

Rapid critical appraisal
using GATE

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February 2011

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GATE: Graphic Appraisal Tool for
Epidemiology

1 picture, 2 formulas & 3 acronyms

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One picture: the GATE frame

the shape of every epidemiological study

3

British doctors

smoking status measured

smokers non-smokers

Lung cancer yes no

10 years

Longitudinal (cohort) study

4

British doctors

smoking status measured

smokers non-smokers

Lung function normal abnormal

Cross-sectional study

5

British doctors

Randomised to aspirin or placebo

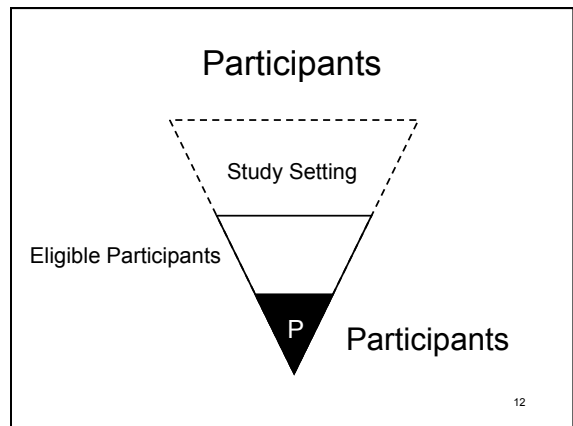
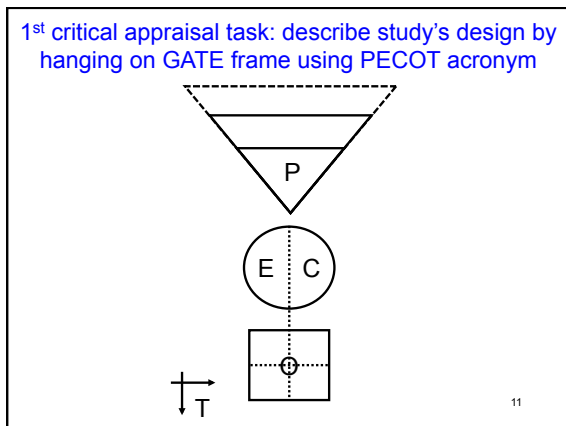
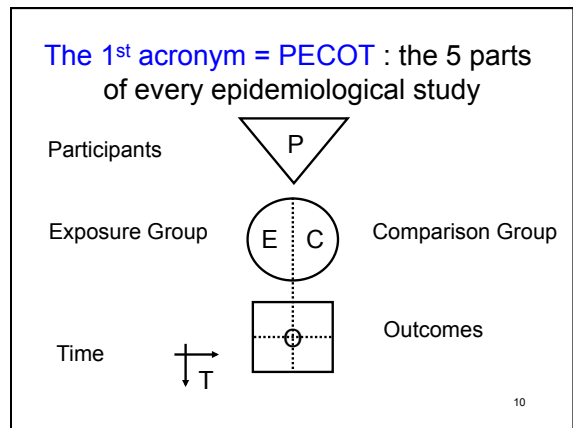
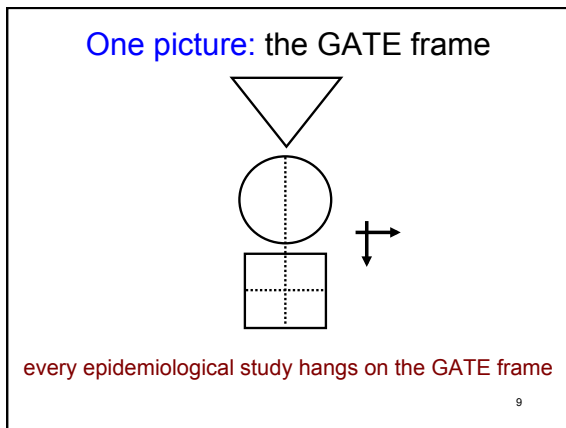
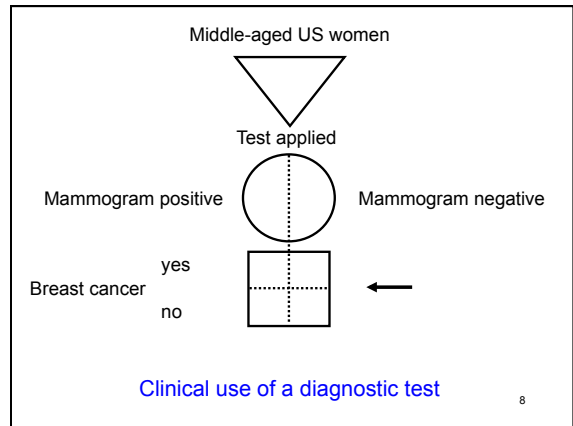
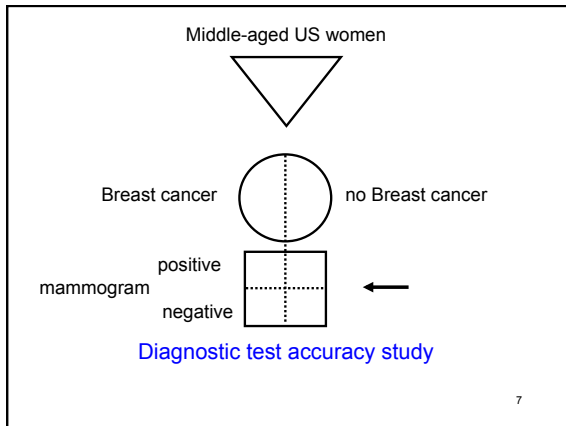
aspirin placebo

