

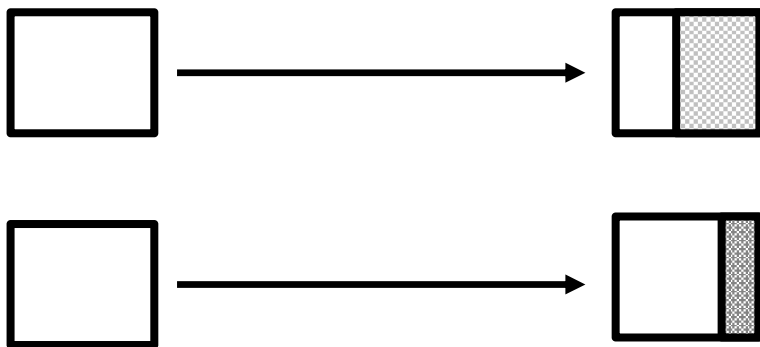
Critical appraisal of epidemiological studies

.....and other helpful epi tips

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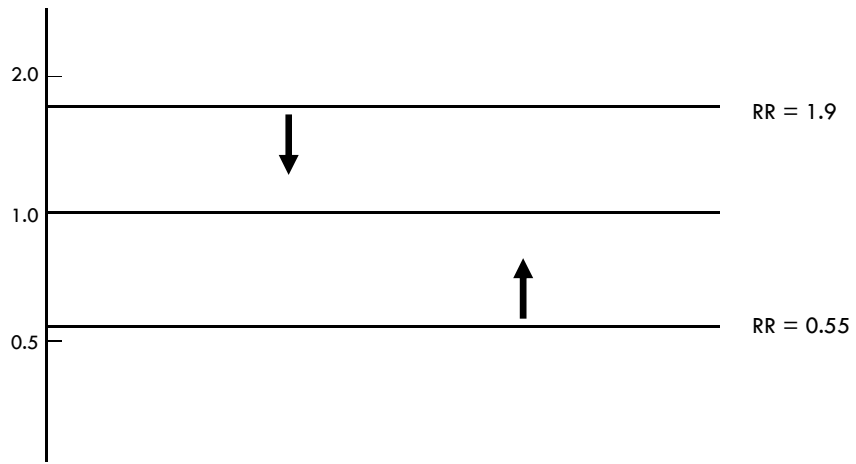
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The basic epidemiological study



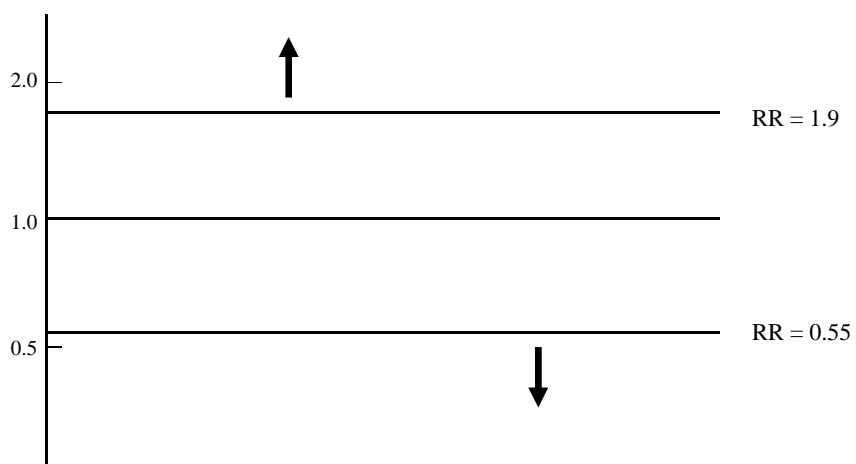
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Bias towards the null



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Bias away from the null



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General strategy

- Use a systematic approach
- All studies will have strengths and weaknesses
- Look for the key issues for the particular type
- Those aspects done well will be important strengths
- Those aspects done poorly will be important weaknesses
- Try to predict the direction and size of any bias

What to look at

- Research question
- Study type
- Selection
- Measurement
 - Exposure, outcome, confounders
- Confounders
- Analysis
- Generalisability

Research question

- Is it clear?
- What is the study factor?
- What is the outcome factor?

Study type

- What is the study type?
- Is it appropriate for the study question?

Issues and study type

- Some issues will be more specific to, or more relevant to, particular study types
- Some issues will be common to many study types

Issues and study type

- Some issues will be more specific to, or more relevant to, particular study types
- Some issues will be common to many study types
- Try to work out if important bias is likely
- If it is, try to work out the direction and magnitude (size) of the bias

Selection issues

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Selection – RCT and cohort 1

- Are the study groups at the BEGINNING of the study comparable in all relevant ways except the exposure?

