

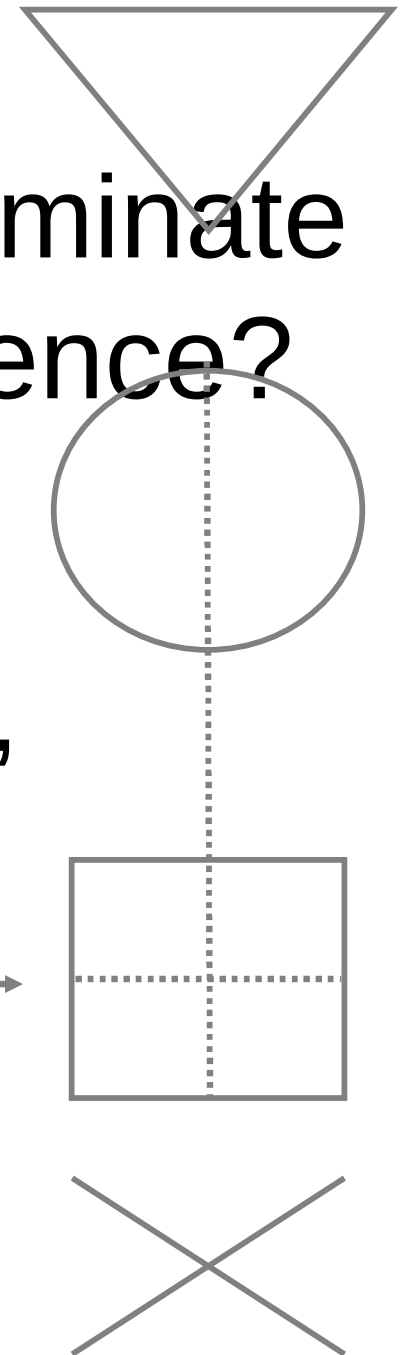
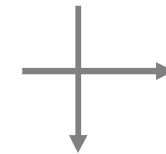
Can we teach how to discriminate
between good & bad evidence?

in 20 minutes!

‘the GATE approach’

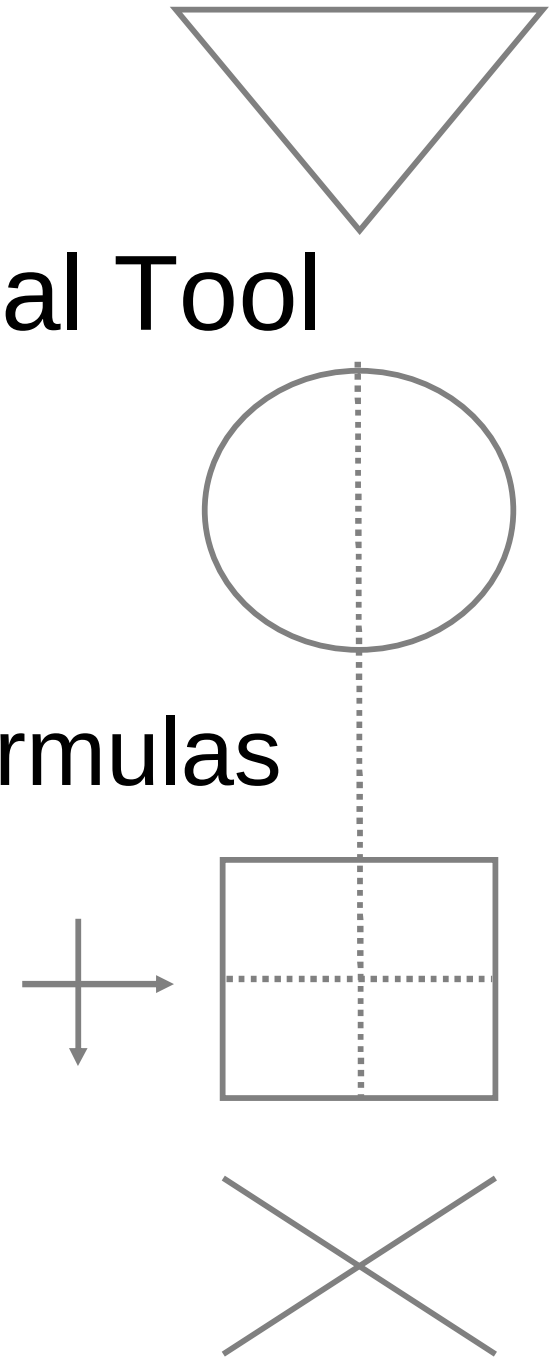
Rod Jackson

June 2010

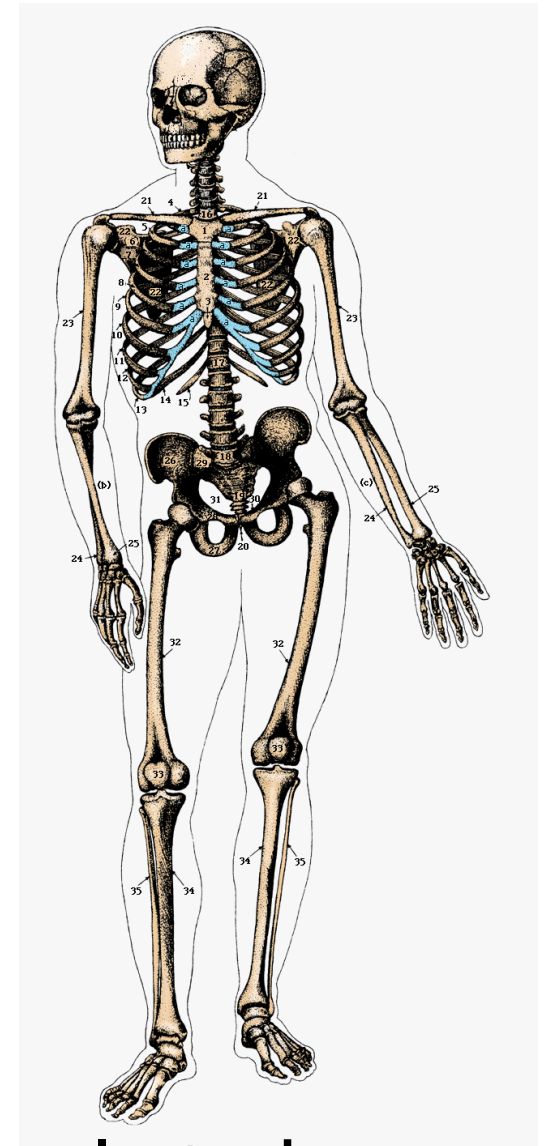
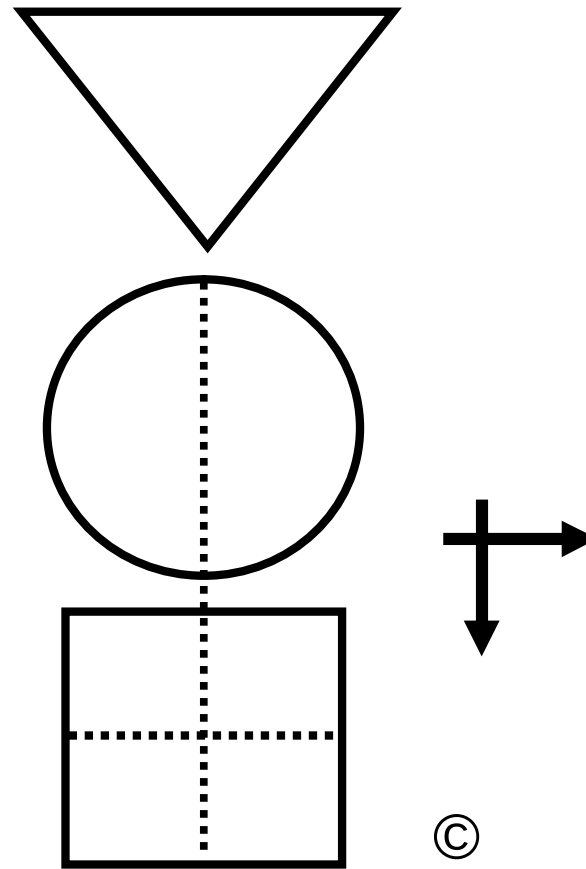


