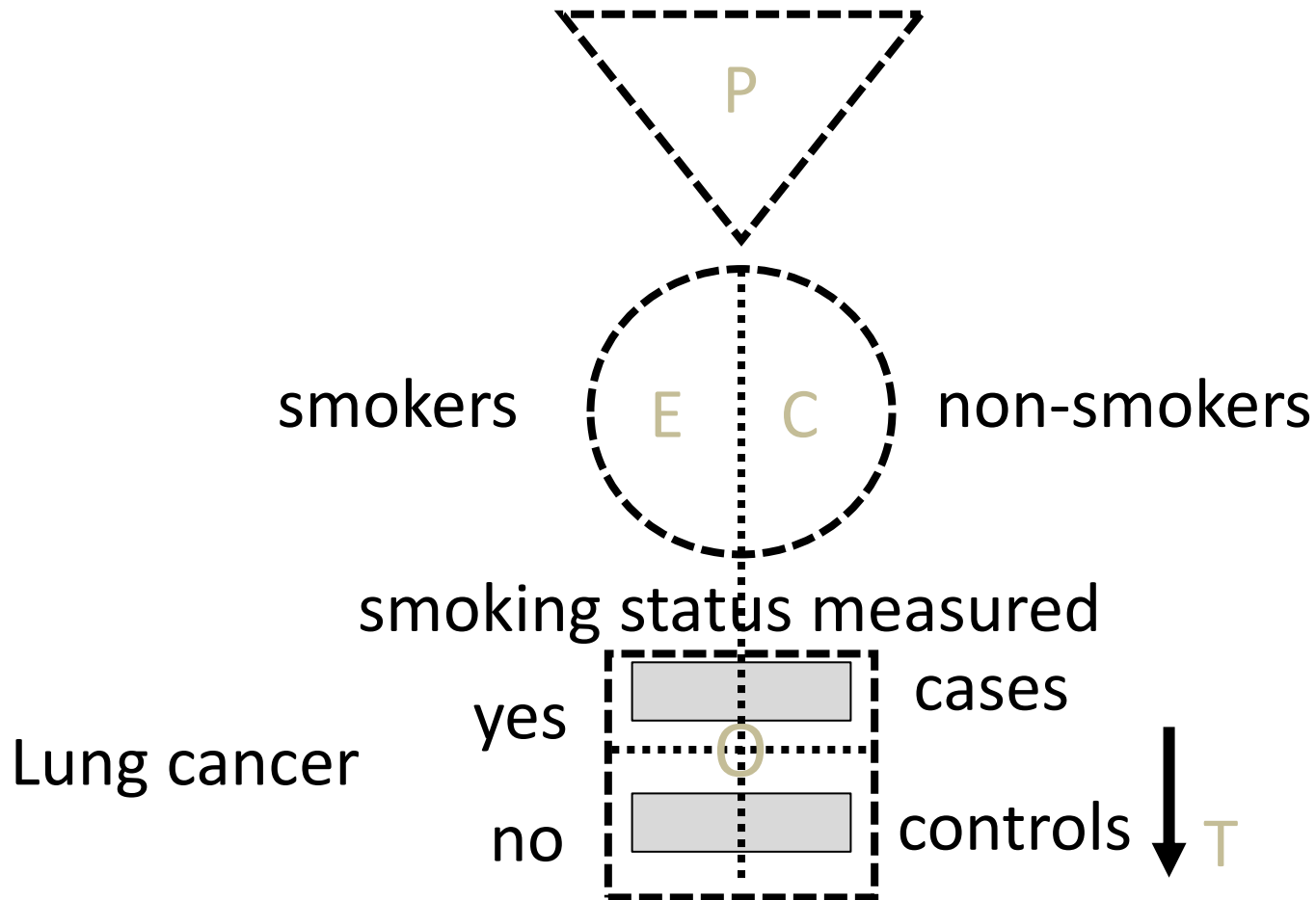
About 1/2 of 'valid' evidence today is out of date in 5 years

About 1/2 of valid evidence is not implemented



"...and, as you go out into the world, I predict that you will, gradually and imperceptibly, forget all you ever learned at this university."

