Advancing Best Care through Education & Research

6th Asia Pacific Primary Care Research Conference
in conjunction with Family Medicine Symposium

Introduction Meta-analysis

Presented by Dr Wilson Tam
ALCNS, YYL School of Medicine
National University of Singapore

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Organised by: SingHealth Duke NUS Academic Medical Centre FAMILY MEDICINE Supported by: AFPM PRIME

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Introduction to Meta-Analysis
Part I: Forest Plot & Effect Measures

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What is Meta-analysis?

- “*Meta-analysis – the statistical combination of results from two or more separate studies – is the most commonly used statistical technique. Cochrane review writing software (RevMan) can perform a variety of meta-analyses, but it must be stressed that meta-analysis is not appropriate in all Cochrane reviews*” extracted from Section 9.1.2 Cochrane Handbook of Systematic Reviews of Interventions.

What is Meta-analysis?

- Study A
  - ➢SBP ↓ 10 mm Hg

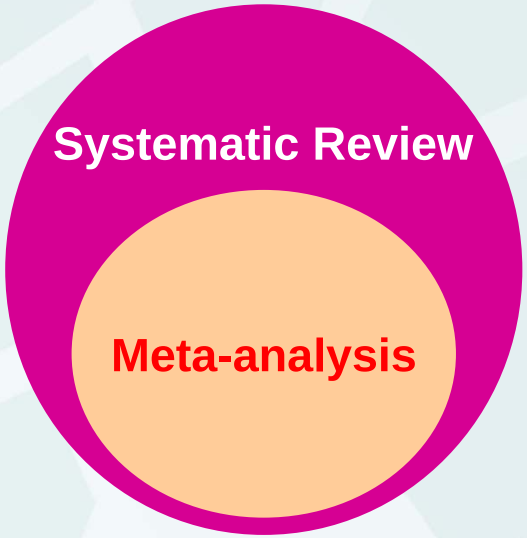
- Study B
  - ➢ SBP ↓ 5 mm Hg

- Study A & B
  - ➢ SBP ↓ 7.5 mm Hg ???

What is Meta-analysis?

- Meta-analysis = Systematic review?

- A systematic review may or may not include meta-analysis to combine the study results

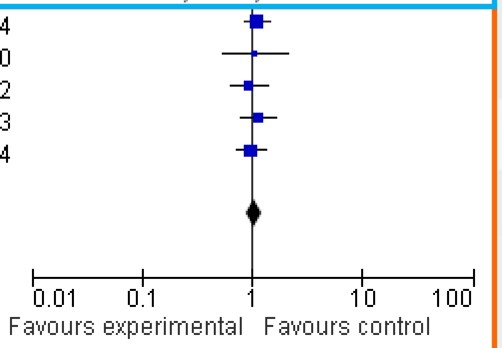


What is Meta-analysis?

- Results of meta-analysis is usually summarized in a forest plot
- Compare the effectiveness of *including a visual screening as part of multiphasic screening package* versus *standard care* on detecting *eye problems of elderly* (BMJ 1998; 316: 660-3)

Study or Subgroup	Experimental Events	Experimental Total	Control Events	Control Total	Weight	Odds Ratio IV, Fixed, 95% CI	Year
Vetter	161	486	141	453	34.2%	1.10 [0.83, 1.44]	1984
McEwan	21	118	19	111	5.5%	1.05 [0.53, 2.08]	1990
Vetter1	75	240	68	207	16.2%	0.93 [0.62, 1.38]	1992
van Rossum	99	231	87	221	18.3%	1.16 [0.79, 1.68]	1993
Wagner	74	581	111	846	25.9%	0.97 [0.71, 1.32]	1994
Total (95% CI)		**1656**		**1838**	**100.0%**	**1.04 [0.89, 1.22]**	
Total events	430		426				

Heterogeneity: Chi² = 0.96, df = 4 (P = 0.92); I² = 0%
Test for overall effect: Z = 0.48 (P = 0.63)



What is Meta-analysis?

- Odds ratio – the effect measure selected by the reviewer
- IV – Inversed Variance method as the weighting scheme
- Fixed – Fixed effect model for combining the results from each study

	Experimental		Control			Odds Ratio	
Study or Subgroup	Events	Total	Events	Total	Weight	IV, Fixed, 95% CI	Year
Vetter	161	486	141	453	34.2%	1.10 [0.83, 1.44]	1984
McEwan	21	118	19	111	5.5%	1.05 [0.53, 2.08]	1990
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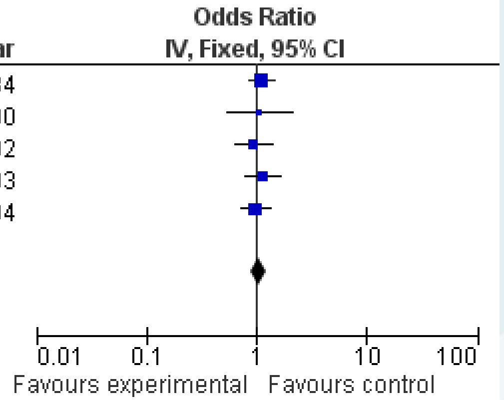

- The combined odds ratio, it 95% confidence interval, and test for significant
- Heterogeneity among the studies

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What is Meta-analysis?

- Extract appropriate data from individual study, from the table, text or even by contacting the authors

581*0.128= 74

TABLE 5—Prevalence of Health Behaviors, by Treatment Group at 1 and 2 Years of Follow-Up

	Treatment Group		
Health Behavior	Intervention	Visit Only	Usual Care
Exercise			
Exercise > 15 minutes 3 times/week, %			
Year 1	37.1	33.1	34.1
Year 2	34.9	30.4	30.5
Number of blocks walked per week, mean			
Year 1	53.3	47.3	46.4
Year 2	52.2	47.7	45.8
Alcohol use: high-risk drinking, %			
Year 1	25.9	23.8	24.1
Year 2	22.6	23.1	21.4
Home safety: home inspection, %			
Year 1	37.0	26.3[a]	24.2[a]
Year 2	31.3	25.5	24.1[a]
Prescription drug use: taking high-risk drug, %			
Year 1	59.2	53.6	54.7
Year 2	59.7	58.4	58.8
Hearing: hearing impairment, %			
Year 1	7.8	7.0	7.2
Year 2	6.6	5.9	7.2
Vision: uncorrected vision problem, %			
Year 1	12.4	13.0	9.8
Year 2	12.8	13.6	12.9

[a]Chi square test (1 df) comparing usual care or visit groups with intervention group; significant difference at $P \leq .01$.

Reference: Wagner E H, LaCroix A Z, Grothaus L, Leveille S G, Hecht J A, Artz K, et al. Preventing disability and falls in older adults: a randomised controlled trial. Am J Public Health 1994;84: 1800-6.