GATE: a Graphic Appraisal Tool for Epidemiology

A picture, 2 acronyms & 2 formulas

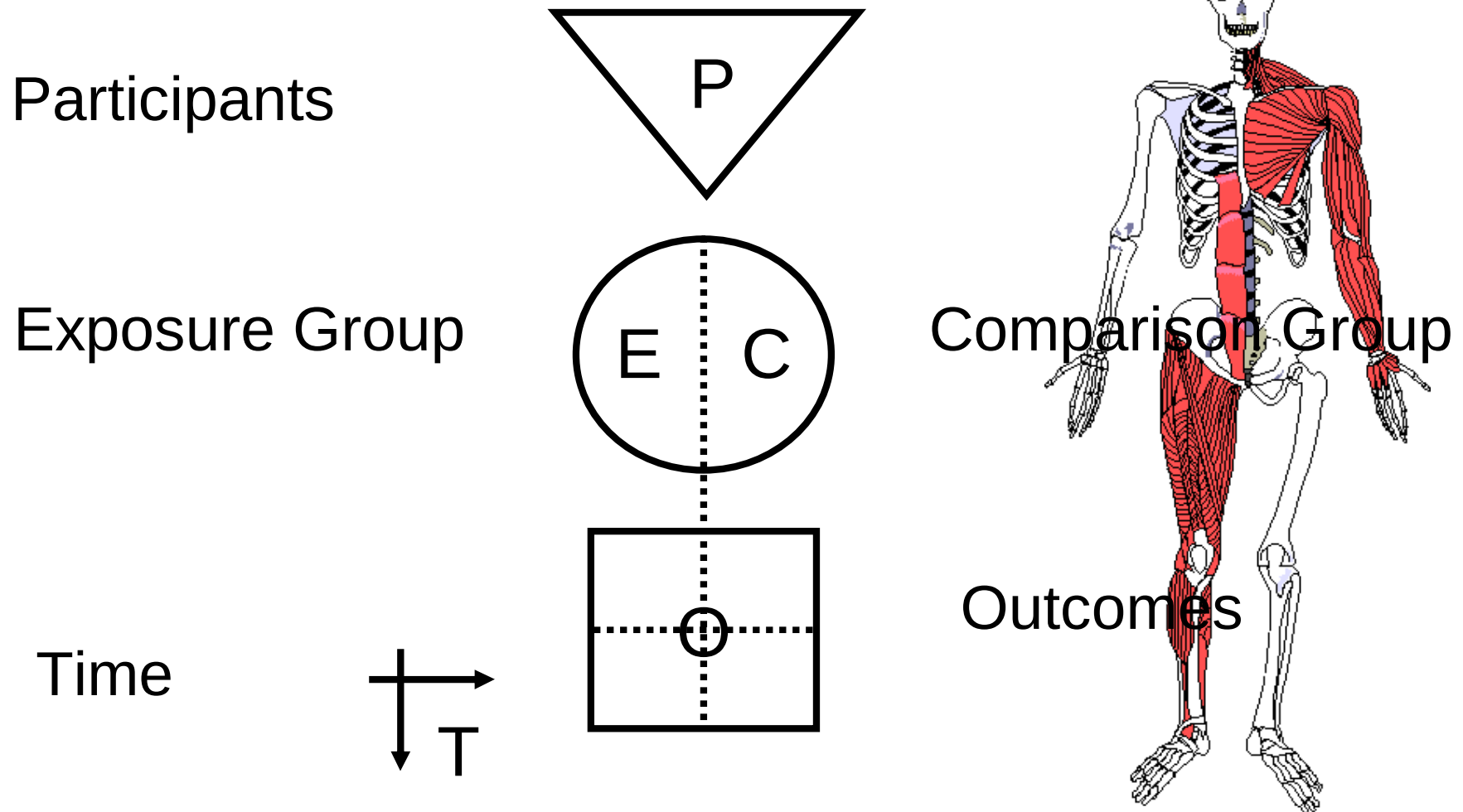


A picture: the GATE frame



the shape of every epidemiological study

The PECOT acronym: the 5 parts of every epidemiological study

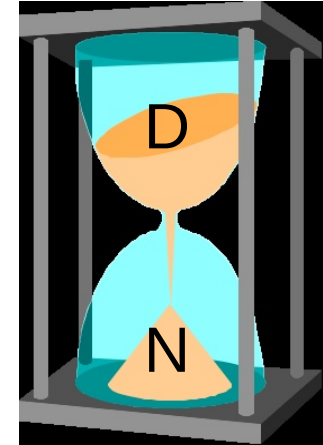


All epidemiological studies can be hung on the GATE frame

2 formulas: study analyses

1. Occurrence of disease

= Numerator $\div$ Denominator $\div$ Time



2. Random error (95% Confidence Interval)

= 1.96 x Standard Error

The RAMMbo* acronym: assessing study bias

P
E
C
O
T



