

Introduction to meta-analysis



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Steps in a systematic review

- Question formulation
- Identification of studies
- Selection of relevant studies
- Quality assessment
- Data-extraction
- Meta-analysis (if possible)
- Presentation and interpretation of results

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- **Meta-analysis (if possible)**
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Why meta-analysis?

- To quantify the results

Not “Is this treatment better?”

but “How much is this treatment better?”

What is a meta-analysis?

- Meta-analysis (pooling) = combining the results of individual studies to obtain an overall estimate of the effect of a treatment
- Pooling only sensible *if the patients, interventions and outcomes of the various studies are sufficiently similar*

NB: a systematic review doesn't need to include a meta-analysis

Confidence intervals

- A study includes a *sample* of patients, not all possible patients in the world
- Results of studies are *estimates* of the real effect
- But, there's some uncertainty due to *sample variation*
- *Confidence intervals* provide an indication of how much uncertainty we have
- Width of CI indicates the *precision* of the estimate of effect

How to do a meta-analysis?

- Extract results from the studies
- RevMan calculates a *weighted average* to obtain an overall estimate of the effect of a treatment
- Weighted average implies that big studies have more weight
- RevMan calculates 95% confidence intervals (CIs)

Hide Statistical Analysis

Statistic: Risk Difference Extra columns on graph:

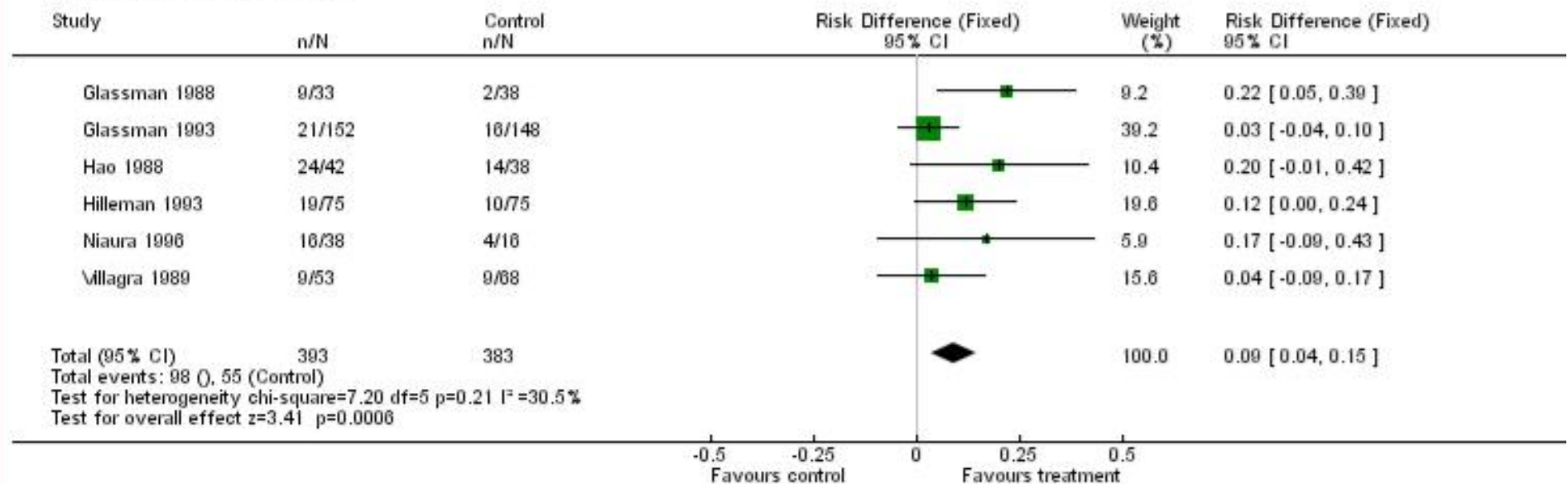
Effect: Fixed Year

Scale: Linear: -0.5 to 0.5

CI Study: 95% Allocation Concealment

Overall CI: 95% User Defined

Review: Clonidine for smoking cessation
 Comparison: 01 Clonidine vs placebo
 Outcome: 01 Smoking Cessation



Measures of treatment effect

Type of measure of treatment effect depends on the data type of the outcome variable

- Dichotomous only 2 categories (present/absent)
- Continuous numerical result (blood pressure)

Dichotomous outcomes

Absolute measure of treatment effect:

Risk Difference (RD)

Relative measures of treatment effect:

Risk Ratio (RR)

(Odds Ratio (OR))

2x2 Table

	Outcome		
	Present	Absent	Total
Intervention	a	b	a+b
Control	c	d	c+d
Total	a+c	b+d	n

Proportion “present” among intervention:

$$P_i = a / (a + b)$$

Proportion “present” among control:

$$P_c = c / (c + d)$$

2x2 Table: example

	Outcome		
	Present	Absent	Total
Intervention	70	30	100
Control	20	80	100
Total	90	110	200

$$P_{\text{intervention}} = 70 / 100 = 0.7 \text{ (or 70\%)}$$

$$P_{\text{control}} = 20 / 100 = 0.2 \text{ (or 20\%)}$$

Risk Difference (RD)

	Outcome		
	Cured	Not Cured	Total
Intervention	70	30	100
Control	20	80	100
Total	90	110	200

$$RD = P_i - P_c = 0.7 - 0.2 = 0.5 \text{ (or 50\%)}$$

The chance of a cure after treatment is *50% higher* than after control treatment

Risk Ratio (RR)

	Outcome		
	Cured	Not Cured	Total
Intervention	70	30	100
Control	20	80	100
Total	90	110	200

$$RR = P_i / P_c = 0.7 / 0.2 = 3.5$$

The chance of a cure after treatment is 3.5 *times greater* than after control treatment

Number needed to treat (NNT)

Number Needed to Treat (NNT): $1 / |RD|$

NNT =

number of patients that must be treated
with the treatment to get one more success
(or to prevent one extra bad outcome)
compared with control treatment

And now it's your turn!