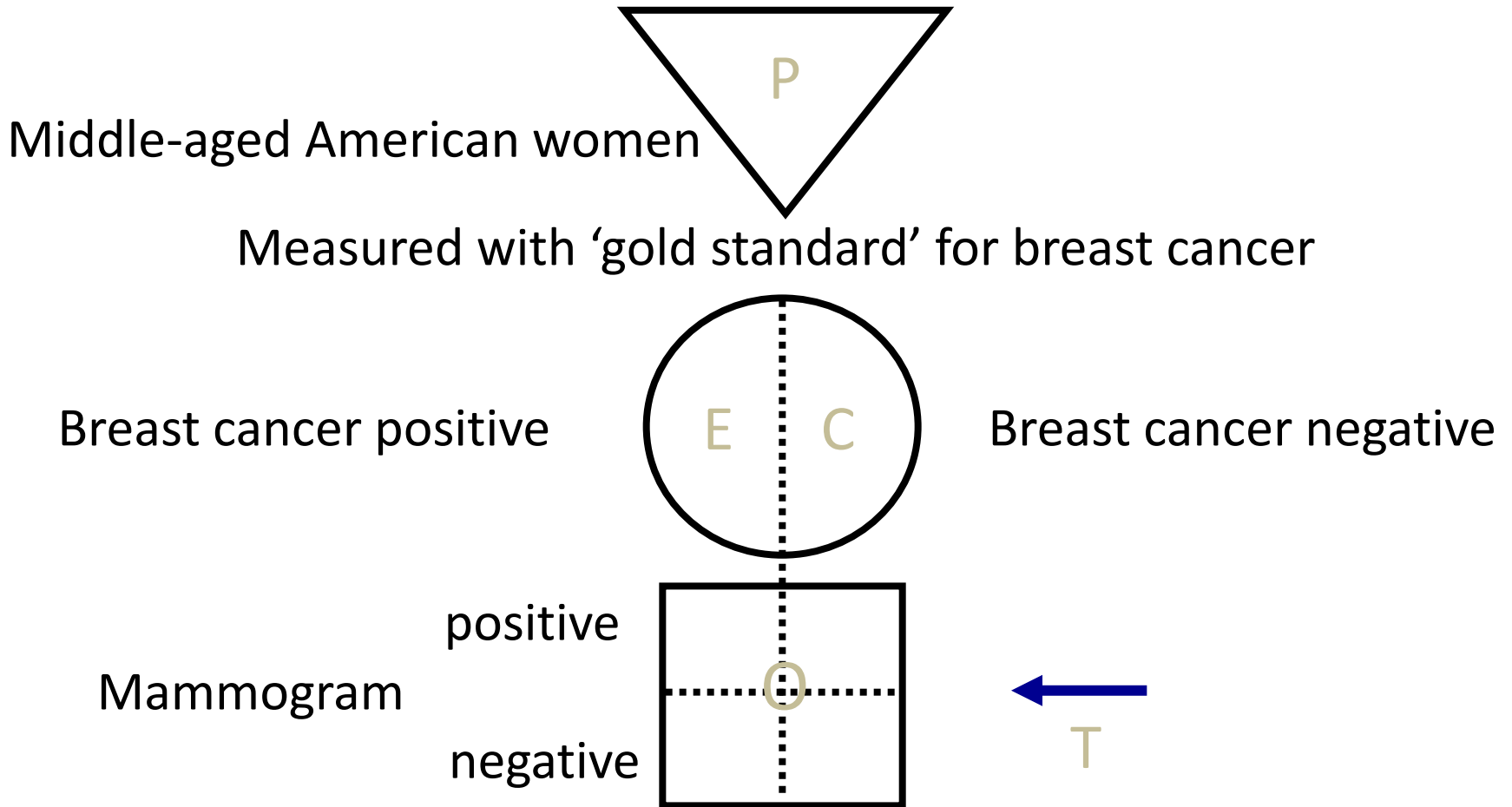
GATE Frame *picture & 1st acronym*



Case-control study