Recruitment

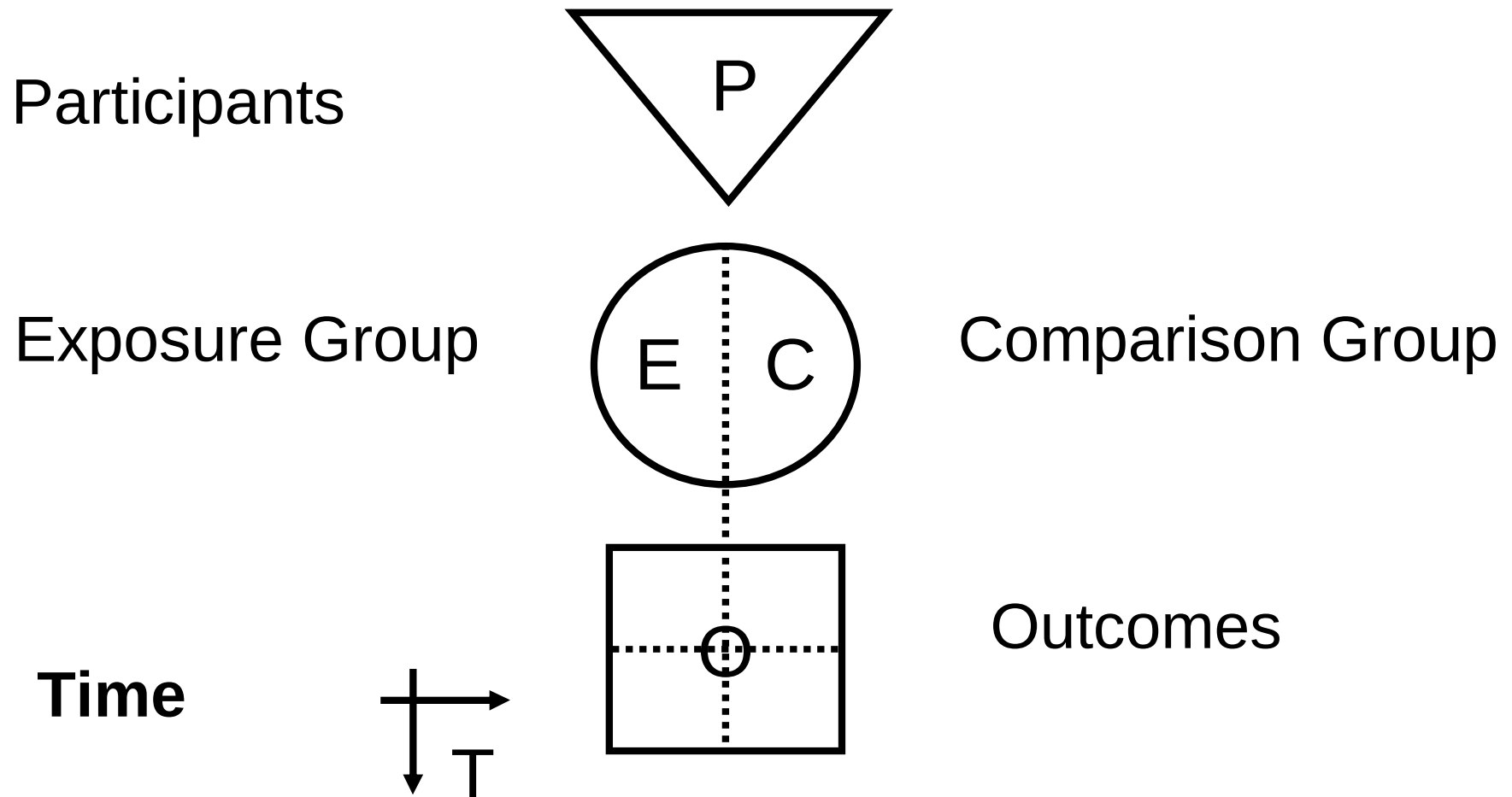
Allocation

Maintenance

Measurement of outcomes
blind or
objective

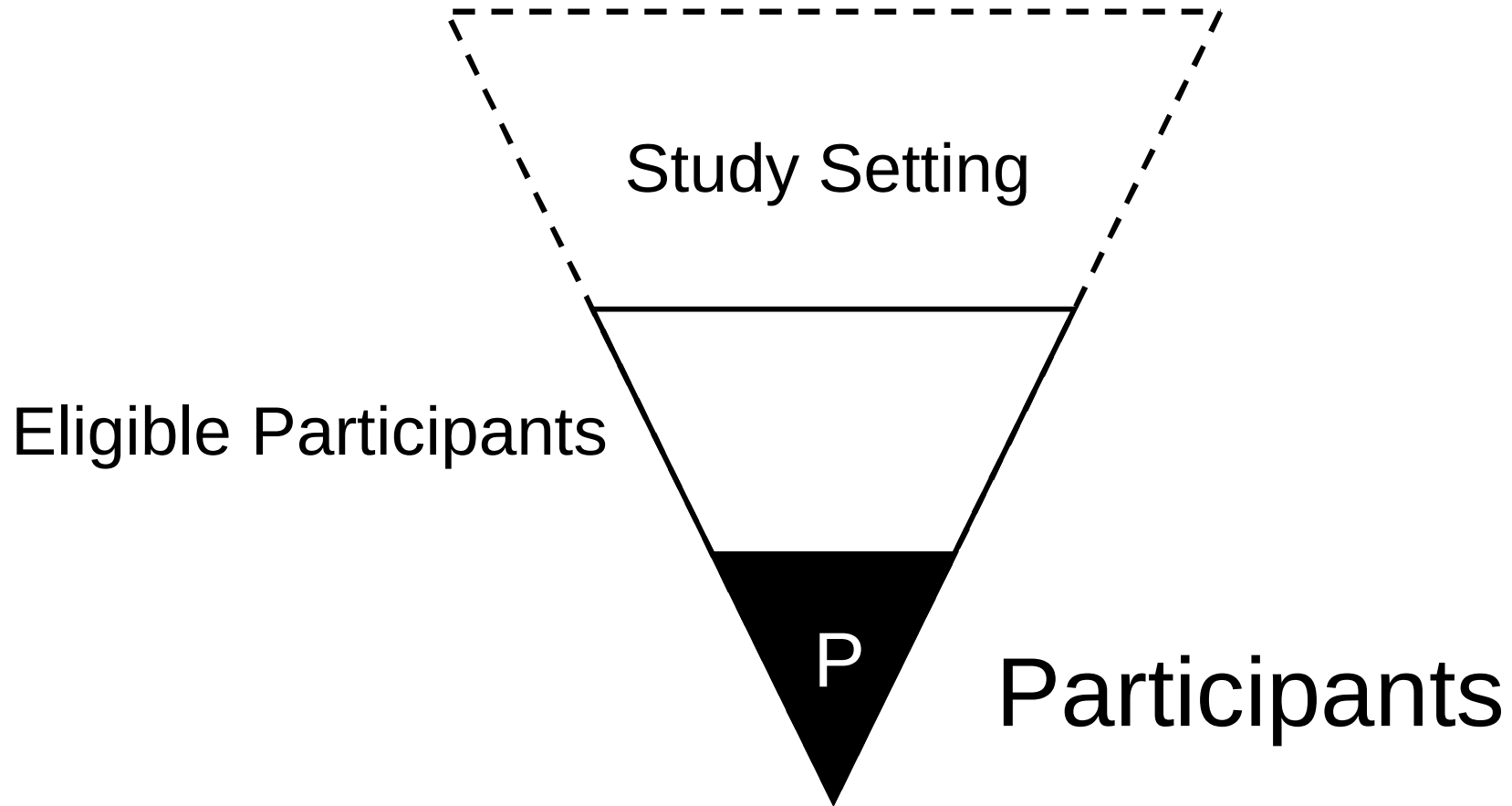
* Paul Glasziou

GATE frame picture & PECOT acronym

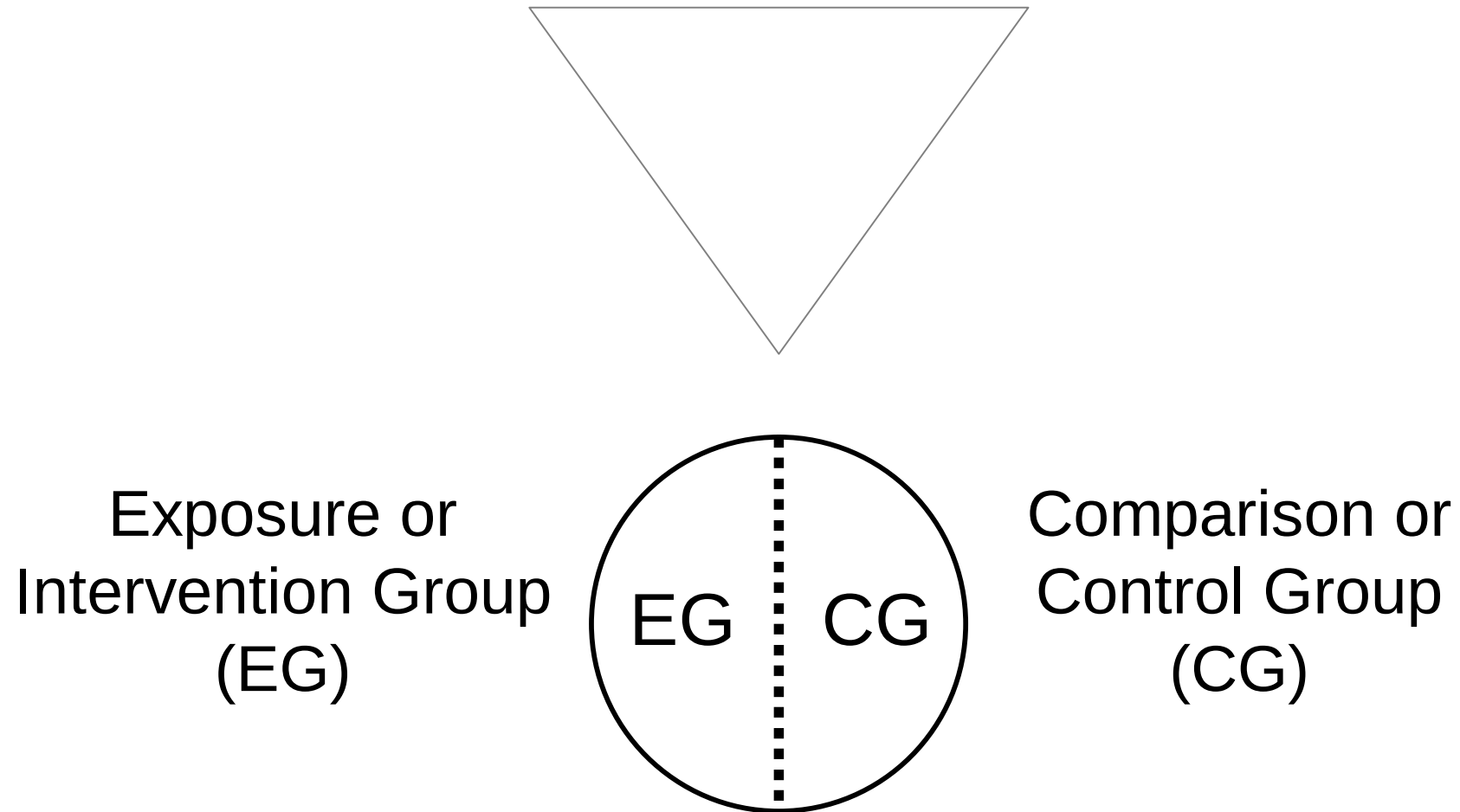


Describe a study's design by hanging PECOT on the frame

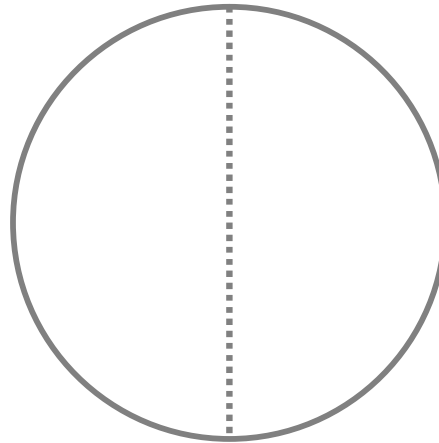
Participants



Exposure & Comparison Groups



Outcomes (O)



‘Dis-ease’

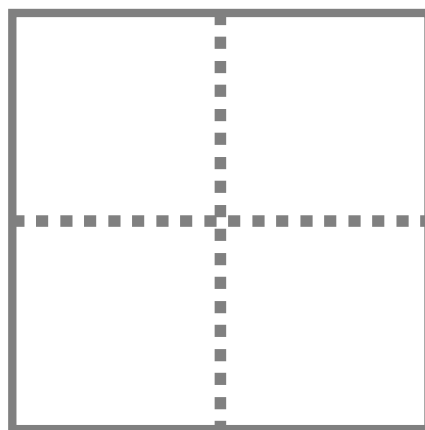
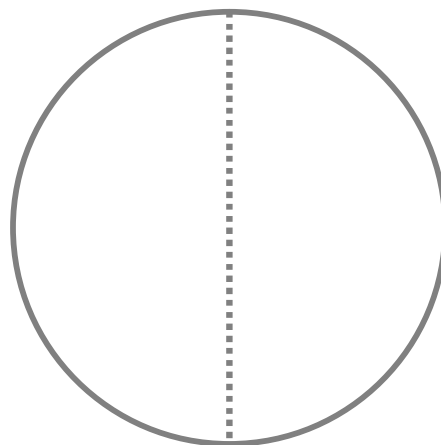
yes

no

a	b
c	d

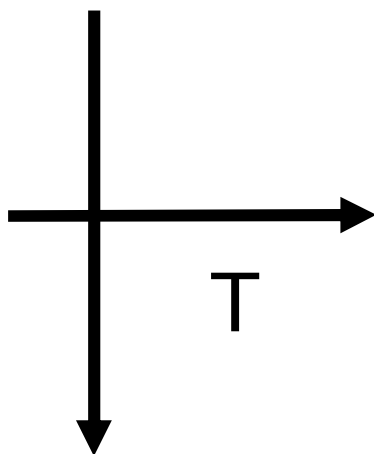
Outcomes (O)