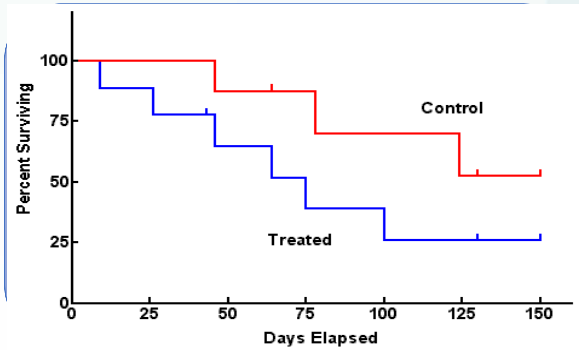
Procedure of Conducting a Systematic Review

1. Identifying research question
2. Setting inclusion/ exclusion criteria
3. Searching for studies
4. Selecting studies and collecting data
5. Assessing risk of bias of included studies
6. Analyzing data & conducting meta-analysis
7. Assessing reporting biases
8. Presenting & interpreting the results
9. Drawing conclusion and writing report

Type of outcomes

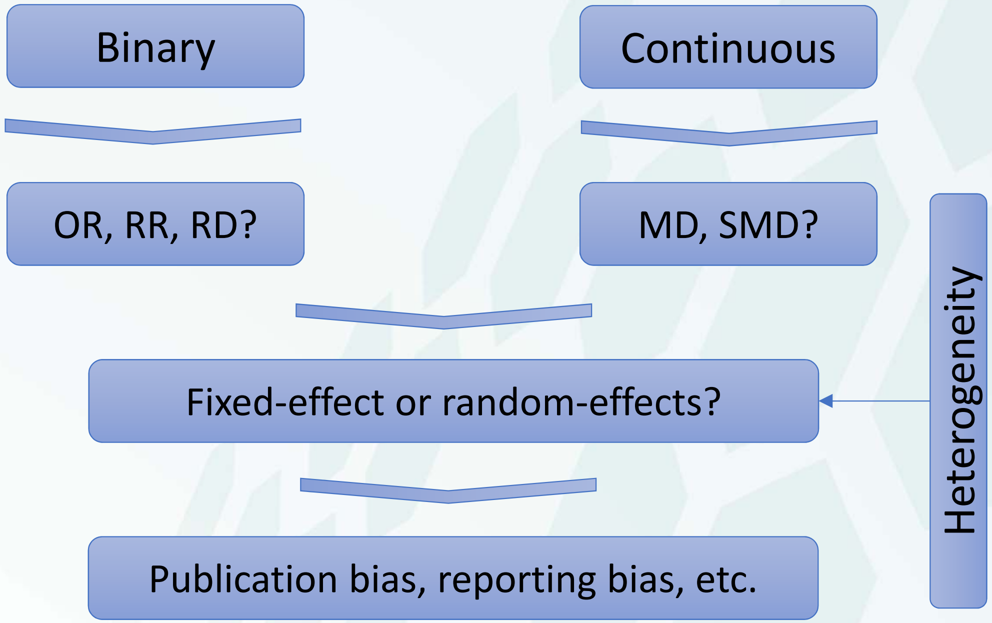
Continuous:
Blood pressure; Quality of Life;
readmission

Binary:
Dead/ Alive
BP (High/ Normal);
QoL (Good/ Poor);
Readmission (Y/N)



		Disease: Present	Disease: Absent
Test	Positive	TP	FP
	Negative	FN	TN

Steps in conducting a meta-analysis



Binary and Continuous Variables

- Binary variables – Observations that occur in one of two possible states, often labelled zero and one.
- E.g., “death/ alive” , “improved/not improved”

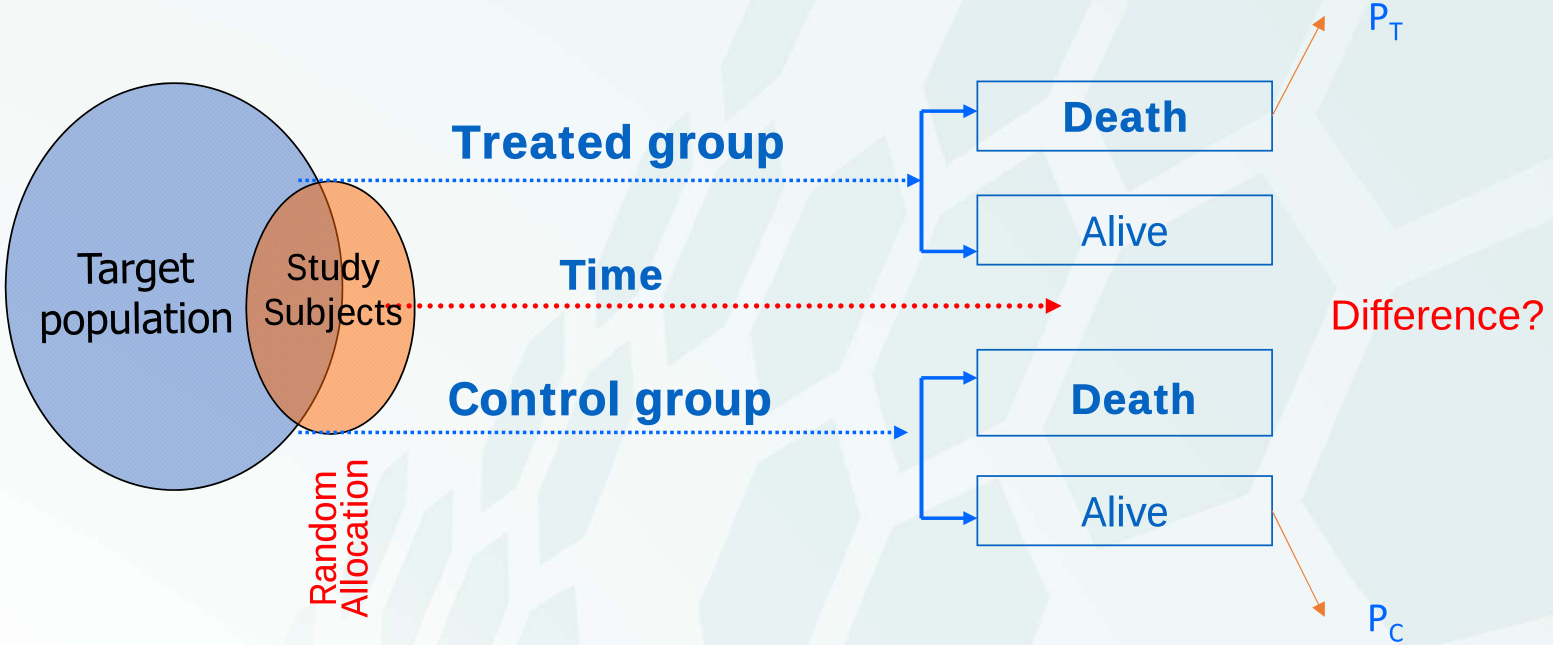
- Continuous variables – A variable that is not restricted to particular values (other than limited by the accuracy of the measuring instrument).
- E.g., Blood pressure, reaction time, IQ. Equal size intervals on different parts of the scale are assumed.

Measuring Binary Variable

- How many subjects die from the disease?

