GATE:
Graphic Appraisal Tool for Epidemiology

1991

2015

1 picture, 2 formulas & 3 acronyms
GATE:

Graphic Appraisal Tool for Epidemiology

Graphic Architectural Tool for Epidemiology

Graphic Approach To Epidemiology

making epidemiology accessible
presentation outline

GATE is a framework for:

1. study design
2. study analysis
3. study error
4. practicing EBM
GATE: a framework for study design

1 picture

every epidemiological study can be hung on the GATE frame
**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*
1st acronym: PECOT

- Participants: British doctors randomly allocated to aspirin or placebo
- Exposure: aspirin
- Comparison: placebo
- Outcomes: MI yes, MI no
- Time: 5 years

randomised controlled trial
middle-aged Americans

body mass index measured

overweight

‘normal’ weight

diabetes status measured in all participants

yes

no

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
smokers

lung cancer

non-smokers

smoking status measured

cases

controls

case-control study
(all nested in virtual cohort studies)
GATE: a framework for study analysis:

1st formula: occurrence = outcomes \div \text{population}

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

1 picture, 2 formulas & 3 acronyms
1\textsuperscript{st} formula: occurrence of outcomes = \frac{\text{number of outcomes}}{\text{number in population/group}}

Participants Population

Exposure Group
smokers

Comparison Group
non-smokers

Outcomes
Lung cancer

yes

no

British doctors

smoking status measured

\[ a \quad b \quad \frac{a}{a+b} \quad T \]

Time
10 years
British doctors

smoking status measured

Exposure Group
smokers

Comparison Group
non-smokers

Outcomes
Lung cancer

Exposure Group Occurrence (EGO) = \( \frac{a}{\text{EG}} \)
= number of outcomes (a) ÷ number in exposed population (EG)

Time
10 years
Comparison Group Occurrence (CGO) = \( \frac{b}{CG} \)

= number of outcomes \( (b) \) ÷ number in comparison population \( (CG) \)

Population

randomly allocated

Exposure Group

aspirin

Comparison Group

placebo

Outcomes

MI

yes

no

Time

5 years

Comparison Group Occurrence (CGO) = \( \frac{b}{CG} \)
Epidemiology = Numerator ÷ Denominator

- Participant Population
  - middle-aged American women
  - receive mammogram screening test

- Exposure Group
  - mammogram positive

- Comparison Group
  - mammogram negative

- Outcomes
  - breast cancer
  - yes
  - no
  - Time

- EG: Exposure Group
- D: Denominator
- N: Numerator
the goal of all epidemiological studies is to calculate **EGO and CGO**

**British doctors**

- Smoking status measured

**smokers**

- EG: Occurrence (risk) of cancer in smokers
- CG: Occurrence of cancer in non-smokers

- yes: a
- no: b

**10 years**

**CGO: Occurrence of cancer in non-smokers**

- T
Middle-aged Americans

Body Mass Index (BMI) measured

High BMI

Low BMI

EGO:
Average blood glucose in EG

CGO:
Average blood glucose in CG
Middle-aged American women

Gold Standard

Breast cancer  no Breast cancer

positive  negative

mammogram

EGO: likelihood of a positive mammogram if breast cancer

CGO: likelihood of a positive mammogram if no breast cancer
1st 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\textsuperscript{nd} acronym: RAMBOMAN

1 picture, 2 formulas & 3 acronyms
Recruitment of participants

‘who are the findings applicable to?’
**RAMBOMAN:** ‘were participants well *Allocated* to exposure & comparison groups?’

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

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

EG & CG similar at baseline?

EG & CG

E & C measures accurate?

EG & CG
‘were Participants well *Maintained* in the groups they were allocated to?’

completeness of follow-up compliance
contamination co-interventions
RAM\textbf{BoM}AN

‘were outcomes well \textbf{Measured}?’

were they measured \textbf{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?
"were the **ANalyses** done well?"