Time (T)

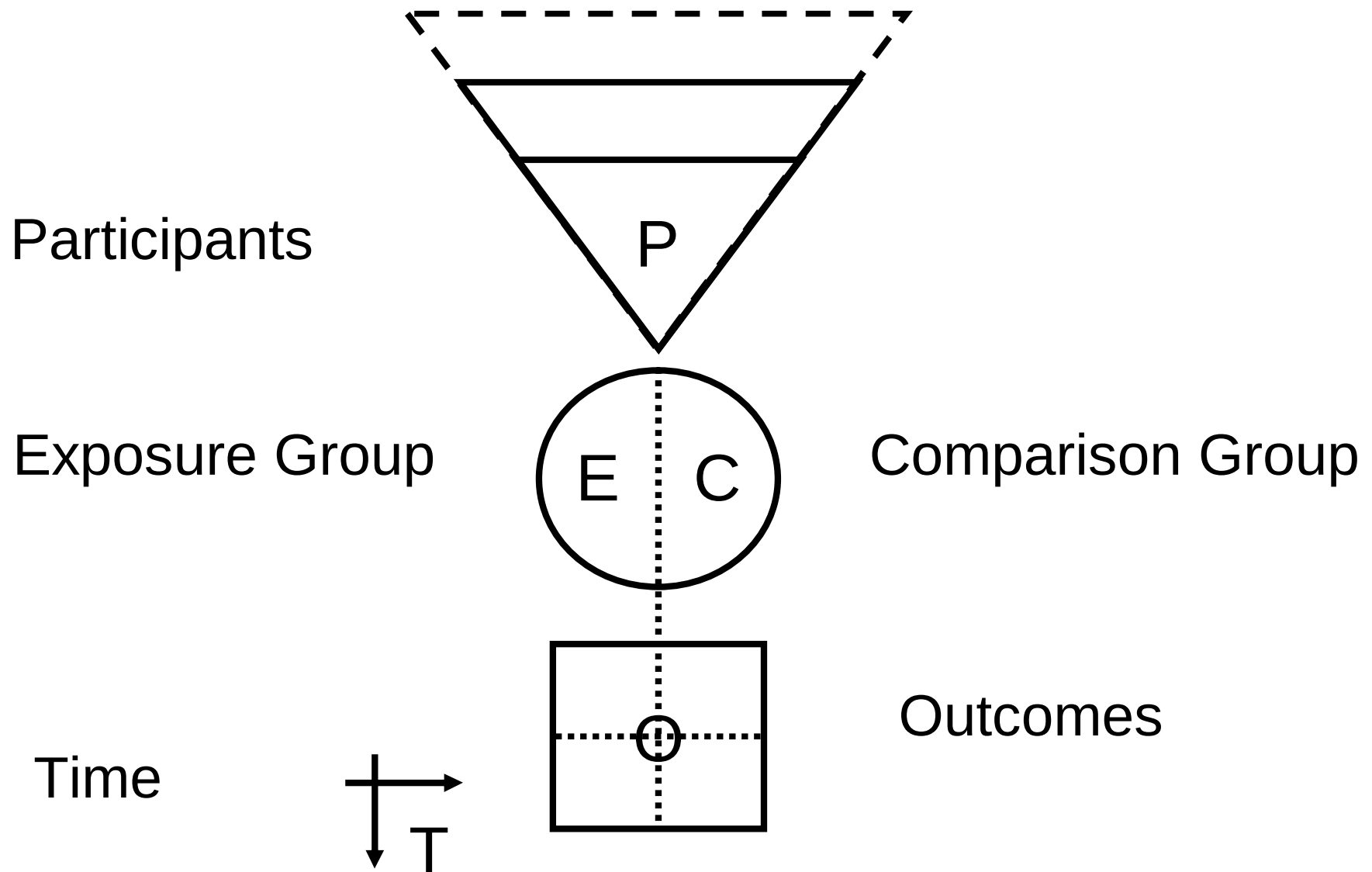


incidence

prevalence



Study design: GATE frame & PECOT



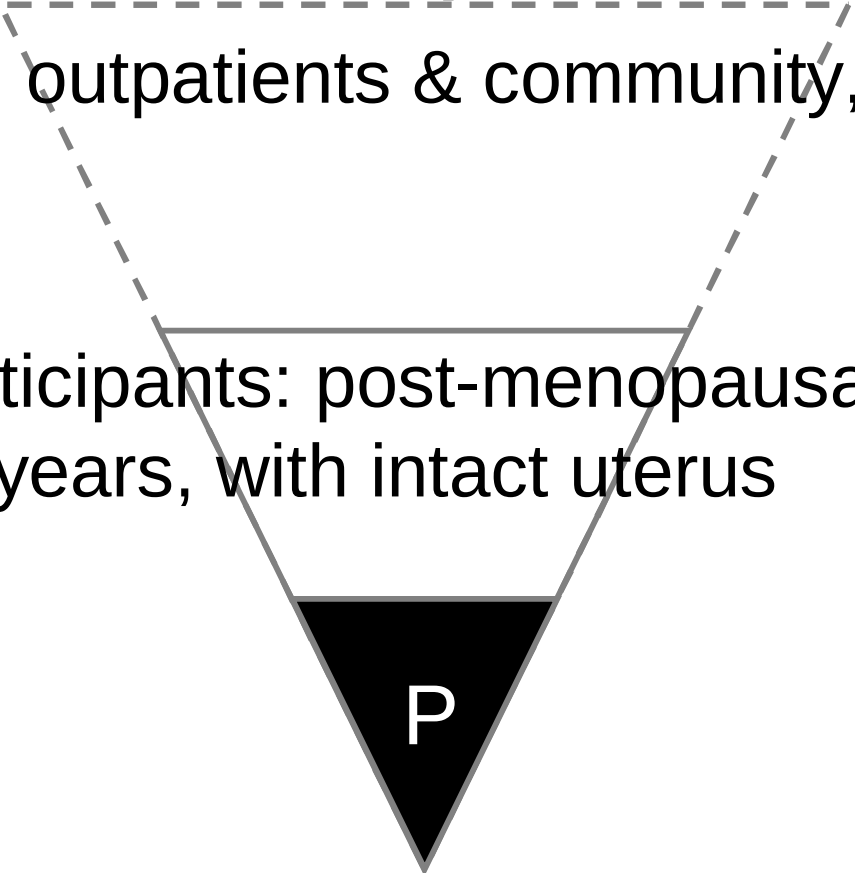
Every epidemiological study hangs on the GATE frame

HERS example JAMA 1998;280:605-613

Participants

Study Setting: outpatients & community, 20 US centres

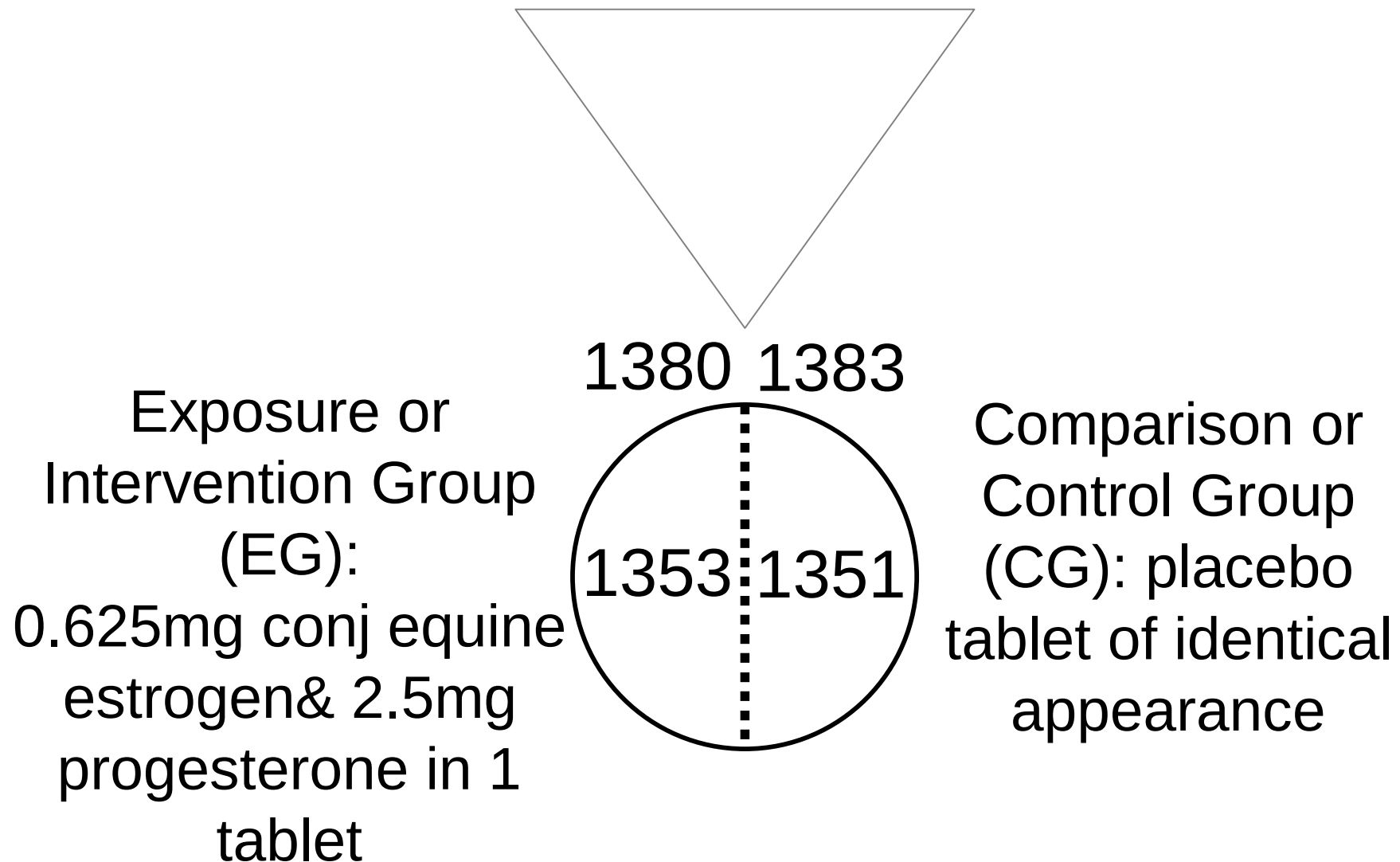
Eligible Participants: post-menopausal women with
CHD, < 80 years, with intact uterus



