

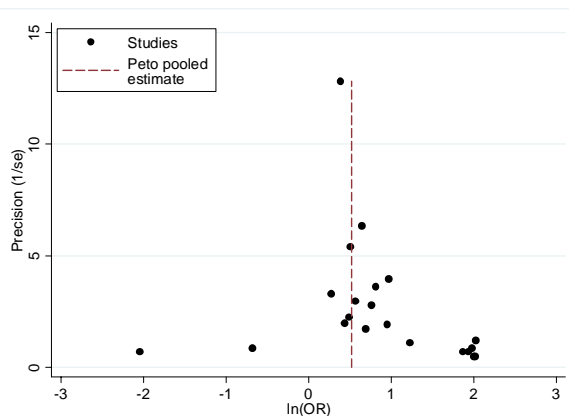
# DEALING WITH PUBLICATION BIAS: FUNNEL PLOTS & BEYOND

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## The Funnel Plot

- Used to check for asymmetry in distribution of study results in a meta-analysis
- Scatter plot of data used in meta-analysis



Risk of gastrointestinal  
haemorrhage with long term  
Use of aspirin  
(Derry & Loke 2000)

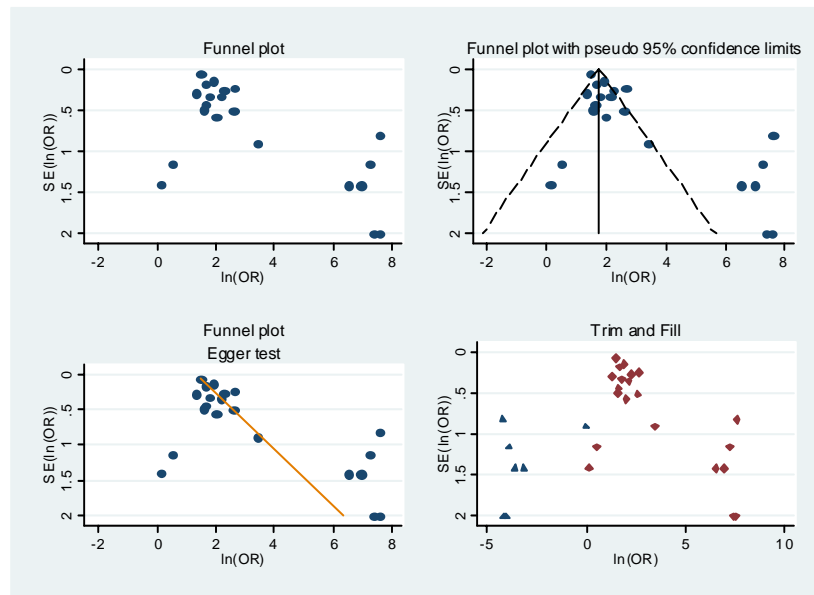
## Problems With Funnel Plot

- Assessment is subjective
  - Addressed by statistical tests
- Needs moderate numbers of studies before interpretable
- For OR / RR underlying funnel shape not expected due to relationship between  $\ln(\text{OR})$  and its SE.
  - Becomes more serious the larger the OR
  - Addressed by statistical tests
- Asymmetry may be indicative of publication bias or could be caused by other factors (small study effects)
  - See contour enhanced funnel plot (later)
- Appearance can change depending on outcome measure / definition of x & y axes
  - Partially addressed by the statistical tests

## BACK TO BASICS: What Causes Publication Bias?

- Uninteresting/unfavourable studies less likely to be published
- Precise mechanisms unknown
- Evidence suggests statistical significance most important factor  
(Dickersin 1997; Easterbrook et al 1991; Ioannidis 1998)
  - *This fact is often ignored when assessing whether publication bias is present*