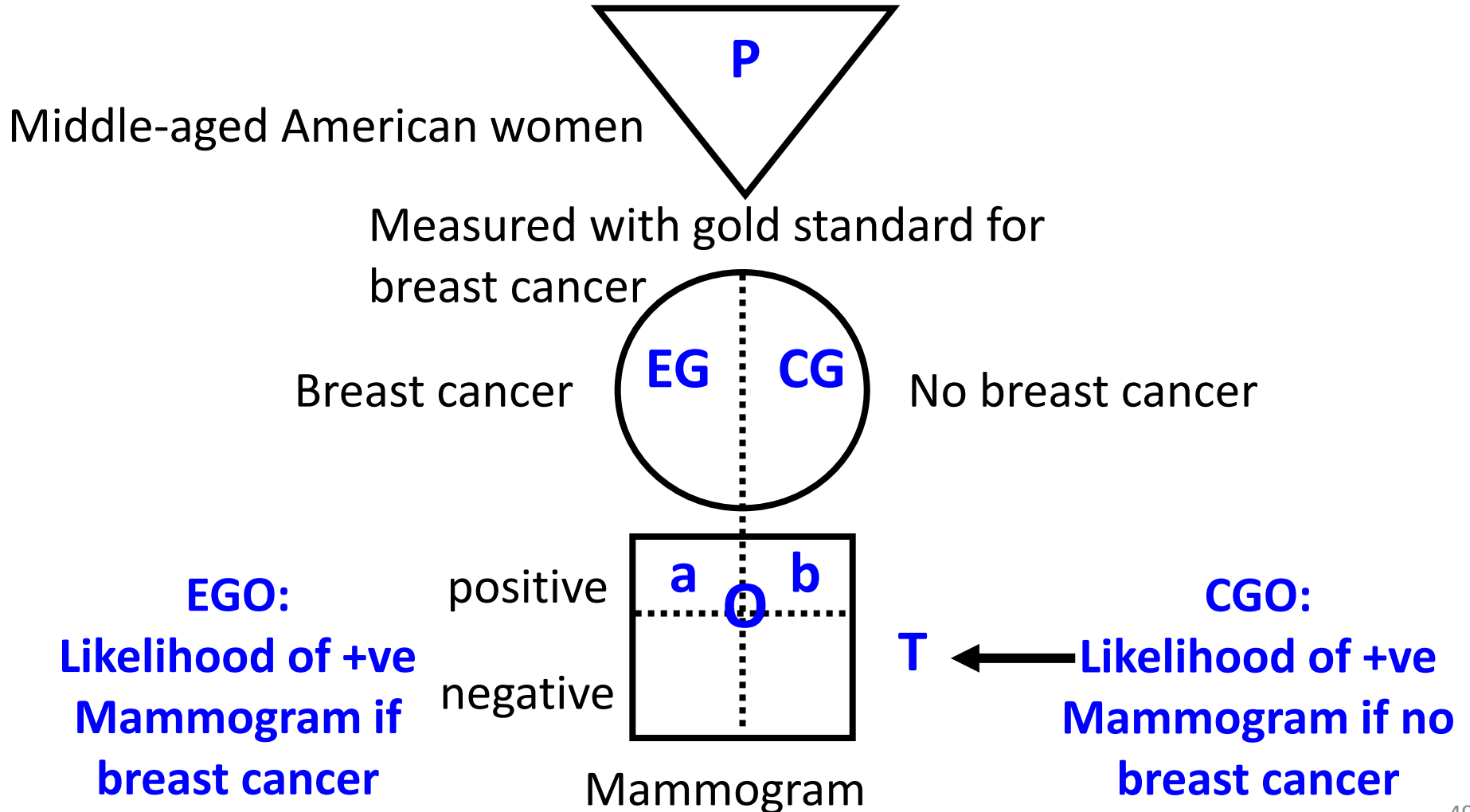
Observational study: allocated by measurement