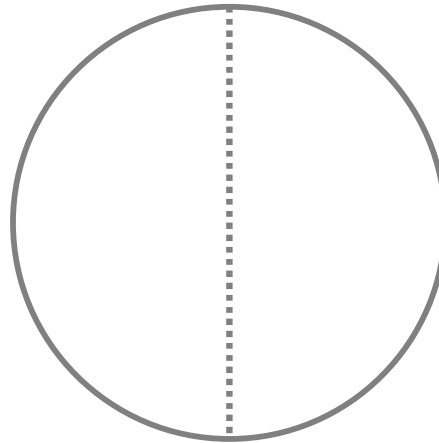
P

Participants: 2763, mean age 66.7 years

Exposure & Comparison Groups



Outcomes (O)



'Dis-ease': non-fatal MI or CHD death

yes

no

a= 172	b= 176
c	d

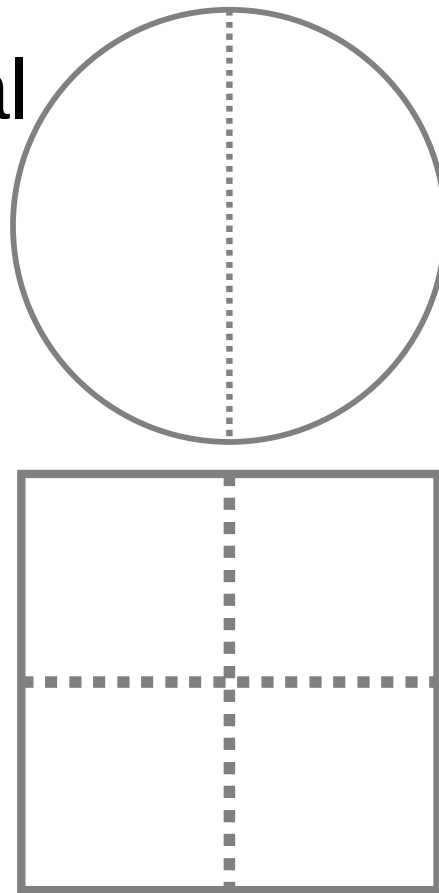
Outcomes (O)

Time (T)

Outcome: non-fatal
MI & CHD death



T= 4.1 years
(av. follow-up)



incidence

Time (T)