Assignment

(This is a workshop, you know!)

Is the treatment effective?

Neutral (“null”) values	<i>Unfavourable outcome</i>	<i>Favourable outcome</i>
(= treatment not effective)	Treatment effective	Treatment effective
RD = 0	RD < 0	RD > 0
RR = 1	RR < 1	RR > 1

Continuous outcomes

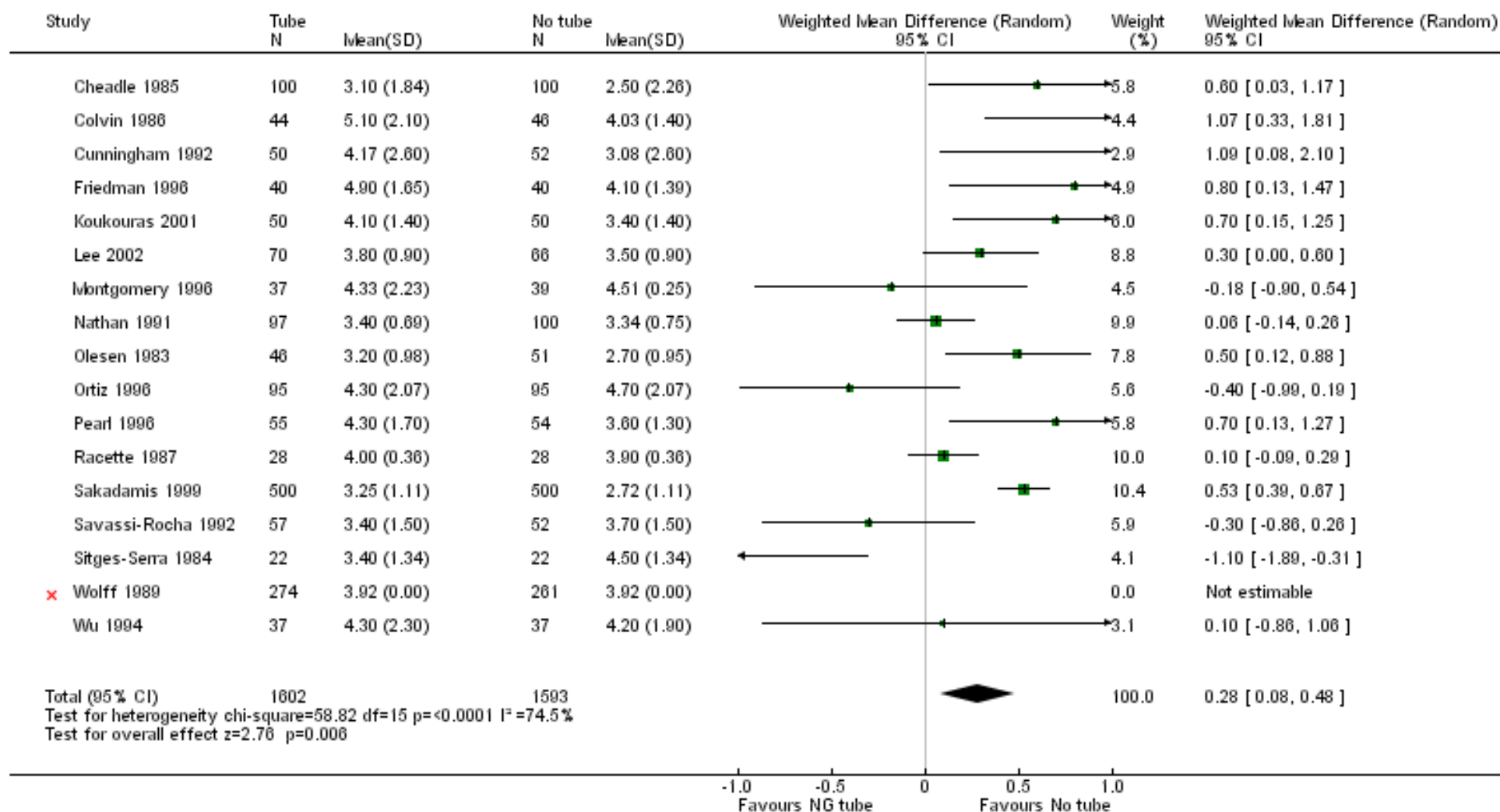
- Numerical outcomes, e.g. weight loss, blood pressure
- Ingredients per study:
 - Mean effect for both the intervention group and the control group
 - Some other measures needed to calculate the 95%-CIs
- Calculate mean difference (MD) = difference of the effects

Mean difference (example)

Review: Prophylactic nasogastric decompression after abdominal surgery

Comparison: 01 Time to Flatus

Outcome: 01 Does Postoperative nasogastric decompression hasten recovery of gastrointestinal function?



Resumé

- Meta-analysis: calculating a *weighted average* (= pooled estimate)
- 95%-confidence intervals tell you how precise the estimate is
- Measures of treatment effect
 - dichotomous outcomes: RD, RR; NNT
 - continuous outcomes: MD

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Systematic Review
doesn't need to include a
Meta-Analysis