- 90 is the number of events & 120 is the total number of subjects
- P=0.75 is the mortality rate (or called risk of the disease)

Effect Measures for Binary Variable



- Risk of the disease in the treatment group (P_T) and risk of the disease in the control group (P_C)

Effect Measures for Binary Variable

- Aim: to examine the difference between P_T and P_C
- Compare the magnitude of P_T and P_C. For example, if the outcome is mortality

- $P_T << P_C$ ➔ Intervention is effective
- $P_T \sim= P_C$ ➔ Intervention is not effective
- $P_T >> P_C$ ➔ Intervention is harmful

Effect Measures for Binary Variable

- 3 commonly used effect measures (i) Risk Difference, (ii) Risk Ratio and (iii) Odds Ratio
- Risk Difference (RD) $=P_T - P_C$
- Using Wanger's data:
- $P_T=74/581= 0.127$; $P_C= 111/846 =0.131$
- $RD=P_T – P_C= -0.004$
- So RD<0 (i.e. $P_T < P_C$), can we conclude control group is more effective in detecting eye problem among elderly?

Study or Subgroup	Experimental Events	Experimental Total	Control Events	Control Total
Vetter	161	486	141	453
McEwan	21	118	19	111
Vetter1	75	240	68	207
van Rossum	99	231	87	221
Wagner	74	581	111	846
Total (95% CI)		**1656**		**1838**
Total events	430		426	

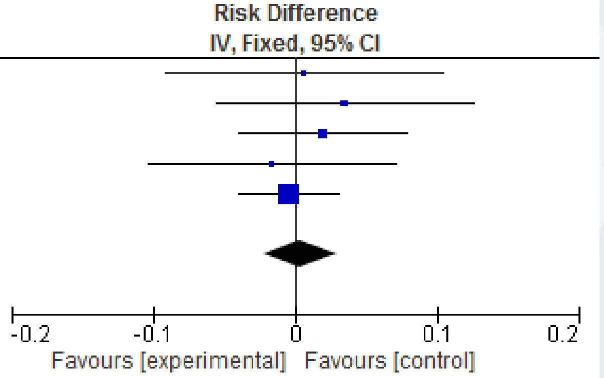
Heterogeneity: $Chi^2 = 0.96$, $df = 4$ ($P = 0.92$); $I^2 = 0\%$
Test for overall effect: $Z = 0.48$ ($P = 0.63$)

Effect Measures for Binary Variable

- Following are the RD and its 95% confidence intervals for the trials in the visual screening meta-analysis:

Study or Subgroup	Experimental Events	Experimental Total	Control Events	Control Total	Weight	Risk Difference IV, Fixed, 95% CI
McEwan 1990	21	118	19	111	7.2%	0.01 [-0.09, 0.11]
van Rossum 1993	99	231	87	221	8.5%	0.03 [-0.06, 0.13]
Vetter 1984	161	486	141	453	19.5%	0.02 [-0.04, 0.08]
Vetter1 1992	75	240	68	207	9.2%	-0.02 [-0.10, 0.07]
Wagner 1994	74	581	111	846	55.6%	-0.00 [-0.04, 0.03]
Total (95% CI)		**1656**		**1838**	**100.0%**	**0.00 [-0.02, 0.03]**
Total events	430		426			

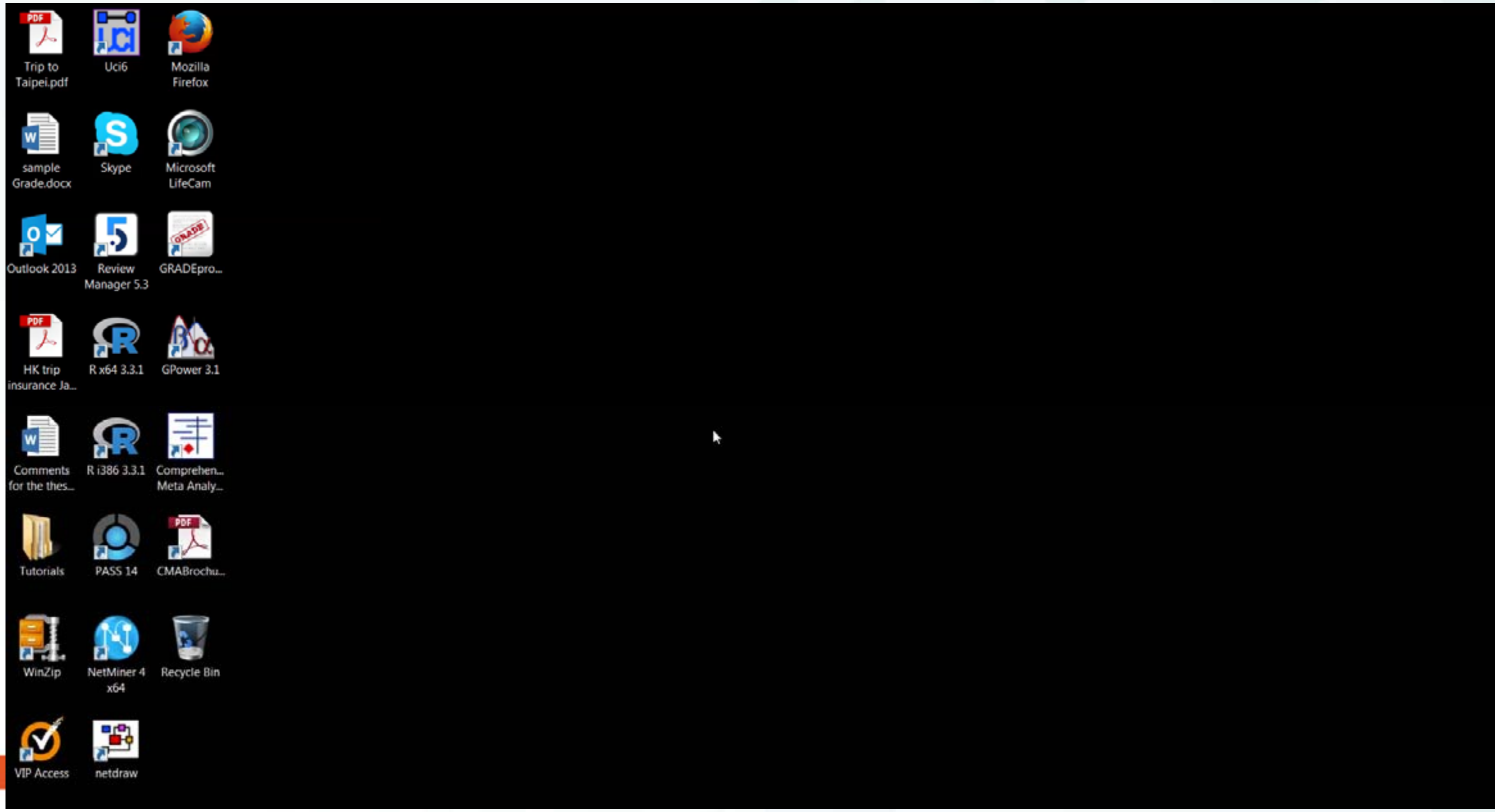
Heterogeneity: Chi² = 1.12, df = 4 (P = 0.89); I² = 0%
Test for overall effect: Z = 0.28 (P = 0.78)



- Demonstration of data-entry for Review Manager (can download at http://community.cochrane.org/tools/review-production-tools/revman-5/revman-5-download)

Effect Measures for Binary Variable

- McEwan (1990), 21 out of 118 in treatment group, 19 out of 111 in control group