Outcome:
lipid levels



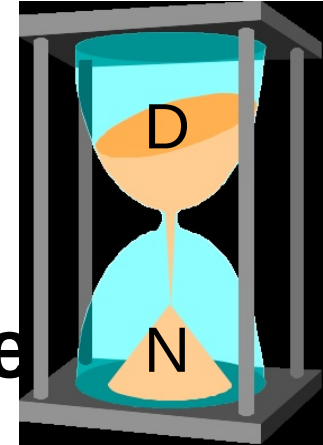
T = at 1 year

prevalence

2 formulas: study analyses

1. Occurrence of disease

$$= \text{Numerator} \div \text{Denominator} \div \text{Time}$$

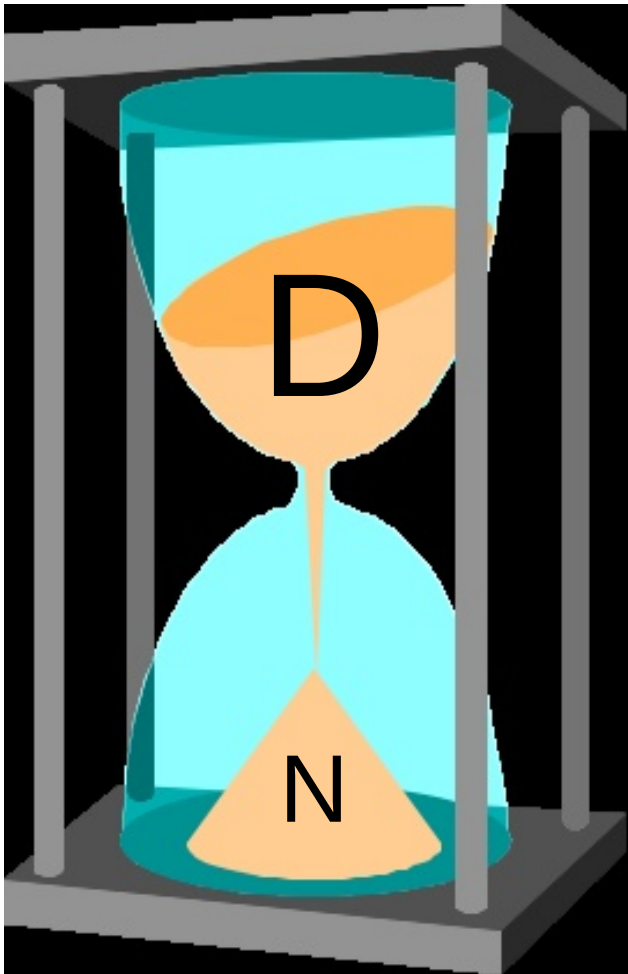


2. Random error (95% Confidence Interval)

$$= 1.96 \times \text{Standard Error}$$

All epidemiological studies involve measuring the OCCURRENCE of disease

Occurrence = Numerator $\div$ Denominator

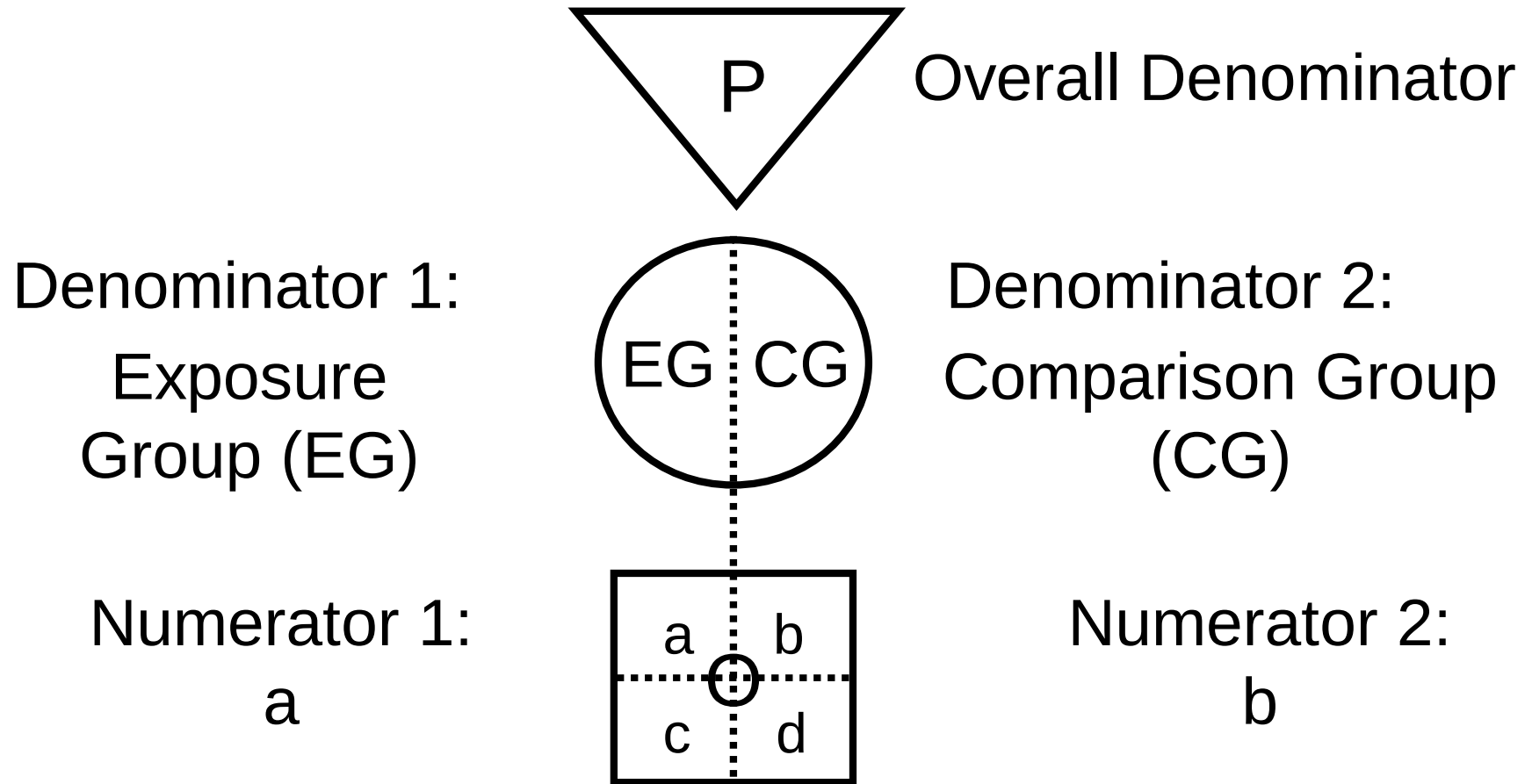


Denominator (Participants)

$$O = N \div D$$

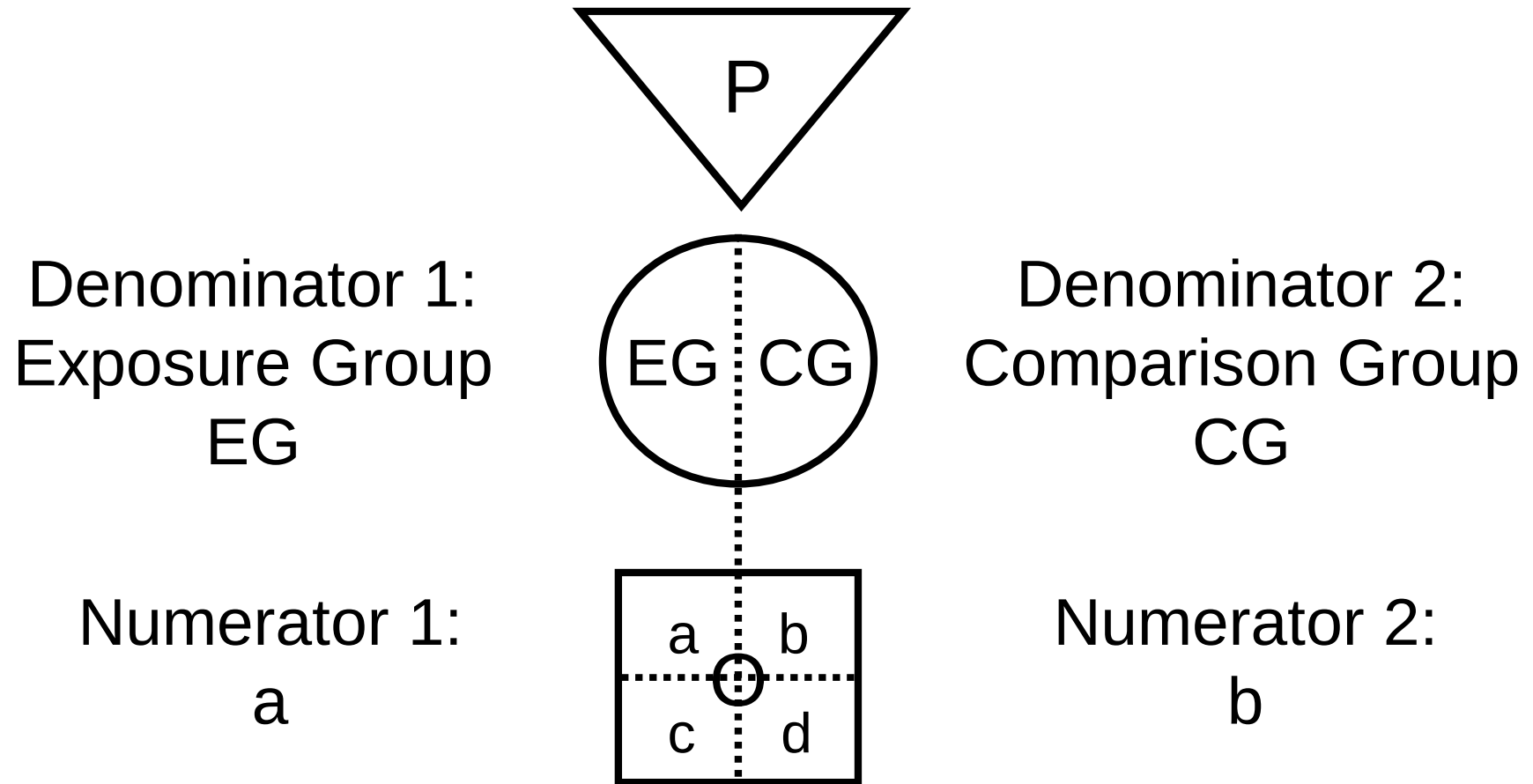
Numerator (Outcomes)