Myocardial infarction yes no

5 years

RCT

6



DVT in long-haul flights: Lancet 2001;357:1485-9

Participants

Study Setting: London, UK, ? 1990s

Eligible Participants: no previous DVT, > 50 yrs, planned economy air travel 2 sectors > 8 hours

Participants: 231, mean age 61-62 years

P

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Exposure & Comparison Groups

Exposure or Intervention Group (EG)

Comparison or Control Group (CG)

14

Exposure & Comparison Groups

231

115 116

Exposure or Intervention Group (EG):
Below knee compression stockings

Comparison or Control Group (CG):
no stockings

15

Exposure & Comparison Groups

231

115 116

100 100

Exposure or Intervention Group (EG):
Below knee compression stockings

Comparison or Control Group (CG):
no stockings

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Outcomes (O)

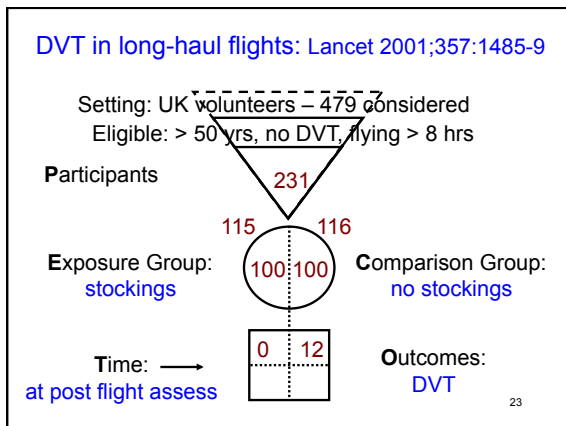
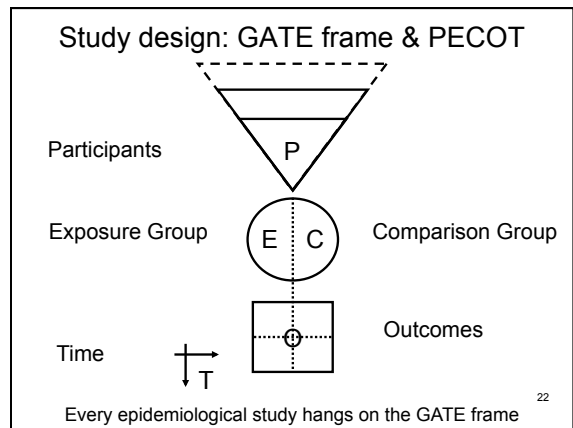
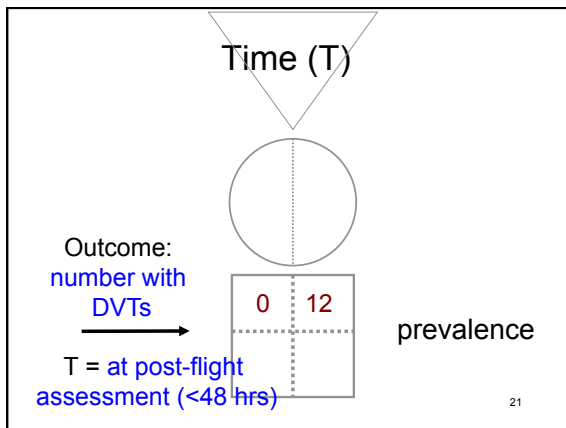
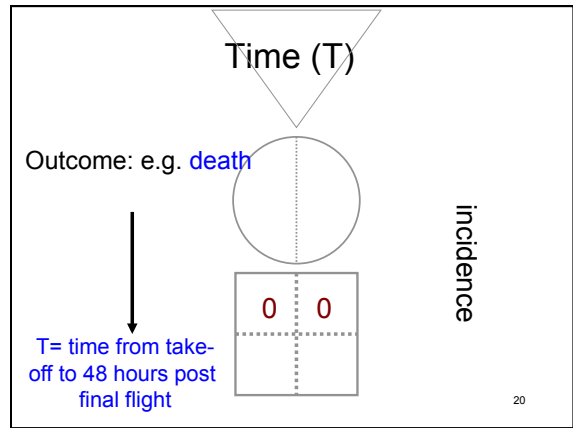
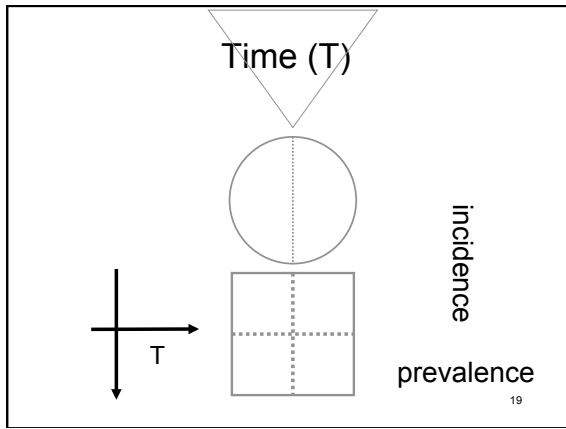
| | | | | |
|------------|-----|---|---|--------------|
| | yes | a | b | |
| 'Dis-ease' | no | c | d | Outcomes (O) |