GATE Frame *picture & 1st acronym*



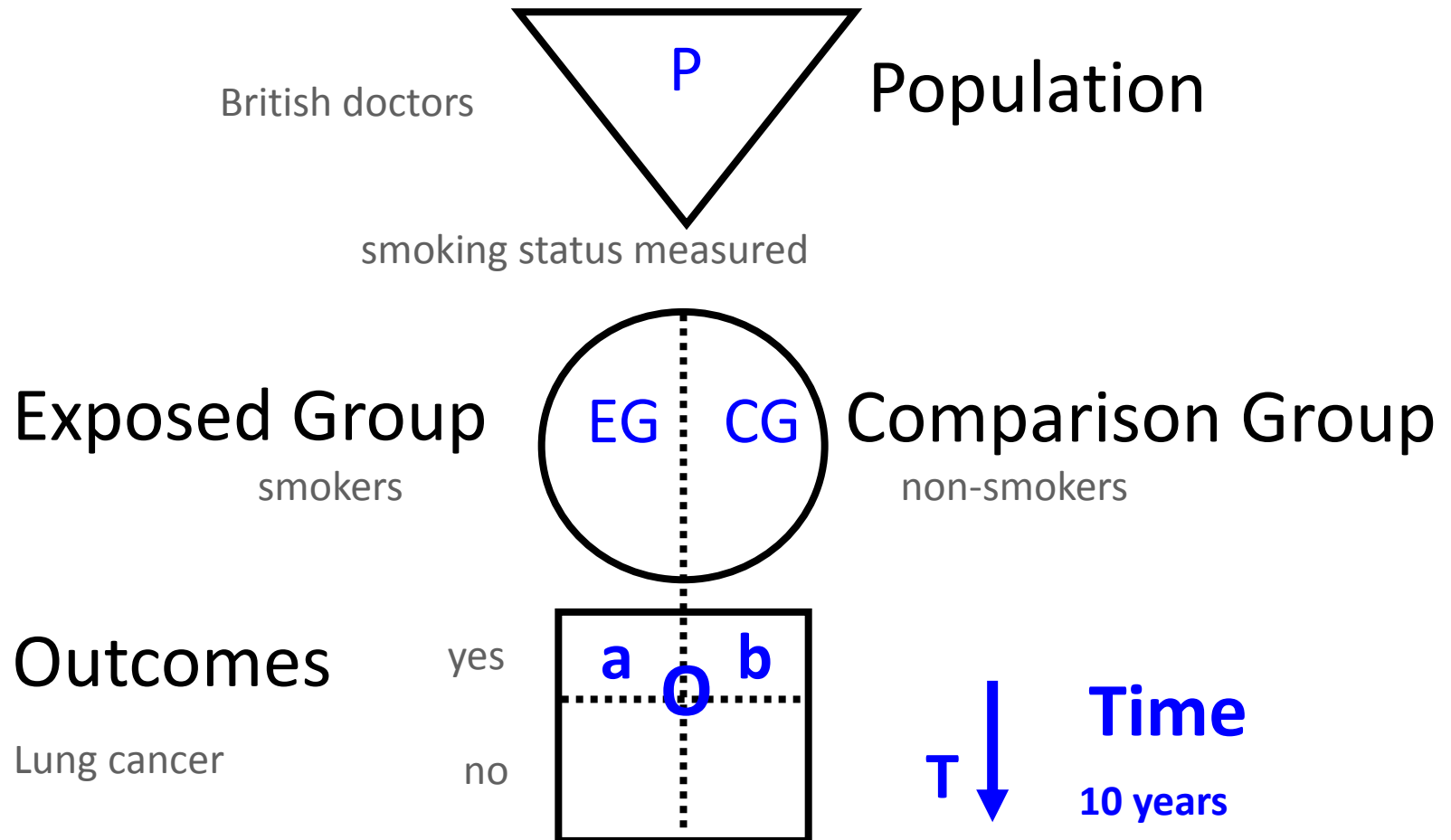
Diagnostic test accuracy study

The goal of all epidemiological studies is to measure (& compare) the occurrence of outcomes in (different) populations (EGO compared with CGO)