GATE study analyses



Describe a study's analyses by hanging the numbers on the frame

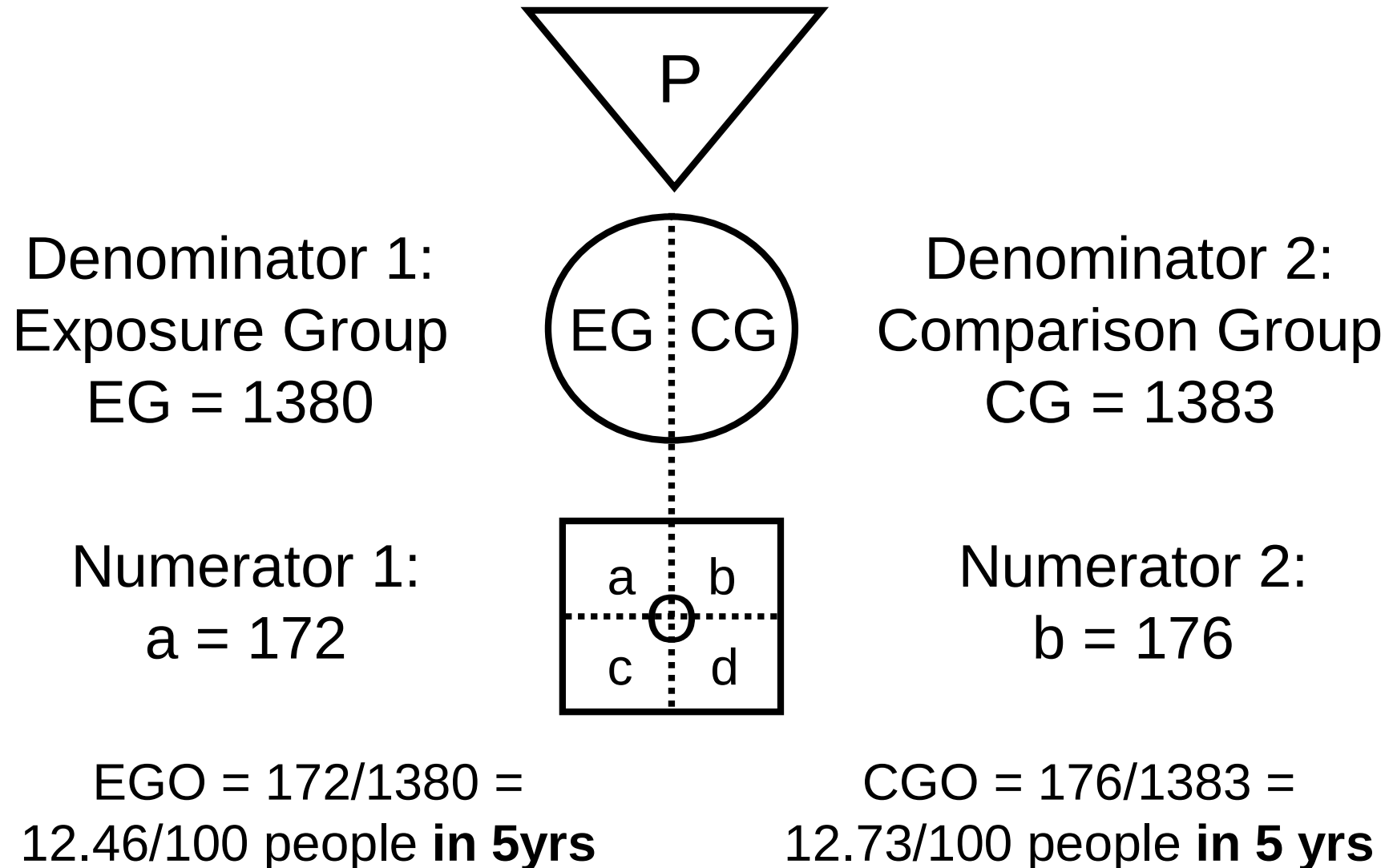
$$\text{Occurrence} = N \div D$$



Exposure Group Occurrence:
 $EGO = a \div EG$

Comparison Group Occurrence:
 $CGO = b \div CG$

Calculate EGO & CGO for the outcome 'MI & CHD death' in HERS



Describing differences between occurrences

Relative difference or Relative Risk = $EGO \div CGO$

Absolute Difference or Risk Difference = $EGO - CGO$

Number Needed To Treat (NNT) = $1 \div RD$

Analyses

it's all about EGO & CGO

The RAMMbo acronym: assessing study bias

P
E
C
O
T



Recruitment

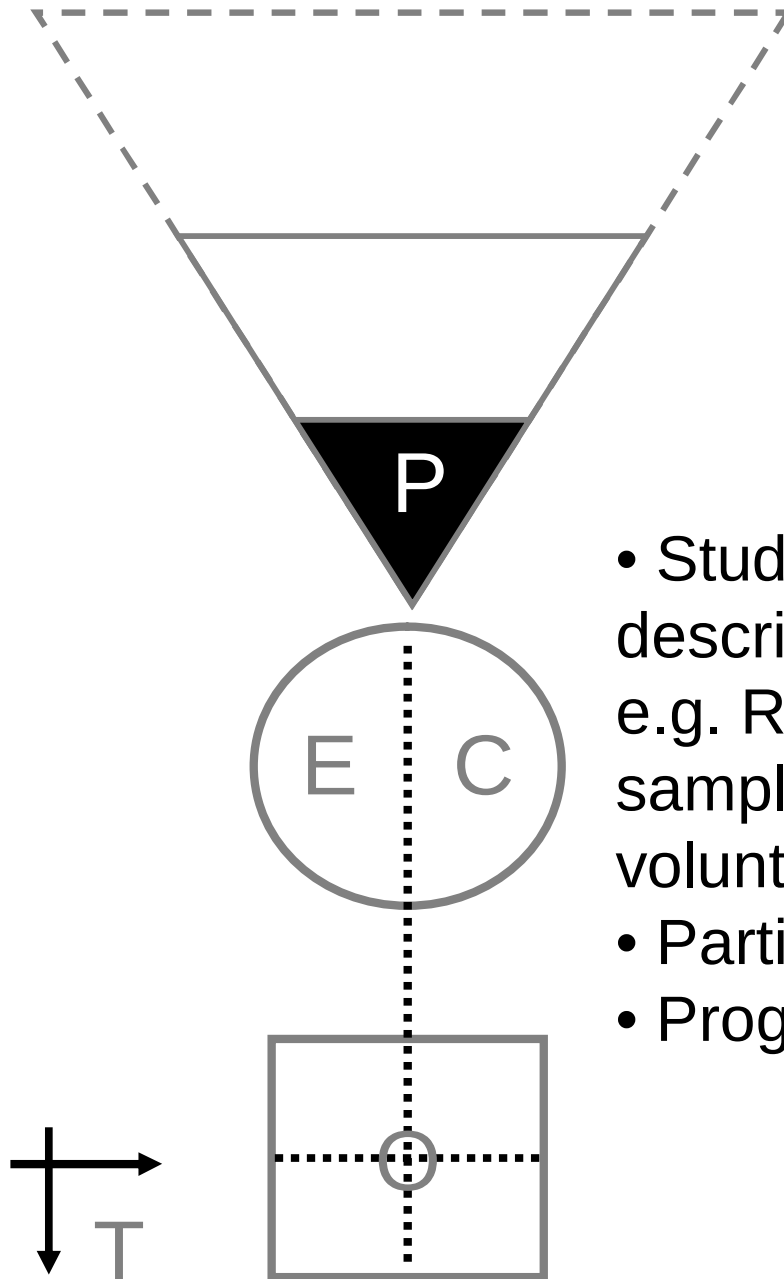
Allocation

Maintenance

Measurement of outcomes
blind or
objective

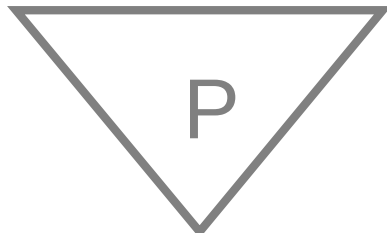
RAMMbo

appropriate **Recruitment**
processes?

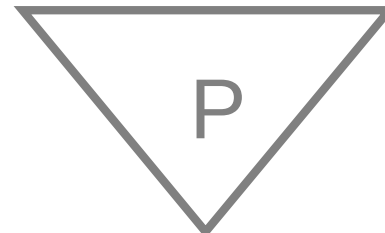


- Study setting & eligibility criteria well described?
e.g. Recruit random/representative sample OR consecutive eligibles OR volunteers from advertisements
- Participants representative of eligibles?
- Prognostic/risk profile appropriate?

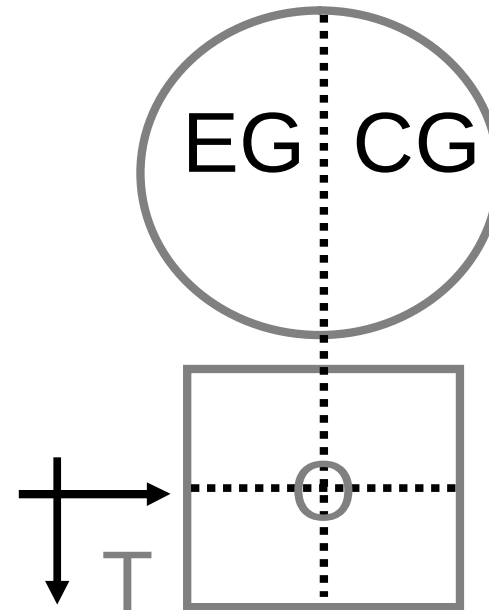
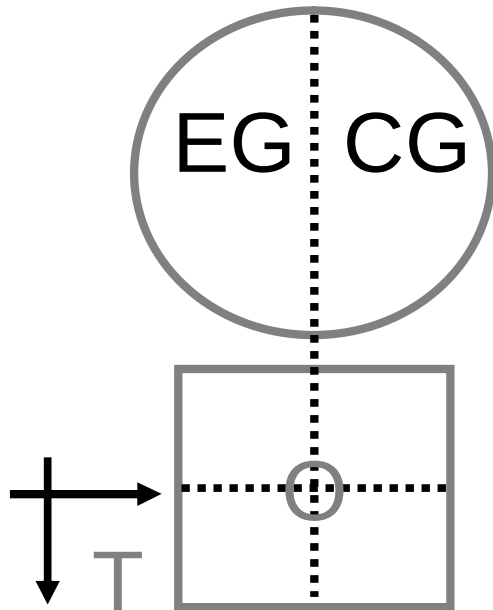
RAMBbo: A is for Allocation

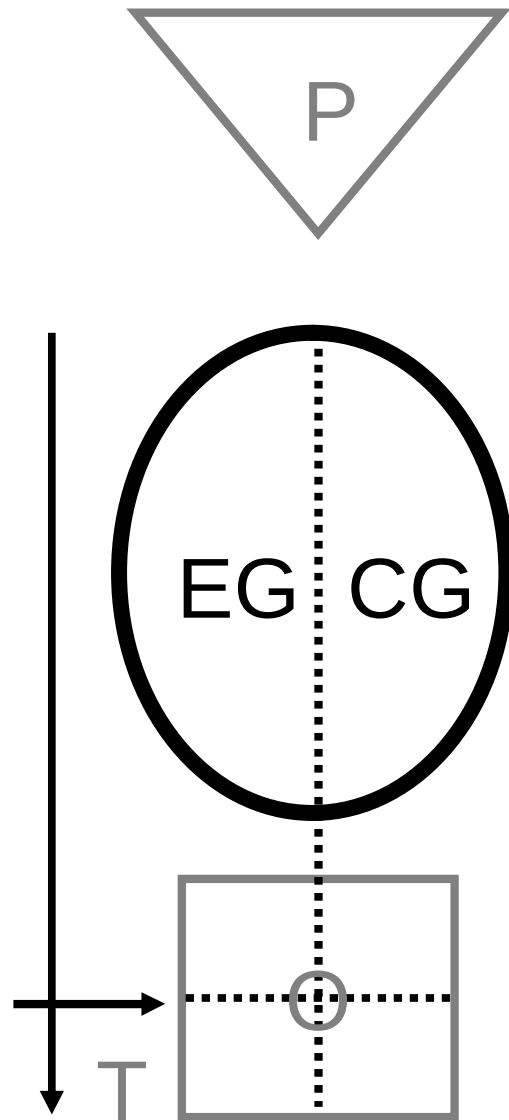


RCT: Allocate randomly by investigators (e.g. drugs)



Cohort: Allocate by measurement (e.g. smoking)





RAMMbo

good **Maintenance**?

did most participants remain
in allocated groups (EG &
CG)

Participants &/or investigators blind to
exposure (and comparison exposure)?