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Outcomes (O)

| | | | | |
|-----|-----|------|-------|---------------------|
| | yes | a= 0 | b= 12 | |
| DVT | no | c | d | Primary Outcome (O) |

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Questions?

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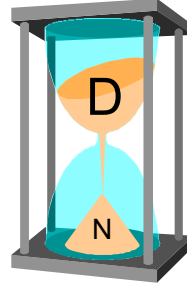
The 1st formula: study analyses

Occurrence (risk) of disease
= Numerator ÷ Denominator



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All epidemiological studies involve measuring the OCCURRENCE of 'outcomes'



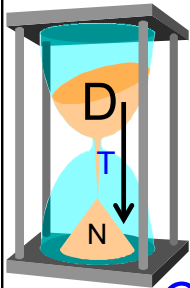
Denominator (Participants)

Numerator (Outcomes)

$Occ = N \div D$

26

All epidemiological studies involve measuring the OCCURRENCE of 'outcomes'



Denominator (Participants)

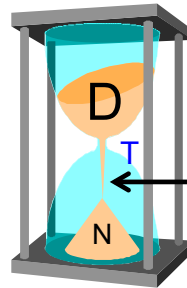
During what period of time (T) was N measured? (incidence)

Numerator (Outcomes)

$Occ = N \div D (?T)$

27

All epidemiological studies involve measuring the OCCURRENCE of 'outcomes'



Denominator (Participants)

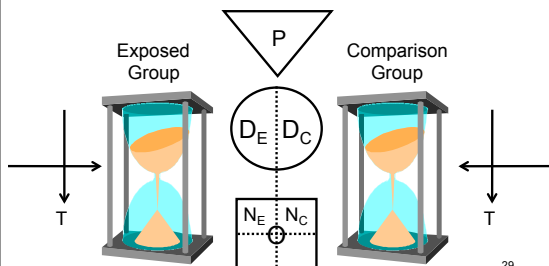
At what point in time (T) was N measured? (prevalence)