Adjustment for baseline differences / confounding?
GATE: random error: 2\textsuperscript{nd} 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: 

3rd acronym: FAITH
systematic review: a study of studies

study sources

studies screened

studies appraised & allocated:

included

excluded

studies summarised & pooled if homogeneous
critical appraisal of SR: FAITH

Find

Appraise

Include

Total

Heterogeneity?

study sources

studies screened

studies appraised & allocated:

included

excluded

studies summarised & pooled if homogeneous

1 picture, 2 formulas & 3 acronyms
GATE: framework for the 4 steps of Evidence Based Practice (EBP)
the steps of EBP:

1. Ask
2. Access
3. Appraise
4. Apply & Act
EBP Step 1: **ASK** - turn your question into a focused 5-part PECOT question

1. Participants
2. Exposure
3. Comparison
4. Outcomes
5. Time
EBP Step 2: **ACCESS** the evidence – use **PECOT** to help choose search terms

- **Participants**
- **Exposure**
- **Outcomes**
- **Comparison**
- **Time**
EBP Step 3: **APPRAISE** the evidence – with the picture, acronyms & formulas

**Recruitment**
**Allocation**
**Maintenance**
**blind**
**objective**
**Measurements**
**ANalyses**

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

Practitioner expertise: ‘putting it all together’ - the art of practice

Clinical expertise in the era of evidence-based medicine and patient choice. EBM 2002;736-8 (March/April)
GATE critically appraised topic (CATs) forms
GATE CAT – 3-sheet workbook (in Excel)
sheet 1: GATE-Ask & Access

GATE Ask & Access - for all study types

Notes for use: Enter text in yellow areas, replacing current text. Help notes appear in movable boxes.

Problem
Describe the problem that led you to seek an answer from the literature.

Date:

Step 1: Ask a focused 3-part question using PECOT framework (Either 'your question' OR 'the study's question')
Note: question doesn't need to be grammatically correct or sentence; main aim is to identify key terms for search (Step 2)

Population / patient / client
Specify the relevant population / patient group (be reasonably specific about: medical condition, age group, sex, etc.)

Exposure (intervention / target disease / risk or prognostic factor)
Specify the intervention(s) you want to find out about for RCTs & other intervention studies: OR the target disease / condition to be diagnosed for diagnostic test accuracy studies: OR the risk / intervention factor for case-control studies. 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 normality) for diagnostic test accuracy studies; the comparison factor you want to compare it with for case-control studies and cohort studies? Be reasonably specific.

Outcomes
Specify the relevant health / disease related outcomes you would like to prevent / reduce for RCTs: the relevant test for diagnostic test accuracy studies; the relevant health / disease related outcomes for case-control studies and cohort studies.

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

<table>
<thead>
<tr>
<th>PECOT item</th>
<th>Primary Search term</th>
<th>Synonym 1</th>
<th>Synonym 2</th>
</tr>
</thead>
</table>
| Population / Patient / client | Enter key search terms. Use MeSH terms (not PubMed) if available, then text words. | OK | Include relevant synonym
| Exposure / Intervention | As above | OK | As above |
| Comparison / Control | As above | OK | As above |
| Outcomes | As above | OK | As above |
| Time | Entry generally not required for search

Limits & Filters:
PubMed has limits (e.g. age, English language, years) & PubMed Clinical Queries has limits (e.g. study type) to help focus your search if used.

Database searched:
List database searched.

Evidence Retrieved:
Enter URL citation of publication you have selected or been given to evaluate.

Justification for selection:
Describe main objectives of the study.
Explain why you chose this publication for evaluation.

Please contribute your comments and suggestions on this form to: info@excel.co.uk
GATE CAT – 3-sheet workbook (in Excel) sheet 2: GATE-Appraise (with calculator)
GATE CAT – 3-sheet workbook (in Excel) sheet 3: GATE-Apply