Effect Measures for Binary Variable

- 3 commonly used effect measures (i) Risk Difference, (ii) Risk Ratio and (iii) Odds Ratio
- Risk Ratio (RR) =P_T / P_C
- Using Wanger's data:
- P_T=74/581= 0.127; P_C= 111/846 =0.131
- RR=0.969
- So RR<1 (i.e. $P_T < P_C$)

	Experimental		Control	
Study or Subgroup	Events	Total	Events	Total
Vetter	161	486	141	453
McEwan	21	118	19	111
Vetter1	75	240	68	207
van Rossum	99	231	87	221
Wagner	74	581	111	846
Total (95% CI)		**1656**		**1838**
Total events	430		426	

Heterogeneity: Chi^2 = 0.96, df = 4 (P = 0.92); I^2 = 0%
Test for overall effect: Z = 0.48 (P = 0.63)

Effect Measures for Binary Variable

- 3 commonly used effect measures (i) Risk Difference, (ii) Risk Ratio and (iii) Odds Ratio
- Odds Ratio (OR) $=P_T (1- P_C)/[P_C (1- P_T)]$
- Using Wanger's data:
- $P_T=74/581= 0.127$; $P_C= 111/846 =0.131$
- OR=0.965
- So OR<1 (i.e. $P_T < P_C$)

Study or Subgroup	Experimental Events	Experimental Total	Control Events	Control Total
Vetter	161	486	141	453
McEwan	21	118	19	111
Vetter1	75	240	68	207
van Rossum	99	231	87	221
Wagner	74	581	111	846
Total (95% CI)		**1656**		**1838**
Total events	430		426	

Heterogeneity: Chi² = 0.96, df = 4 (P = 0.92); I² = 0%
Test for overall effect: Z = 0.48 (P = 0.63)

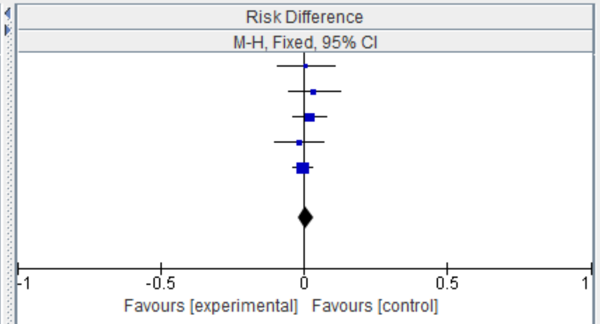
Effect Measures for Binary Variable

- Changing the effect measure by simply clicking " RD ", it will shift between RD, RR and OR

Text of Review | 3.1 Visual screening...

Comparison: 3 Visual screening, Outcome: 3.1 Visual screening for elderly

Study or Subgroup	Experimental Events	Experimental Total	Control Events	Control Total	Weight	Risk Difference M-H, Fixed, 95% CI
McEwan 1990	21	118	19	111	6.6%	0.01 [-0.09, 0.11]
Van Rossum 1993	99	231	87	221	13.1%	0.03 [-0.06, 0.13]
Vetter 1984	161	486	141	453	27.3%	0.02 [-0.04, 0.08]
Vetter1 1992	75	240	68	207	12.9%	-0.02 [-0.10, 0.07]
Wagner 1994	74	581	111	846	40.0%	-0.00 [-0.04, 0.03]
Total (95% CI)		1656		1838	100.0%	0.01 [-0.02, 0.03]
Total events	430		426			
Heterogeneity: Chi² = 1.17, df = 4 (P = 0.88); I² = 0%						
Test for overall effect: Z = 0.48 (P = 0.63)						



Which Effect Measure for Binary Variable?

- RR & OR, relative measures, relatively insensitive to difference in control event (more homogeneous)
- RD, absolute measure, more sensitive to baseline control (more heterogenuous)
- OR (46%) and RR (46%) are more common than RD (1%)

Papageorgiou SN, Tsiranidou E, Antonoglou GN, Deschner J4, Jäger A. Choice of effect measure for meta-analyses of dichotomous outcomes influenced the identified heterogeneity and direction of small-study effects.J Clin Epidemiol. 2015 May;68(5):534-41.

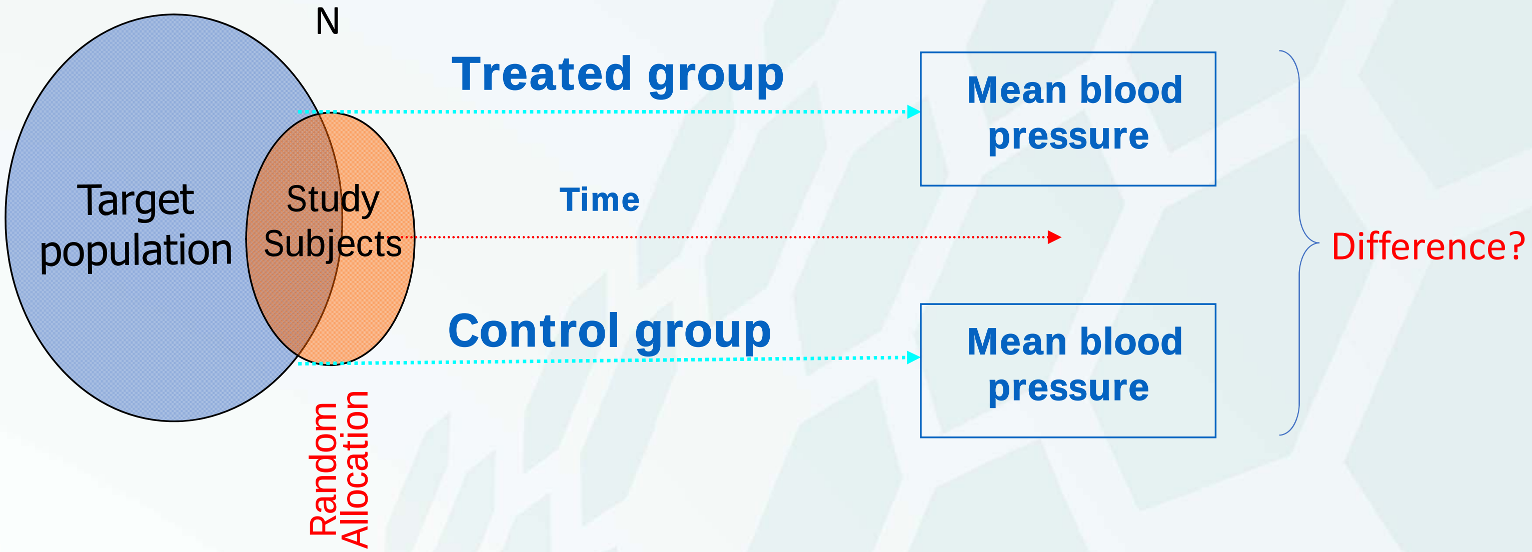
Continuous Variables

- What is the systolic blood pressure of the 50 patients?