## Assessments of Publication Bias

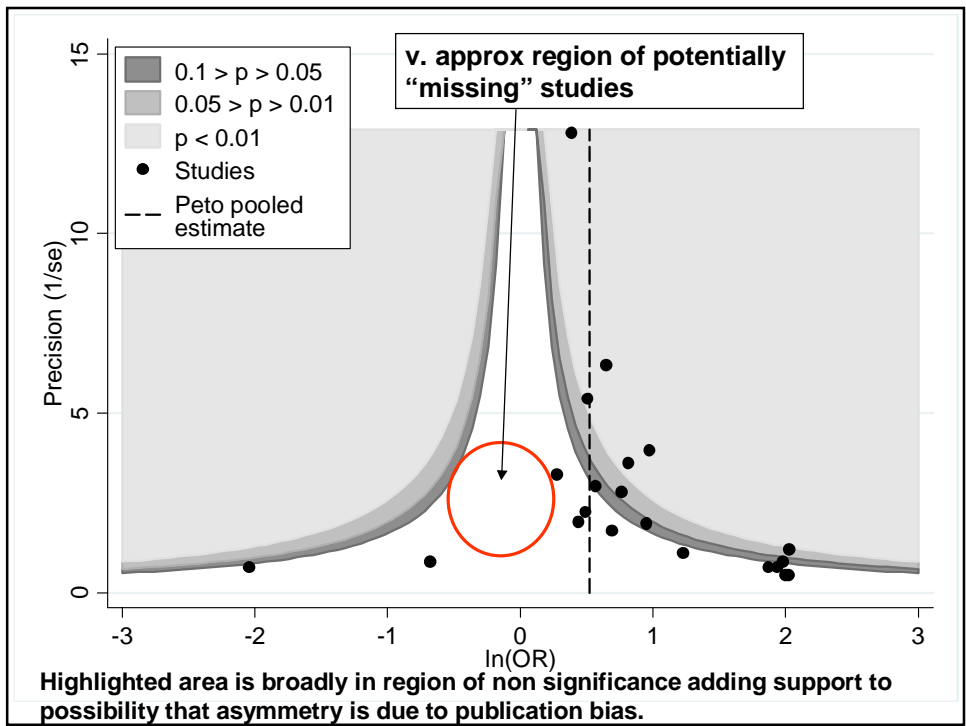
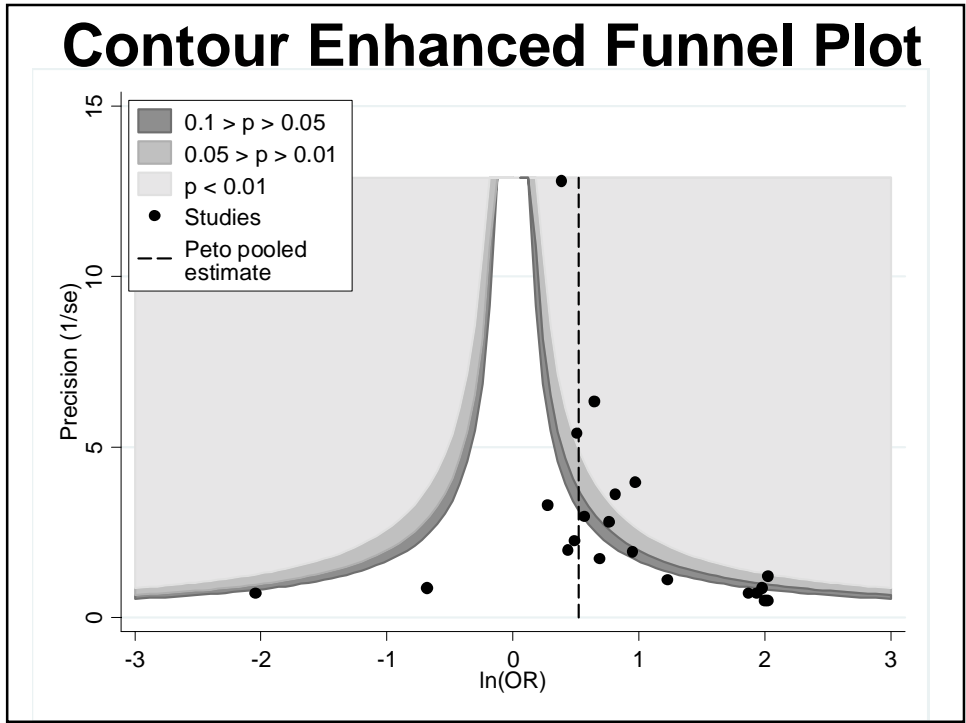


- Which of these studies are statistically significant?