Numerator (Outcomes)

$Occ = N \div D (?T)$

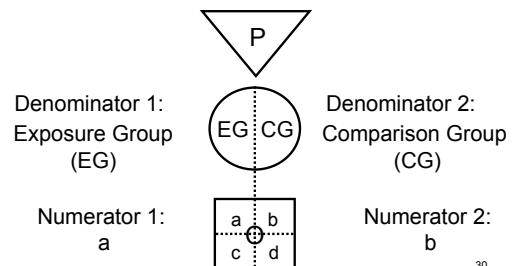
28

The 1st formula:
Occurrence (risk) = Numerator ÷ Denominator

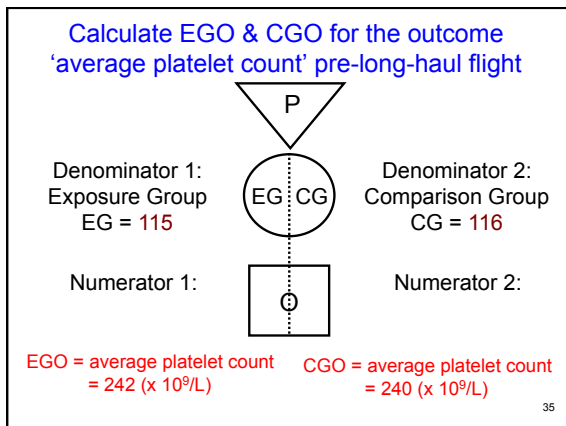
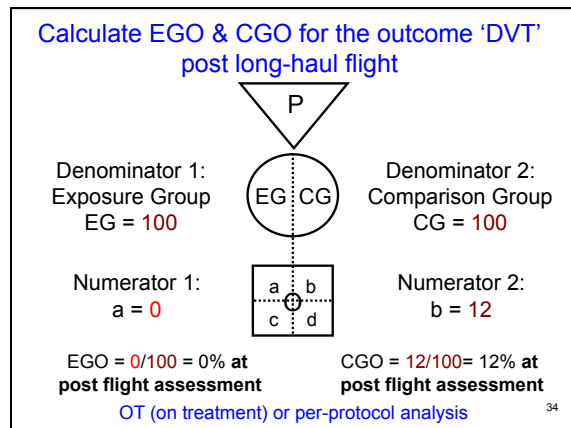
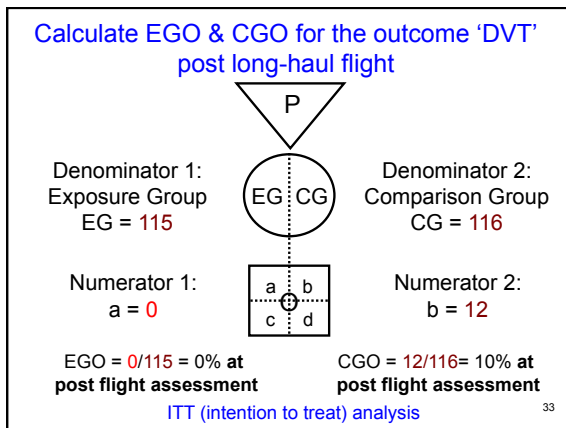
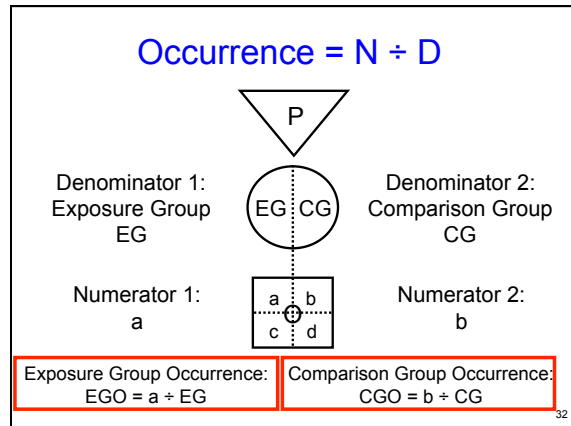
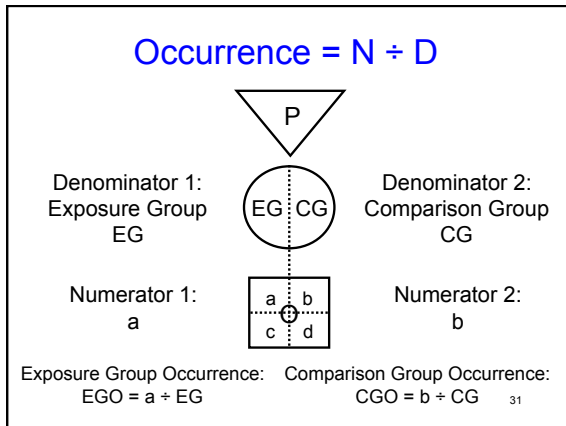