123	92	103	108	94	135	112	94	135	99
135	99	134	123	154	126	130	153	98	143
86	133	99	121	152	104	93	95	132	108
143	154	112	115	88	98	108	146	133	120
151	142	100	108	141	110	129	96	144	107

- The mean systolic blood pressure of the 50 patients is 119.2 mm Hg with standard deviation 20.5 mm Hg
- Mean is the sum of the data divided by the total number of subjects

Continuous Variables



- Mean in the treatment group ($\bar{X}_T$) and mean in the control group ($\bar{X}_C$)

Effect Measures for Continuous Variable

- Mean Difference (MD) is the difference between the mean of the outcome in the treatment and the control group, i.e., $\bar{X}_T - \bar{X}_C$

Table II. Specialist care for stroke patients from nine studies: comparing specialist multidisciplinary team care for managing stroke inpatients with routine management in general medical wards. Source: reference 2

Source	Specialist care			Routine management		
	N	Mean LOS	SD	*N*	Mean LOS	SD
1. Edinburgh	155	55·0	47·0	156	75·0	64·0
2. Orpington-Mild	31	27·0	7·0	32	29·0	4·0
3. Orpington-Moderate	75	64·0	17·0	71	119·0	29·0
4. Orpington-Severe	18	66·0	20·0	18	137·0	48·0
5. Montreal-Home	8	14·0	8·0	13	18·0	11·0
6. Montreal-Transfer	57	19·0	7·0	52	18·0	4·0
7. Newcastle 1993	34	52·0	45·0	33	41·0	34·0
8. Umea 1985	110	21·0	16·0	183	31·0	27·0
9. Uppsala 1982	60	30·0	27·0	52	23·0	20·0
Total	548			610		

LOS = length of stay measured in days; SD = standard deviation.

Data extracted from: Normand SLT. Tutorial in Biostatistics: Meta-analysis: formulating, evaluating, combining, and reporting. Stat Med 1999; 18: 321-59.

Effect Measures for Continuous Variable

- Mean Difference (MD) = 55- 75 = -20
- Variance of MD can be computed by:

$$s_p^2 = \frac{(155-1)47^2 + (156-1)64^2}{155+156-2} = 3156$$

$$SE = \sqrt{2055(\frac{1}{155} + \frac{1}{156})} = 6.37$$

- 95% C.I. for MD = (-20-1.96 × 6.37, -20+1.96 × 6.37) = (-32.49, -7.51)

Effect Measures for Continuous Variable

- Standardize Mean Difference (SMD) = $\frac{\text{MD}}{S_p} = \frac{55-75}{\sqrt{3156}} = -0.356$

- Variance of SMD can be computed by:

$$V_d = \frac{n_1+n_2}{n_1 \times n_2} + \frac{SMD^2}{2\times(n_1+n_2)} = \frac{155+156}{155*156} + \frac{-0.36^2}{2(155+156)}$$

$$= 0.01286 + 0.000208 = 0.01307$$

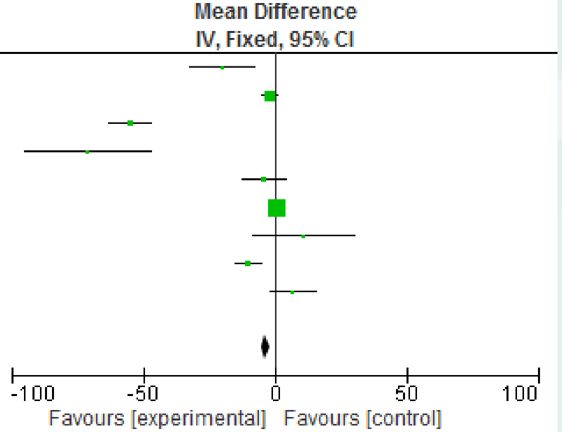
$$SE = \sqrt{0.01307} = 0.1143$$

- 95% C.I. for MD = (-0.356-1.96 × 0.1143, -0.356+1.96 × 0.1143) = (-0.580, -0.132)

Effect Measures for Continuous Variable

Study or Subgroup	Experimental Mean	Experimental SD	Experimental Total	Control Mean	Control SD	Control Total	Weight	Mean Difference IV, Fixed, 95% CI
1-Edinburgh 0001	55	47	155	75	64	156	1.4%	-20.00 [-32.47, -7.53]
2- Orpington-Mild 0002	27	7	31	29	4	32	28.1%	-2.00 [-4.83, 0.83]
3- Orpington-Moderate 0003	64	17	75	119	29	71	3.7%	-55.00 [-62.77, -47.23]
4- Orpington-Severe 0004	66	20	18	137	48	18	0.4%	-71.00 [-95.02, -46.98]
5- Montreal-Home 0005	14	8	8	18	11	13	3.4%	-4.00 [-12.15, 4.15]
6-Montreal-Transfer 0006	19	7	57	18	4	52	50.1%	1.00 [-1.12, 3.12]
Newcastl1 1993	52	45	34	41	34	33	0.6%	11.00 [-8.06, 30.06]
Umea 1985	21	16	110	31	27	183	9.3%	-10.00 [-14.92, -5.08]
Uppsala 1982	30	27	60	23	20	52	2.9%	7.00 [-1.73, 15.73]
Total (95% CI)			**548**			**610**	**100.0%**	**-3.46 [-4.96, -1.96]**

Heterogeneity: Chi² = 238.92, df = 8 (P < 0.00001); I² = 97%
Test for overall effect: Z = 4.53 (P < 0.00001)



Which Effect Measure for Continuous Variable?

- Mean difference is used when all the studies in meta-analysis use the same scale/ instrument as measure.

- If studies in the meta-analysis use different instruments (such as different psychological or educational test) to assess the outcome, then the scale of measurement will differ from study to study and it would not meaningful to combine raw mean difference.

Which Effect Measure for Continuous Variable?

- Examine the effect of sham acupuncture on low back pain*

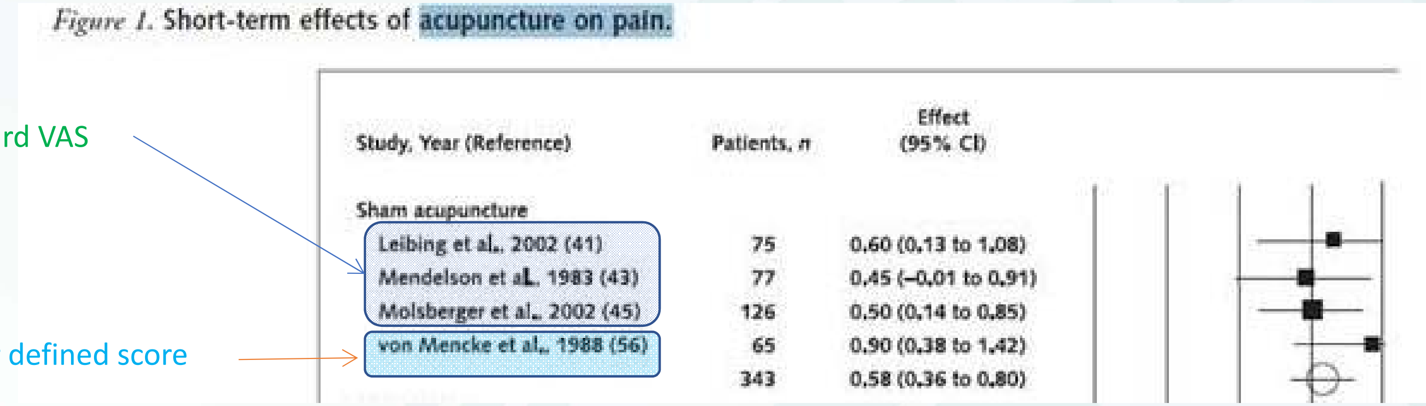


Figure 1. Short-term effects of acupuncture on pain.