1st formula (with time):

occurrence = (outcomes ÷ population) ÷ Time

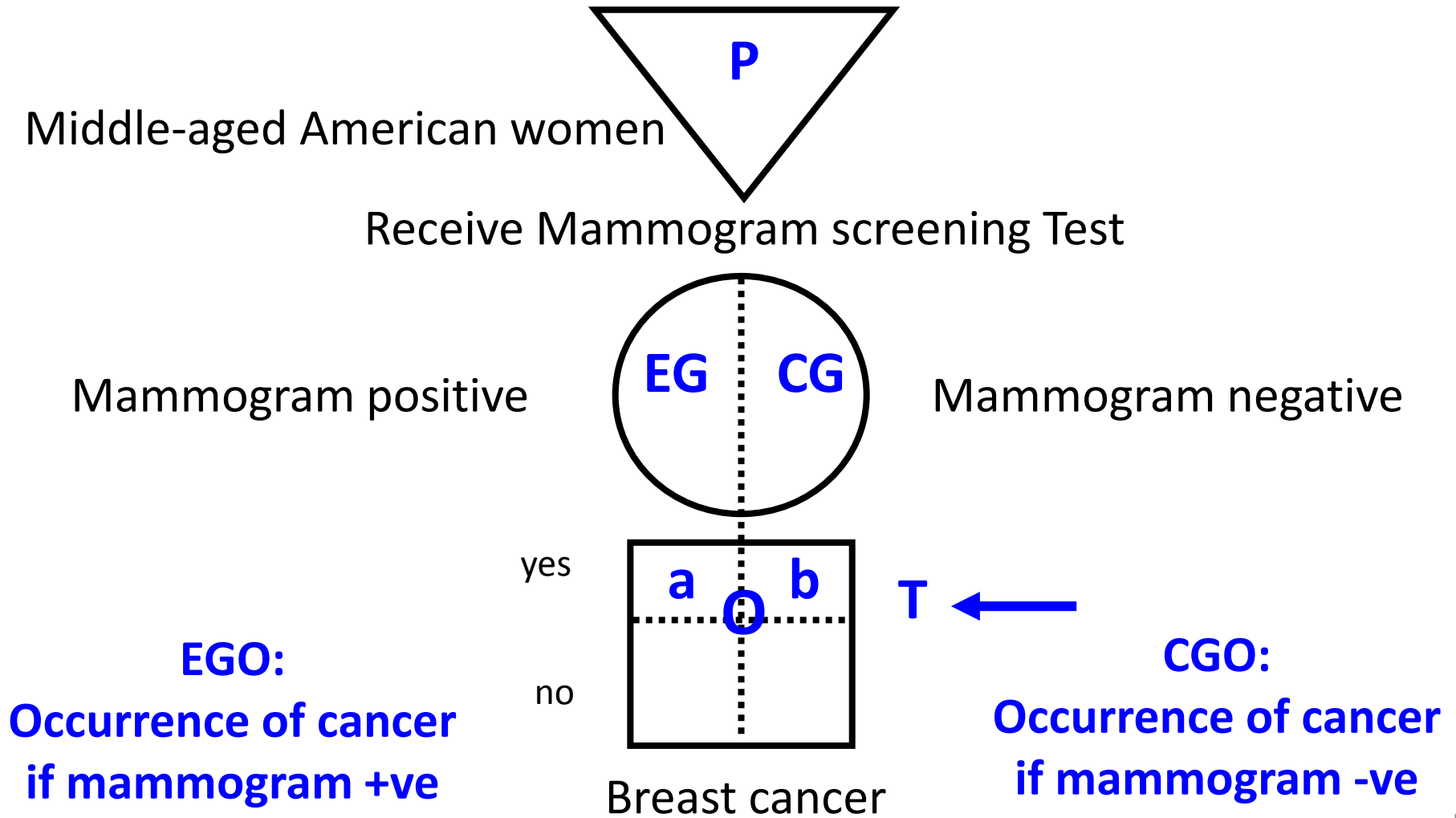


EGO = (a ÷ EG) during time T (a measure of cumulative incidence)

EGO = (a ÷ EG) ÷ T (a measure of incidence rate)

1st formula (with time):

occurrence = (outcomes ÷ population) ÷ Time



EGO = (a ÷ EG) at time T (a measure of prevalence)