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2nd appraisal task: describe analyses by hanging numbers on the GATE frame and calculating occurrences in exposure & comparison groups



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Describing differences between occurrences

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

Absolute Difference or Risk Difference = $EGO - CGO$

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

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Describing differences between occurrences

Relative difference or Relative Risk = EGO ÷ CGO
 = 0/115 (0%) ÷ 12/116 (10%) = 0%/10% = 0

Absolute Difference or Risk Difference = EGO - CGO
 = 0/115 (0%) - 12/116 (10%) = - 10% (-10/100)

Number Needed To Treat (NNT) = 1 ÷ RD
 = 1 ÷ (- 10 /100) = - 100/10 = 10

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'if 10 people wore compression stockings 1 DVT would be prevented'

Describing differences between occurrences (averages/means)

Relative difference or Relative Mean= EGO ÷ CGO

Absolute Difference or Mean Difference = EGO - CGO

~~Number Needed To Treat (NNT) = 1 ÷ RD~~

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Study analyses

it's all about EGO & CGO

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Questions?

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The 2nd acronym = RAMBO* : assessing bias 'strength of study'



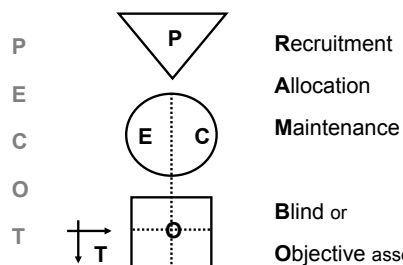
P
E
C
O
T

Recruitment
Allocation
Maintenance
Blind or
Objective assessment of
outcomes

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* Paul Glasziou

The 2nd acronym = RAMBO* : assessing systematic error (i.e. bias)



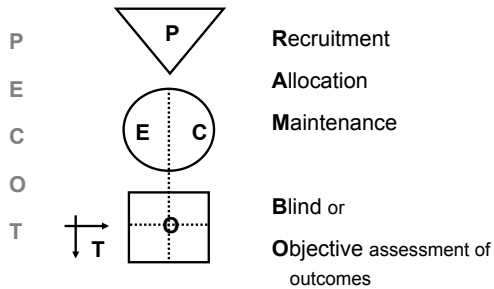
P
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O
T

Recruitment
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* Paul Glasziou

3rd appraisal task: assess the degree of bias by applying the RAMBO acronym



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RAMBO

were **Recruitment** processes appropriate to study goals?

- 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 to study question?

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RAMBO

were **Recruitment** processes appropriate to study goals?

- Study setting & eligibility criteria well described?
Recruited volunteers from advertisements; eligibility criteria well described
- Participants representative of eligibles?
479 considered, 248 excluded - probably
- Prognostic/risk profile appropriate to study question? **yes**

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RAMBO: A is for Allocation

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

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

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

were EG & CG similar at baseline?