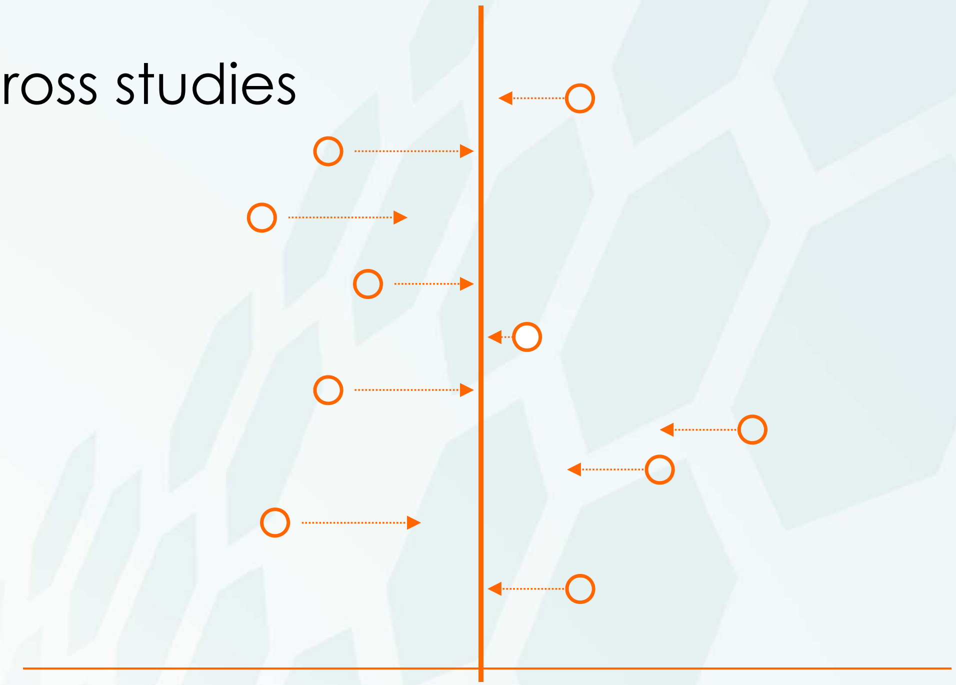
Study, Year (Reference)	Patients, n	Effect (95% CI)
Sham acupuncture		
Leibing et al., 2002 (41)	75	0.60 (0.13 to 1.08)
Mendelson et al., 1983 (43)	77	0.45 (–0.01 to 0.91)
Molsberger et al., 2002 (45)	126	0.50 (0.14 to 0.85)
von Mencke et al., 1988 (56)	65	0.90 (0.38 to 1.42)
	343	0.58 (0.36 to 0.80)

Reference: Manheimer E, White A, Berman B, Forys K, Ernst E. Meta-analysis: Acupuncture for low back pain. Ann Int Med 2005; 142: 651-663.

Part II: Heterogeneity, Fixed- & Random-effects models

Weighted Average in Meta-analysis

- Average (Mean) across studies



Combined Effect Measures (RR)

Weighted Average in Meta-analysis

- Average (Mean) across studies

Weighted Average in Meta-analysis

- Reasons of using weighted average
  - Trials differ in their closeness to the truth
  - 'Weights' according to the importance of variables are given to the data when calculating the mean
  - The closeness is determined by the variance of the estimate of effect
  - A trial could be weighted according to its variance (within study variance)

Weighted Average in Meta-analysis

- Generic inversed variance approach

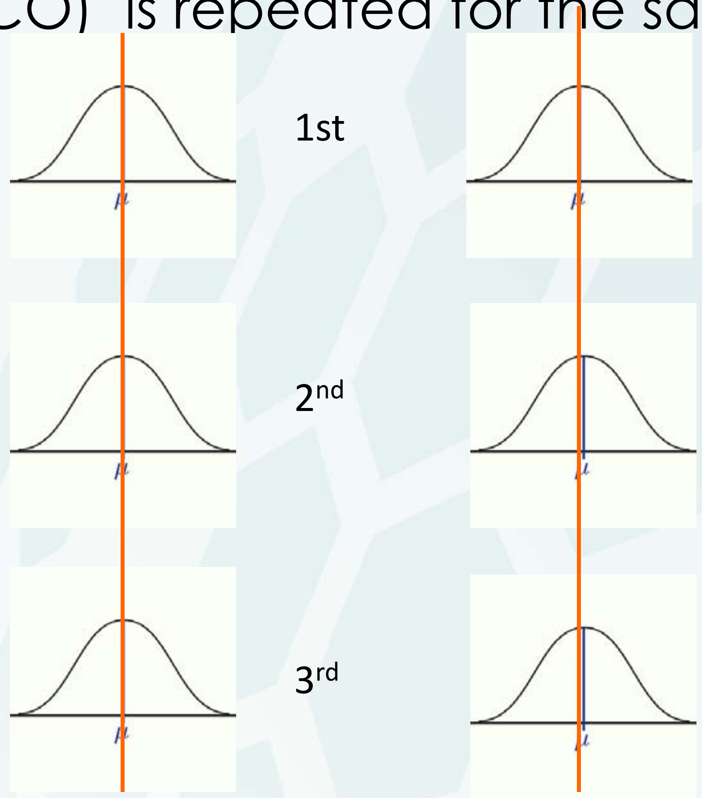
$$\text{Summary effect of meta-analysis} = \frac{\text{Sum of the weighted effects}}{\text{Sum of weights}}$$

- Variance = (SE)2 and Weight = 1/variance
- (Note: This weighting method is applicable to combining any statistics such as RD, RR, mean difference, etc.)

$$\text{Summary effect of meta-analysis} = \frac{\sum W * X}{\sum W} = \frac{\sum \frac{1}{Var_{RD}} \times RD}{\sum \frac{1}{Var_{RD}}}$$

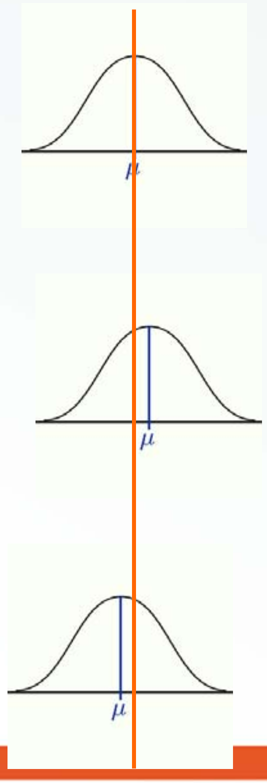
Heterogeneity in Meta-analysis

- Imagine a RCT (identical PICO) is repeated for the same group of subjects for several times

