by the end of this session you will know how to use this picture to help you rapidly critique clinical studies (& to teach others how to use it)
Evidence-based medicine is the (explicit) application of clinical epidemiological evidence in clinical decision making.
what makes a good teacher?

1. enthusiastic, energetic, excited, passionate & accessible, prepared

2. highly knowledgeable in their area?

3. maintains that knowledge base

4. life long reflective learner

5. changes and influences practice

6. makes their area of expertise accessible
GATE: Graphic Appraisal Tool for Epidemiology

1991  2019

1 picture, 2 formulas & 3 acronyms
GATE:

Graphic Appraisal Tool for Epidemiology

Graphic Architectural Tool for Epidemiology

Graphic Approach To Epidemiology

making epidemiology accessible
4th year medical students 1991
epidemiology = \frac{\text{numerator}}{\text{denominator}}

In: Uses of Epidemiology 1977
Medical Student Pub crawl
Contributions SF to NZ diet
Dear sir

I have just read what you said in the sunday paper. From this I can only conclude that you are some sort of fuckwit.

How dare you describe good food like butter as poisonous.

How long have you been in this country?

I bet you are one of the auckland wankers that drive around with thier lights on.
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

every epidemiological study can be hung on the GATE frame
cohort of British doctors

smoking status allocated by measurement (observation)

smokers

non-smokers

lung cancer events counted

followed for 10 years

cohort / longitudinal / follow-up study
British doctors randomly allocated to aspirin or placebo.

**Participants**

- Aspirin
- Placebo

**Exposure**

- MI yes
- MI no

**Comparison**

- MI yes
- MI no

**Outcomes**

- MI

**Time**

- 5 years

**Randomised controlled trial**

1 picture, 2 formulas & 3 acronyms
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
non-smokers

smokers

smoking status measured

lung cancer

yes

no

cases

controls

case-control study
(all nested in virtual cohort studies)
$10,000
GATE: a framework for study analysis:

1st formula: occurrence = outcomes ÷ population

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

1 picture, 2 formulas & 3 acronyms
1st formula: occurrence of outcomes = number of outcomes ÷ number in population/group

Participant Population

British doctors

smoking status measured

Exposure Group

smokers

Comparison Group

non-smokers

Outcomes

yes

no

Lung cancer

T

10 years

\[ P = \frac{\text{occurrence of outcomes}}{\text{number in population/group}} \]
British doctors

smoking status measured

Exposure Group
smokers

Outcomes
Lung cancer

Comparison Group
non-smokers

Exposure Group Occurrence (EGO) = a ÷ EG
= number of outcomes (a) ÷ number in exposed population (EG)
Comparison Group Occurrence (CGO) = $\frac{b}{CG}$

= number of outcomes (b) ÷ number in comparison population (CG)
Epidemiology = \textbf{N}umerator \div \textbf{D}enominator

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

- **Exposure Group**
  - mammogram positive

- **Comparison Group**
  - mammogram negative

- **Outcomes**
  - breast cancer
  - yes
  - no

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

![Diagram](image)

**EGO:** Occurrence (risk) of cancer in smokers

**CGO:** Occurrence of cancer in non-smokers
Middle-aged Americans

Body Mass Index (BMI) measured

High BMI

Low BMI

EGCG

EGO: Average blood glucose in EG

CGO: Average blood glucose in CG
Middle-aged Americans
Body Mass Index (BMI) measured
High BMI
Low BMI
blood glucose
high
low
cross-sectional study with numerical measures
Middle-aged American women

Gold Standard

Breast cancer
positive
mammogram
negative

no Breast cancer

EGO: likelihood of a positive mammogram if breast cancer

CGO: likelihood of a positive mammogram if no breast cancer
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
GATE: framework for nonrandom error

2nd acronym: RAMBOMAN

1 picture, 2 formulas & 3 acronyms
Recruitment of participants

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

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

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

If randomised, were EG & CG similar at baseline?
‘were Participants well **Maintained** in the groups they were allocated to?’

- completeness of follow-up compliance
- contamination co-interventions
were exposures & outcomes well *Measured*?

were outcomes measured *Blind* to whether participant was in EG or CG *(or vice versa)*?
‘were exposures & outcomes well Measured?’
were they measured Objectively?
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: 2nd 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)

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

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

1. Participants

2. Exposure

3. Comparison

4. Outcomes

5. Time
2: **ACQUIRE** the evidence – use **PECOT** to help choose search terms
3: **APPRAISE** the evidence – with the picture, acronyms & formulas

Occurrence = outcomes ÷ population
Random error = 95% Confidence Interval
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

Clinical expertise in the era of evidence-based medicine and patient choice. EBM 2002;736-8 (March/April)
EBP Step 5: Audit

audit practice against evidence-based standards and improve quality of practice
GATE critically appraised topic (CATs) excel workbooks:

1. Intervention & risk studies
2. Diagnostic test accuracy studies
3. Prognostic studies
4. Case-control studies
5. Systematic Reviews

www.epiq.co.nz
# GATE CAT – 4-sheet workbook (in Excel)

**sheet 1: GATE-Ask & Acquire**

<table>
<thead>
<tr>
<th><strong>PECOT item</strong></th>
<th><strong>Primary Search term</strong></th>
<th><strong>Synonym 1</strong></th>
<th><strong>Synonym 2</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Population / Patient / Client</strong></td>
<td>As above</td>
<td>As above</td>
<td>As above</td>
</tr>
<tr>
<td><strong>Exposure (Intervention)</strong></td>
<td>As above</td>
<td>As above</td>
<td>As above</td>
</tr>
<tr>
<td><strong>Comparison (Control)</strong></td>
<td>As above</td>
<td>As above</td>
<td>As above</td>
</tr>
<tr>
<td><strong>Outcomes</strong></td>
<td>As above</td>
<td>As above</td>
<td>As above</td>
</tr>
<tr>
<td><strong>Time</strong></td>
<td>As above</td>
<td>As above</td>
<td>As above</td>
</tr>
</tbody>
</table>

**Limits & Filters:**
- PubMed has Limits (e.g., age, language, years) & PubMed Clinical Queries has Filters (e.g., study type) to help focus your search.
- List database searched:
- Evidence Requested:
- Justification for selection:
- State main objectives of the study.
- Explain why you chose this publication for evaluation.
GATE CAT – 3-sheet workbook (in Excel)
sheet 2: GATE-Appraise (with calculator)
GATE CAT – 3-sheet workbook (in Excel)

sheet 3: GATE-Apply

**Step 4: Apply**

Consider all factors and make decisions to act.

### The X-Factor

- **Patient & Family**
- **Community**
- **Practitioner**

**Epidemiological Evidence**

- **Case Circumstances**
- **Values & Preferences**

**Decision(s):** Taking into account all factors above: What is the best decision(s) for this problem?

**Step 5: What are the implications of this decision(s) for practice?**

- What are the wider considerations of this decision(s) for usual practice? Should it change usual practices in any way?

Please contribute your comments and suggestions to: [email@example.com]
by the end of this lecture you will know how to use this picture to help you rapidly critique clinical studies (& to teach others how to use it)