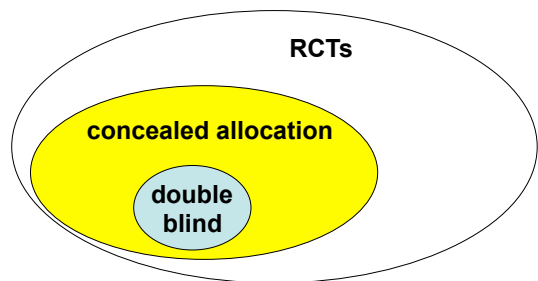
46

Successful randomisation depends on 2 inter-related processes

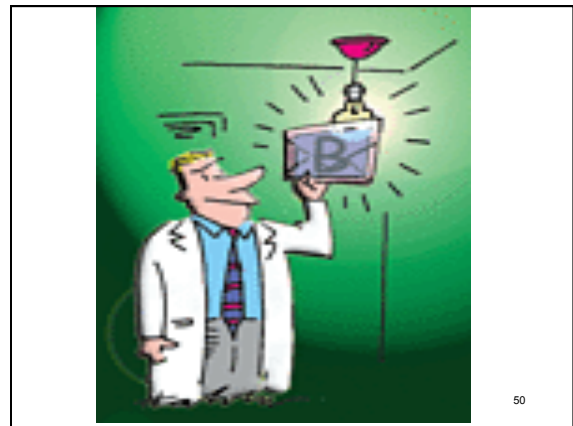
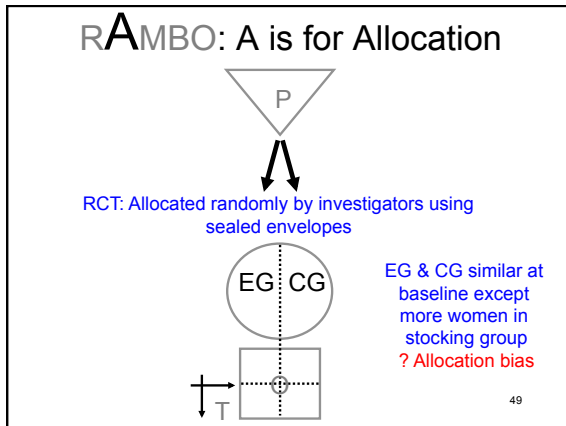
- Generating a random number sequence to allocate participants
- Concealing those involved (participants & investigators) from knowing to which group a participant will be allocated

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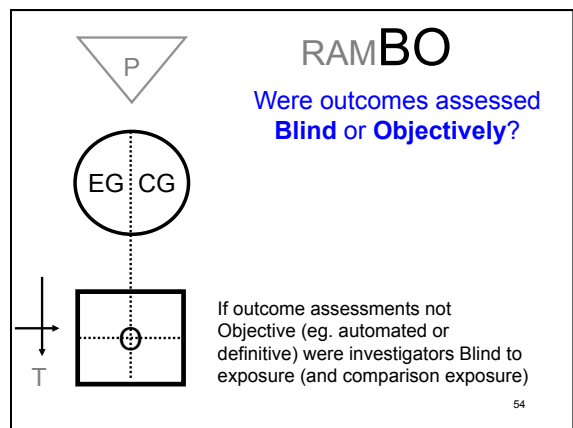
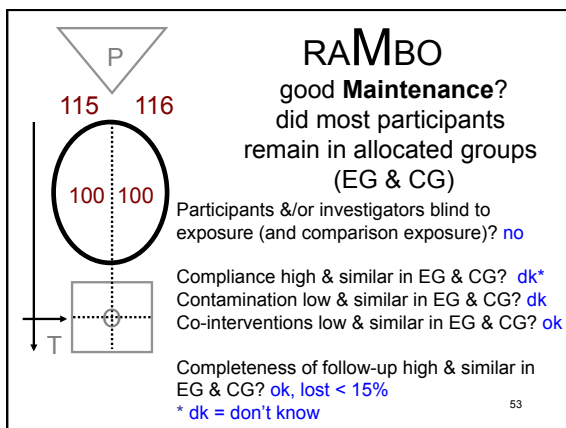
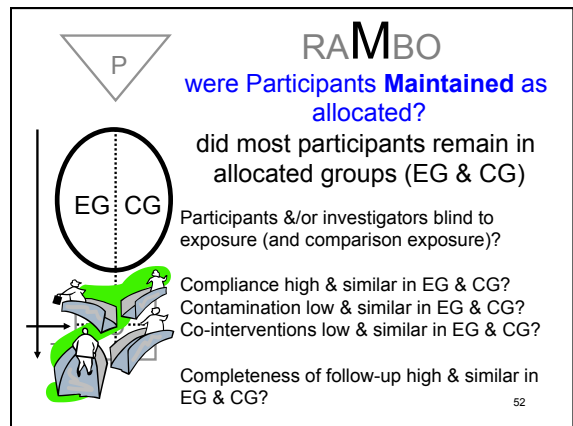
Allocation concealment & double blinding