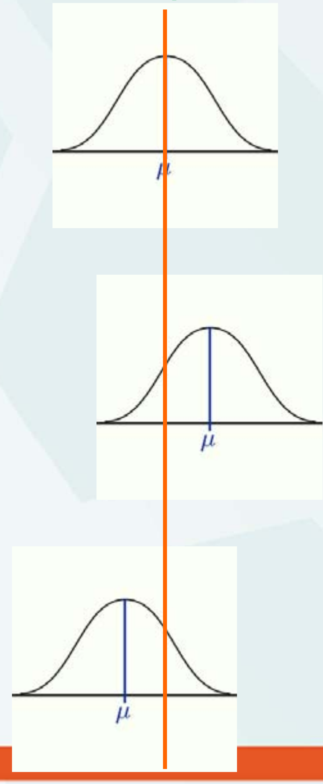


Heterogeneity in Meta-analysis

- Imagine a RCT (identical PICO) is repeated for the different subjects in the same hospital

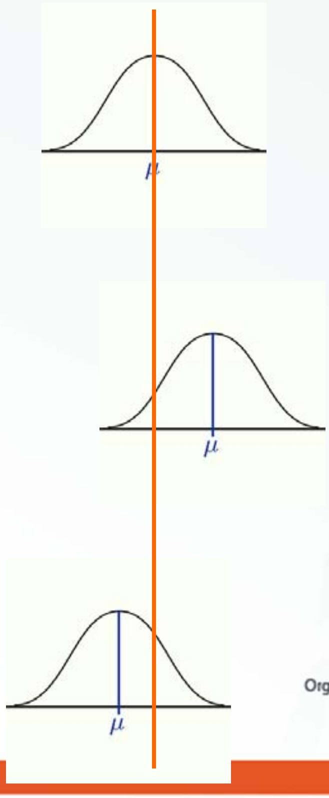


- Imagine a RCT (identical PICO) is repeated for the subjects from different hospitals in a country

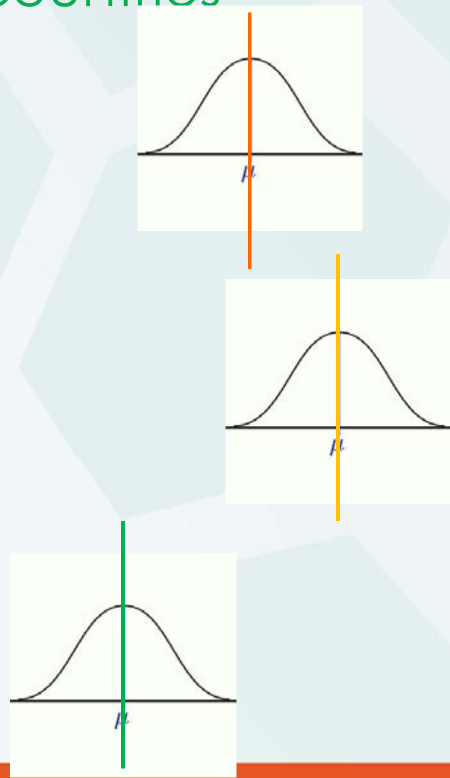


Heterogeneity in Meta-analysis

- Imagine a RCT (identical PICO) is repeated for the subjects from hospitals in different countries



- Imagine a RCT (identical PICO) is repeated for the subjects from hospitals in different countries



Heterogeneity in Meta-analysis

- Clinical heterogeneity – Differences in patients characteristics or treatment regimen
- Methodological heterogeneity – Variation in study design, outcome or duration of follow-up
- Statistical heterogeneity – Multiple ‘true’ treatment effects across the studies (i.e. clinical difference between studies)
- The play of chance – Uncontrollable factors

Evaluation of Heterogeneity in Meta-analysis

- Heterogeneity refers to the variation among study outcomes
- Cochran's Q test is the classical measure to test the heterogeneity. It calculated the weighted sum of squared differences between individual study effects and the pooled effect across studies.

$$Q = \sum w(E - E_C)^2, \text{where } E_C = \frac{\sum wE}{\sum w}$$

- Q-statistic follows Chi-square distribution with k-1 degree of freedom (df) where k is the number of studies
- Q > k-1 (i.e. df) suggesting Statistical Heterogeneity (or the p-value of Q-test<0.1)

Evaluation of Heterogeneity in Meta-analysis

- I^2 statistic describes the percentage of variation across studies that is due to significant heterogeneity rather than random chance

$$I^2 = \begin{cases} (Q-(k-1))/Q \times 100\% & for\ Q > (k-1) \\ 0 & for\ Q \leq (k-1) \end{cases}$$

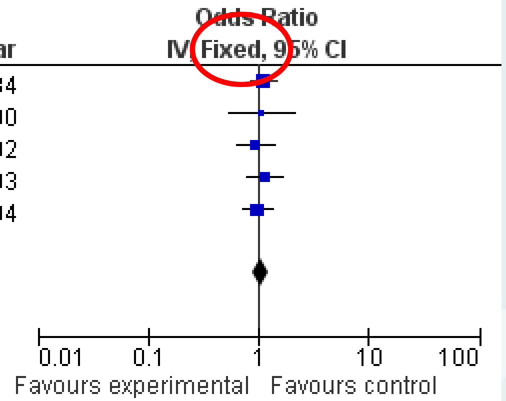
- Unlike Q it does not inherently depend upon the number of studies considered
- I^2 : 25%, 50% & 75% considered as low, moderate & high heterogeneity

Evaluation of Heterogeneity in Meta-analysis

- Cochran's Q test ➔ χ^2 =0.96 > 4 and p-value=0.92
- I^2 = 0%
- Suggesting no heterogeneity (i.e. homogeneous)

Study or Subgroup	Experimental Events	Experimental Total	Control Events	Control Total	Weight	Odds Ratio IV, Fixed, 95% CI	Year
Vetter	161	486	141	453	34.2%	1.10 [0.83, 1.44]	1984
McEwan	21	118	19	111	5.5%	1.05 [0.53, 2.08]	1990
Vetter1	75	240	68	207	16.2%	0.93 [0.62, 1.38]	1992
van Rossum	99	231	87	221	18.3%	1.16 [0.79, 1.68]	1993
Wagner	74	581	111	846	25.9%	0.97 [0.71, 1.32]	1994
Total (95% CI)		**1656**		**1838**	**100.0%**	**1.04 [0.89, 1.22]**	
Total events	430		426				

Heterogeneity: Chi² = 0.96, df = 4 (P = 0.92); I² = 0%
Test for overall effect: Z = 0.48 (P = 0.63)



Fixed-effect model

- The combined effect size (EC) is given by a weighted average of the observed effect (E) from each individual study

$$E_C = \frac{\sum wE}{\sum w}$$

- The weight (w) for each study is the inverse of its variance, i.e.

$$w = \frac{1}{Var(E)}$$

- More precise (less variance) study would contribute more in estimating the true effect.

Fixed-effect model

- The weight of each study in proportional to the inversed variance of each study (The size of the square is proportional to the weight)
- The combined OR is 1.04 with 95% confidence interval from 0.89 to 1.22 and the effect is not statistically significant as p-value is 0.63.