- If not, is this likely to have resulted in important selection bias?
 - Randomisation process (RCT)
 - Selection process (cohort)

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Cohort study - selection of subjects

- How do those who participated compare to those who didn't participate?
That is, are those who participated representative of those who didn't participate?
- If not, did this vary between study groups?
- Is this likely to have resulted in important selection bias?
- Random selection?
- Were volunteers called for?
- Other approach?
- Information on (and comparison of) baseline characteristics

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Selection – RCT and cohort 2

- Are the study groups at the END of the study comparable in all relevant ways except the exposure?
- If not, is this likely to have resulted in important selection bias?
 - Losses and intention to treat (RCT)
 - Losses (cohort)
 - Information on characteristics
 - Information on reasons for loss
 - Comparison of characteristics of final groups

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Selection – case control 1

- Study base
- Is the study base well defined?
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Selection – case control 1

- Study base
- Is the study base well defined?
- If not, is this likely to have resulted in important selection bias?
- Cases
- Are the cases representative of all cases?
 - all cases, random sample?
- Did all selected cases actually take part?
- If not, is this likely to have resulted in important selection bias?
 - › What proportion participated?
 - › Characteristics of those that did and didn't.
 - › Reasons for non—participation.
 - › Likely effect on results.

Selection – case control 2

- Controls
- Do the controls come from the same study base as the cases?

- Are the selected controls representative of all controls?
 - › all controls, random sample?

- Did all selected controls actually take part?
- If not, is this likely to have resulted in important selection bias?
 - › What proportion participated?
 - › Characteristics of those that did and didn't.
 - › Reasons for non-participation.
 - › Likely effect on results.

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Selection – losses 1

- RCT and cohort
- What proportion dropped out? Is this big enough to practically influence the results?

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Selection – losses 1

- RCT and cohort
- What proportion dropped out? Is this big enough to practically influence the results?
- Did those who dropped out differ compared to those who didn't drop out?
- If so, are these differences relevant (related to the probability of developing the outcome; related to the probability of exposure resulting in the outcome)?
 - Why did they drop out? What are their characteristics?
- If so, is this likely to have resulted in important selection bias?

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Selection – losses 2

- Cases
- Did all selected cases actually take part?
- If not, what proportion didn't? Is this big enough to practically influence the results?
- Did those who didn't take part differ compared to those who did?
- If so, are these differences relevant (related to the probability of being exposed)?
 - Why did they not take part? What are their characteristics?
- Is this likely to have resulted in important selection bias?

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Selection – losses 3

- Controls
- Did all selected controls actually take part?
- If not, what proportion didn't? Is this big enough to practically influence the results?

- Did those who didn't take part differ compared to those who did?

- If so, are these differences relevant (related to the probability of being exposed)?
 - Why did they not take part? What are their characteristics?

- Is this likely to have resulted in important selection bias?

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Measurement issues

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Measurement

- Exposure
- Outcome
- Confounders (and effect modifiers)

Measurement – key principles 1

- Was the measuring done without knowledge of other important study parameters (blinding).

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- Use objective, standardised, validated approaches.

Measurement – key principles 1

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- Measure using the same person(s)/equipment/approach, or distribute subjects from different study groups equally between the various people/equipment/approaches.
- Use objective, standardised, validated approaches.
- Train measurers and confirm agreement (inter-rater and intra-rater) and validity (validated in previous studies or a pilot study).

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Measurement – key principles 2

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- Differential mis-classification of exposure (case-control study) or outcome (RCT and cohort study) can bias the measure of effect towards OR away from the null.

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Measurement – key principles 2

- Non-differential mis-classification of exposure or outcome (nearly) ALWAYS biases the measure of effect towards the null.
- Differential mis-classification of exposure (case-control study) or outcome (RCT and cohort study) can bias the measure of effect towards OR away from the null.
- Any mis-classification of confounders can bias the measure of effect towards OR away from the null.

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 - Can have differential and non-differential error of the same parameter
- Which direction is this likely to have biased the estimate of effect (and by how much)?

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Measurement – exposure 1

- RCT
 - any error in exposure will be non-differential

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Measurement – exposure 1

- RCT
 - any error in exposure will be non-differential

- Cohort
 - any error in exposure will nearly always be non-differential

Measurement – exposure 1

- RCT
 - any error in exposure will be non-differential

- Cohort
 - any error in exposure will nearly always be non-differential
 - exception can occur if outcome known before exposure is determined (e.g. some retrospective cohort studies)

Measurement – exposure 2

- Case-control
 - error in exposure can be differential (recall bias)

Measurement – exposure 2

- Case-control
 - error in exposure can be differential (e.g. recall bias)
- Cross-sectional
 - error in exposure can be non-differential or differential

Measurement – outcome 1

- RCT
 - error in outcome can be differential

Measurement – outcome 1

- RCT
 - error in outcome can be differential

- Cohort
 - error in outcome can be differential

Measurement – outcome 2

- Case-control
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 - error in outcome can be non-differential or differential

Measurement – confounders

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- This may vary depending on when information on the confounder is collected.

Confounding

Confounding

- Have the main potential confounders been considered?
- Have the main potential confounders been controlled?
- If not, is this likely to have resulted in important bias?

Analysis

Analysis

- Were the methods appropriate?
- Have the main potential confounders been controlled?
- (Was a dose-response analysis conducted?)
- Are there confidence intervals or p values?
- Is the power high enough (are the confidence intervals too wide)?

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Generalisability

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Generalisability

- To what extent is the study population similar (and different) to other relevant populations?
- To what extent is the relationship between exposure and outcome likely to be the same for other populations?

Summary

Summary

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- Look for the key issues for the particular type
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- Those aspects done poorly will be important weaknesses
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