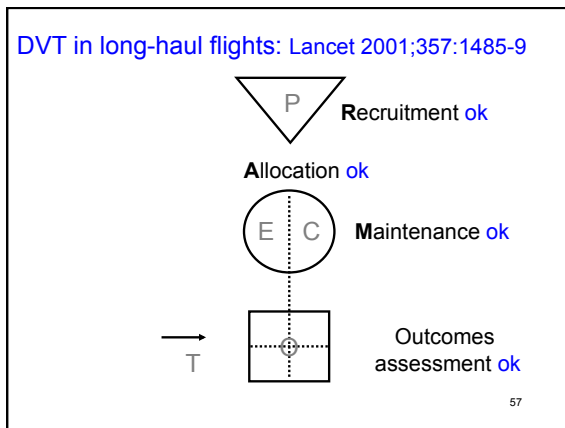
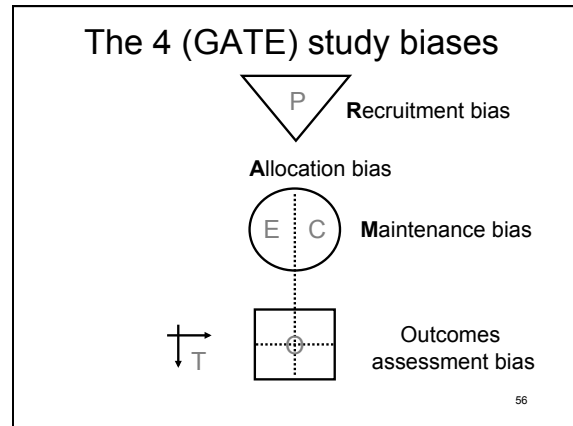
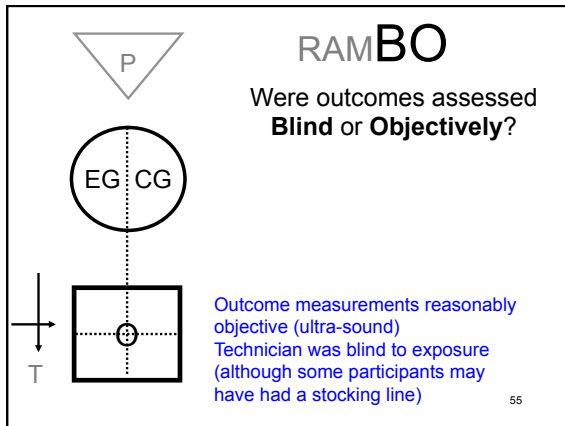


Concealment happens during randomisation, blinding happens after



- ### Inadequate allocation concealment & estimates of treatment effects
- Study of 250 randomised control trials of pregnancy and childbirth (Schulz et al. JAMA 1995;273:408)
 - Results: studies with inadequate or unclear allocation concealment **overestimate** Rx effects by 30-40%
 - Moher et al 1998-Other trials on heart disease, stroke, mental health.
 - Results: On average inadequate concealment yields 37% **larger** estimates of effect (Moher et al. Lancet 1998;352:609)





Questions?

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The 2nd formula: assessing random error

Random error = 95% Confidence Interval
(1.96 x Standard Error)

4th appraisal task: assess degree of random error in study findings using the 2nd formula

Random error = 95% Confidence Interval
 EGO = 0%; 95% CI = 0% - 3%
 CGO = 10%; 95% CI = 4.8% - 16%

Excel CATs & paper Gate-lites

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

Final appraisal task: search for & appraise SRs / meta-analyses using 3rd acronym (FAITH)

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

Muhammad Shafique Sajid et al. Knee-length graduated compression stockings for thromboprophylaxis in air travellers: A meta-analysis. *Int J Angiol.* 2008; 17: 119–123.

Nine trials studying participants using KL stockings were analyzed. Forty-six of 1261 participants randomly assigned to the control group developed deep vein thrombosis (DVT), compared with two of 1237 participants (0.16%) in the KL stockings group.There was an absolute difference of 3.4% in the incidence of DVT, in favour of KL stockings. The number needed to treat with KL stockings to avoid one case of DVT was 29.4. However, there was significant heterogeneity among trials. The RR for DVT was 0.08 in high-risk participants and 0.14 in low- to medium-risk participants.