	Experimental		Control			Odds Ratio	
Study or Subgroup	Events	Total	Events	Total	Weight	IV, Fixed, 95% CI	Year
Vetter	161	486	141	453	34.2%	1.10 [0.83, 1.44]	1984
McEwan	21	118	19	111	5.5%	1.05 [0.53, 2.08]	1990
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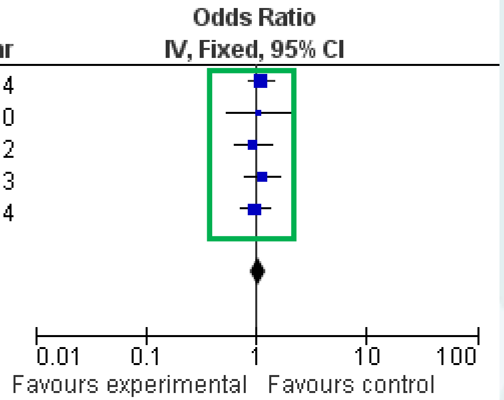


Random-effects model

- Assumptions:
  - Individual studies are estimating different, but related, treatment effects
  - The treatment of different studies have a distribution with some central value and some degree of variability.

- Results are combined with the studies weighted according to the inverse of the sum of within-study variance & among-study variance:
  - DerSimonian and Laird method

Random-effects model

- The excess variation (T) should be taken into consideration in computing the combined estimate
- One common way is to estimate the excess variation:

$$T^2 = \frac{Q-(k-1)}{C} \qquad \text{where } C = \sum w - \frac{\sum w^2}{\sum w}$$

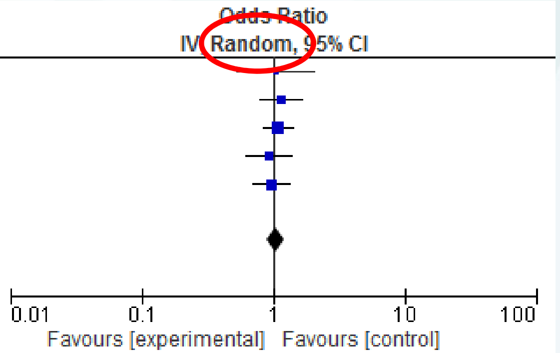
- and Q is the statistic from Cochrane Q test; (k-1) is the degree of freedom; w is the weight

Random-effects model

- $I^2 < 30\%$ can use fixed-effect model
- $30\% \ (40\%) \leq I^2 < 70\% \ (75\%)$ can consider to use random-effects model
- $I^2 \geq 70\% \ (75\%)$ results should not be combined

	Experimental		Control			Odds Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	IV, Random, 95% CI
McEwan 1990	21	118	19	111	5.5%	1.05 [0.53, 2.08]
Van Rossum 1993	99	231	87	221	18.3%	1.16 [0.79, 1.68]
Vetter 1984	161	486	141	453	34.2%	1.10 [0.83, 1.44]
Vetter1 1992	75	240	68	207	16.2%	0.93 [0.62, 1.38]
Wagner 1994	74	581	111	846	25.9%	0.97 [0.71, 1.32]
Total (95% CI)		**1656**		**1838**	**100.0%**	**1.04 [0.89, 1.22]**
Total events	430		426			

Heterogeneity: Tau² = 0.00; Chi² = 0.96, df = 4 (P = 0.92); I² = 0%
Test for overall effect: Z = 0.48 (P = 0.63)



Effect the model for meta-analysis

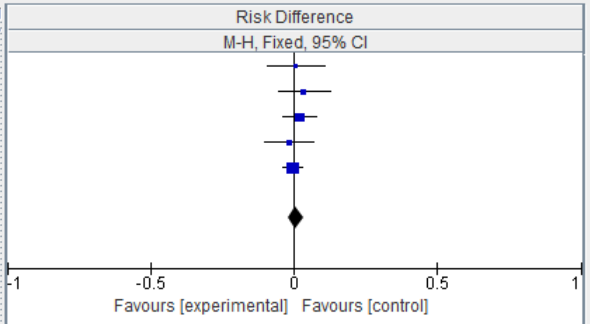
- Changing the model by simply clicking "FE", it will shift between FE (i.e. Fixed-effect Model) and RE (Random-effects model)

Text of Review | 3.1 Visual screening...

Comparison: 3 Visual screening, Outcome: 3.1 Visual screening for elderly

RD FE

Study or Subgroup	Experimental Events	Experimental Total	Control Events	Control Total	Weight	Risk Difference M-H, Fixed, 95% CI
McEwan 1990	21	118	19	111	6.6%	0.01 [-0.09, 0.11]
Van Rossum 1993	99	231	87	221	13.1%	0.03 [-0.06, 0.13]
Vetter 1984	161	486	141	453	27.3%	0.02 [-0.04, 0.08]
Vetter1 1992	75	240	68	207	12.9%	-0.02 [-0.10, 0.07]
Wagner 1994	74	581	111	846	40.0%	-0.00 [-0.04, 0.03]
Total (95% CI)		1656		1838	100.0%	0.01 [-0.02, 0.03]
Total events	430		426			
Heterogeneity: Chi² = 1.17, df = 4 (P = 0.88); I² = 0%						
Test for overall effect: Z = 0.48 (P = 0.63)						



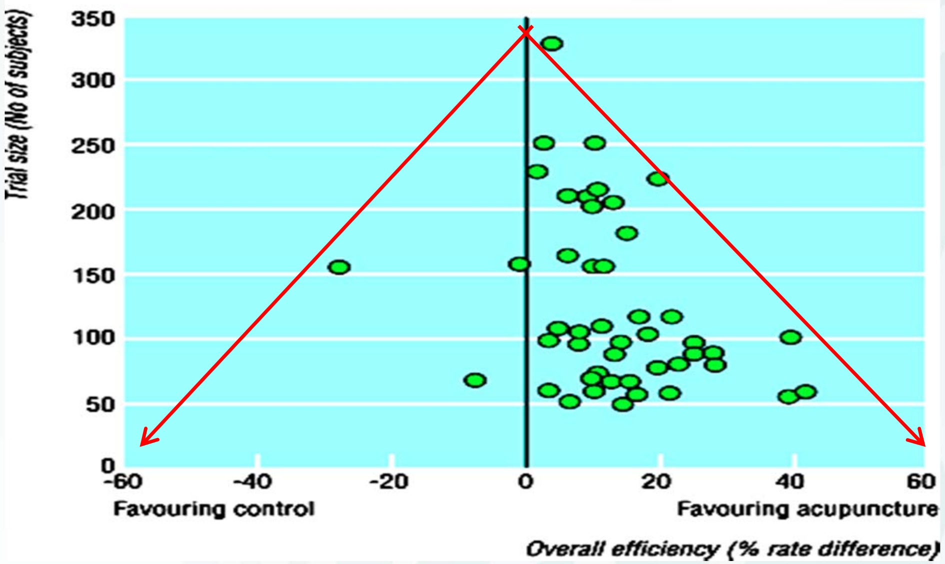
Publication bias in meta-analysis

- Causes:
  - Good news (i.e. significant results) more likely be accepted than bad news (i.e. insignificant results)
  - Small trials with statistically insignificant less likely be published

- Consequence:
  - Leading to over-estimation of the true effect if only published studies included in meta-analysis

Publication bias in meta-analysis

- Trials of Acupuncture in Stroke Rehabilitation



- Can assess by funnel plot (plotting precision or sample size against effect)

Tang JL, Zhan SY, Ernst E. Review of randomised controlled trials of traditional Chinese medicine. BMJ. 1999 Jul 17;319(7203):160-1

End