Compliance high & similar in EG &CG?

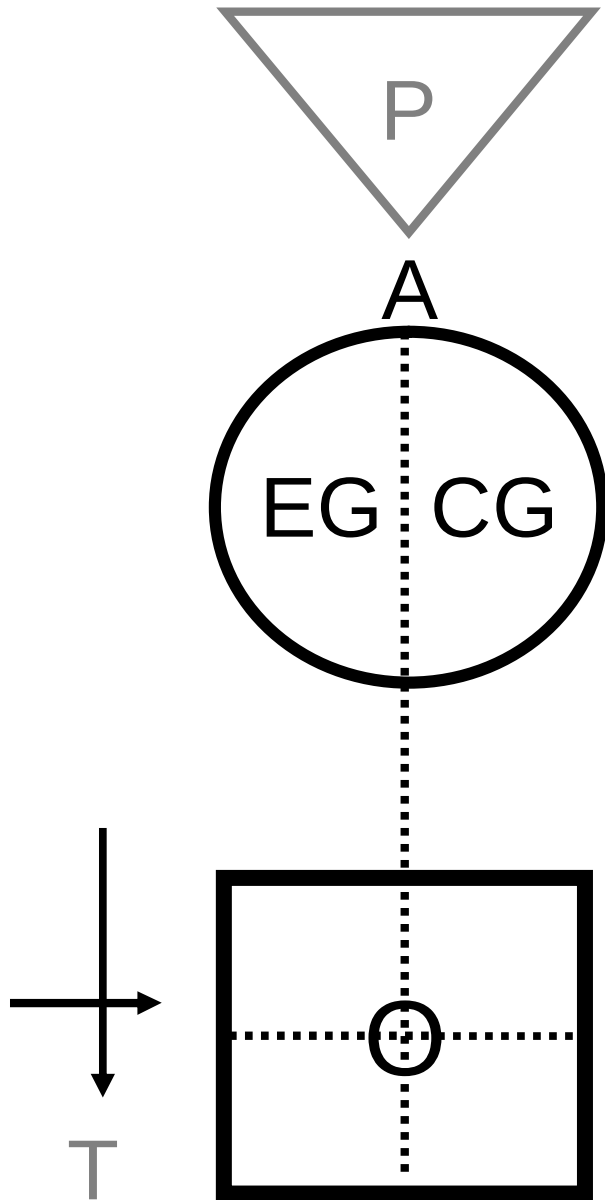
Contamination low & similar in EG &CG?

Co-interventions low & similar in EG &CG?

Completeness of follow-up high & similar in
EG &CG?

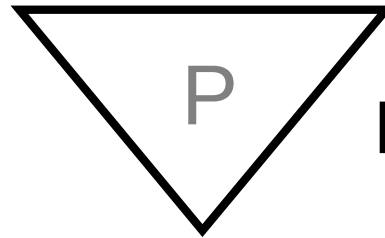
RAMMbo

**Measurement of outcomes
blind or objective?**



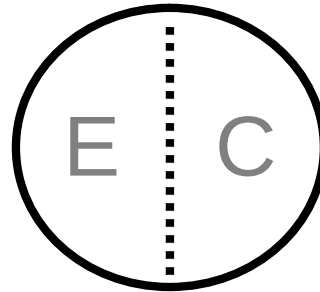
If outcome measurements not
Objective (eg. automated or
definitive) were investigators blind to
exposure (and comparison exposure)

The 4 (GATE) study biases

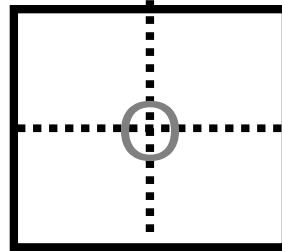
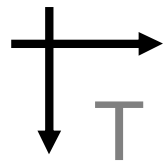


Recruitment bias

Allocation bias



Maintenance bias

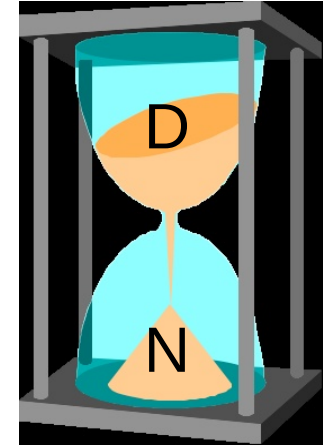


**Measurement (of
outcomes) bias**

2 formulas: study analyses

1. Occurrence of disease

= Numerator $\div$ Denominator $\div$ Time



2. **Random error (95% Confidence Interval)**

= 1.96 x Standard Error

Excel CATs& paper Gate-lites

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

Assessed by:	Assessed when?	Publication details:
RJ	1-Apr-06	Hulley et al. JAMA 1998;280:605-1

Populations

Source population
Eligible population
Participant population 2763

Exposure & Comparison

Participants in each group: Exposure Group (EG) 1380, Comparison Group (CG) 1383

Follow-up: dropped pre-intervention: [] completed follow-up: 1353 EG, 1351 CG

drop-outs / lost during/post-intervention: 27 EG, 32 CG

Percentage lost to follow up: 2% EG, 2% CG

Outcomes

If categorical... what e.g. death? non-fatal MI & CHD death

participants with outcome: 172 EG, 176 CG

without outcome: []

If continuous... what measure? HDL cholesterol (mmol/L) @ 1 year

mean: 1.40 EG, 1.27 CG

standard deviation: [] or, standard error: []

Time

Unit of time (e.g. year) if rate wanted: year

If rate wanted, enter average length of follow-up. If a proportion, enter 1.0: 4.10

Report results per (e.g. per 100): 1000 person-years

Results (unadjusted)

95% confidence intervals

Outcome	EG	CG	RR	RD	NNT
Categorical outcome: Intention to treat analyses	30.40	31.04	0.98	-0.64	-1563
95% CIs	26.11 to 35.20	26.70 to 35.88	0.79 to 1.21	-7.09 to 5.82	-146 to -172
Categorical outcome: On-treatment analyses	31.01	31.77	0.98	-0.76	-146
95% CIs	26.63 to 35.91	27.34 to 36.73	0.79 to 1.22	-7.34 to 5.82	-146 to -172
Continuous outcome: Analysis of means	1.40	1.27	1.10	0.13	
95% CIs					

Key outcome & analysis method, as published: Primary CHD events at 4 years, RH (relative hazard) reported (similar to RR), results very similar to that calculated above

Key results: 0.99

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

STUDY QUESTION: describe using **PECOT**

STUDY DESIGN: hang on **GATE** frame using numbers

STUDY BIAS: assess using **RAMMbo**

P = Participants:

SS: []

EP: Inclusion/Exclusion criteria: []

Method by which EP identified from SS: []

Method by which P recruited from EP: []

R = were P Recruited appropriately?

SS & Incl./Excl. criteria appropriate to study goals?

P representative of EP?

P risk/prognostic factor profile appropriate to study goals?

EG = Exposure Group [Intervention]

Description of E (& how measured if not RCT): []

CG = Comparison Group [Control]

Description of C (& how measured if not RCT): []

O = Primary (& 2° incl. adverse) Outcome

T = Time when outcomes counted

Description of O & how / when measured: []

Random Allocation OR Allocated by Measurement

EG Allocated [] CG Allocated []

EG completed follow-up [] CG completed follow-up []

EG incomplete follow-up [] CG incomplete follow-up []

A = how well were P Allocated to EG & CG?

If by random allocation: was it done well, was it concealed? EG & CG similar at baseline?

If by measurement: done well, same for EG & CG, done before outcomes occurred & measured?

M = were EG&CG Maintained as allocated?

P & Investigators blind to Exposure status?

Compliance high, Contamination low?

Co-interventions similar in EG & CG?

Completeness of follow-up high?

Mbo = were Measurements of Outcomes blind or objective?

Outcomes measured well?

Outcome & Time	EGO = a/EG	CGO = b/CG	RR = EGO/CGO	RD = EGO-CGO	NNT = 1/RD
Intention to treat analyses	30.40	31.04	0.98	-0.64	-1563
95% Confidence interval	26.11 to 35.20	26.70 to 35.88	0.79 to 1.21	-7.09 to 5.82	-146 to -172
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Analysis of means	1.40	1.27	1.10	0.13	
95% Confidence interval					

Analyses: Intention to treat (if intervention study)? Adjusted for confounding if EG & CG unbalanced? Was random error (95% CI) able to explain results?

Summary: Size of effect (RR or RD)? Amount & direction of bias (RAMMbo)? Amount of random error (width of CI)? Power/sample size sufficient (if 95% CI for RR includes 1.0 or for RD includes 0)? Any adverse effects? Applicability?

There is a GATE for every study design
www.epiq.co.nz

Including SRs & meta-analyses (the 3rd acronym!)

- **F**ind *appropriate studies*?
- **A**ppraise *selected studies*?
- **I**nclude *only valid studies*?
- **T**otal-up (*synthesise*) *appropriately*?
- **H**eterogeneity *adequately addressed*?