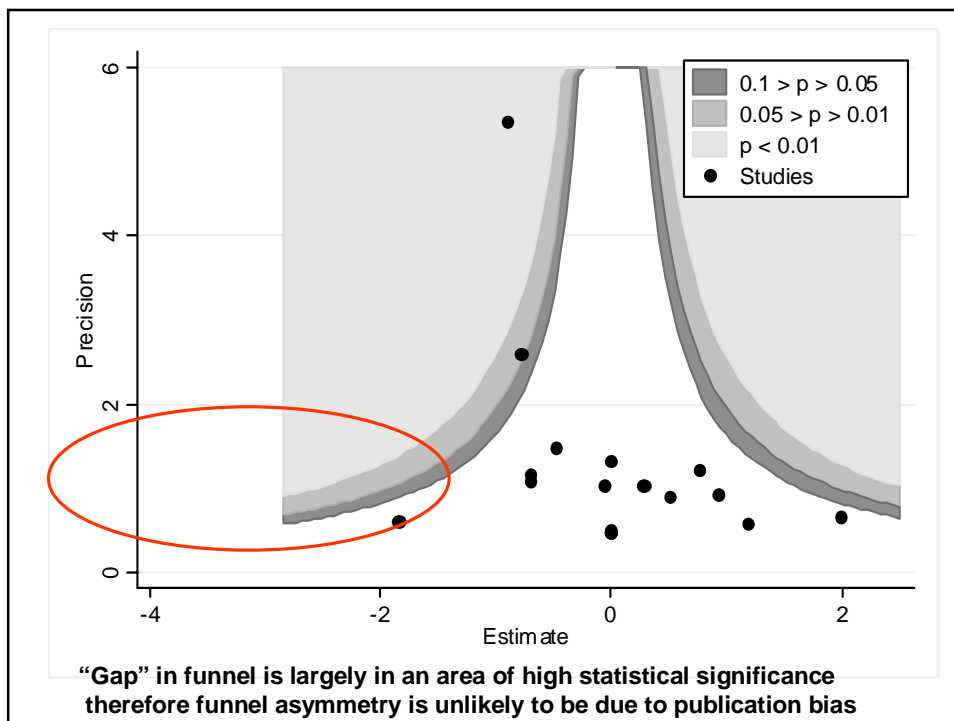
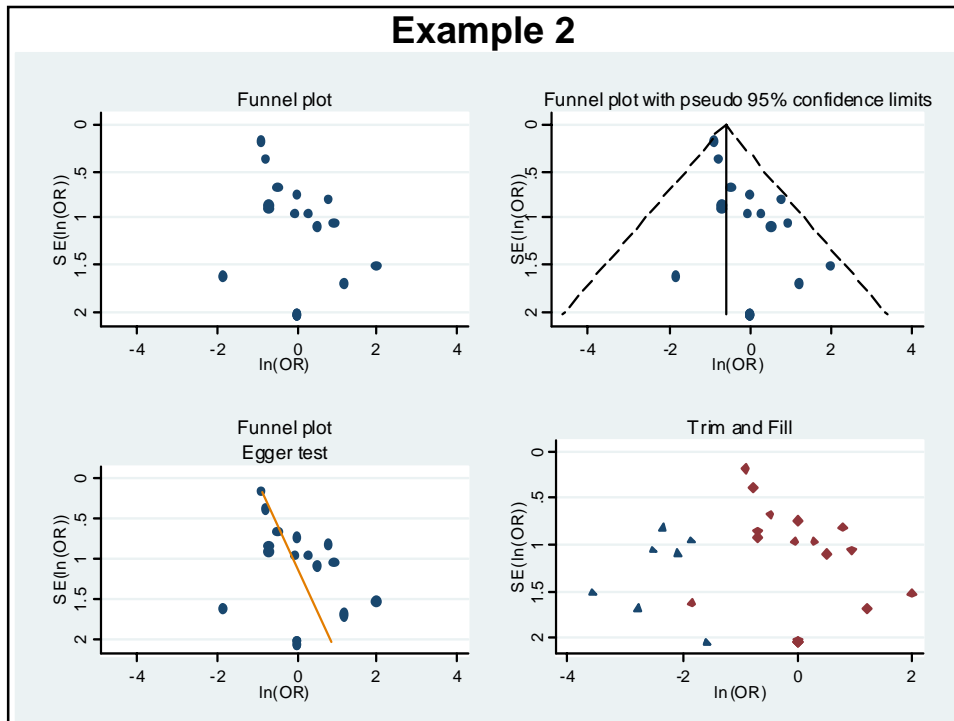
## The Contour Enhanced Funnel Plot

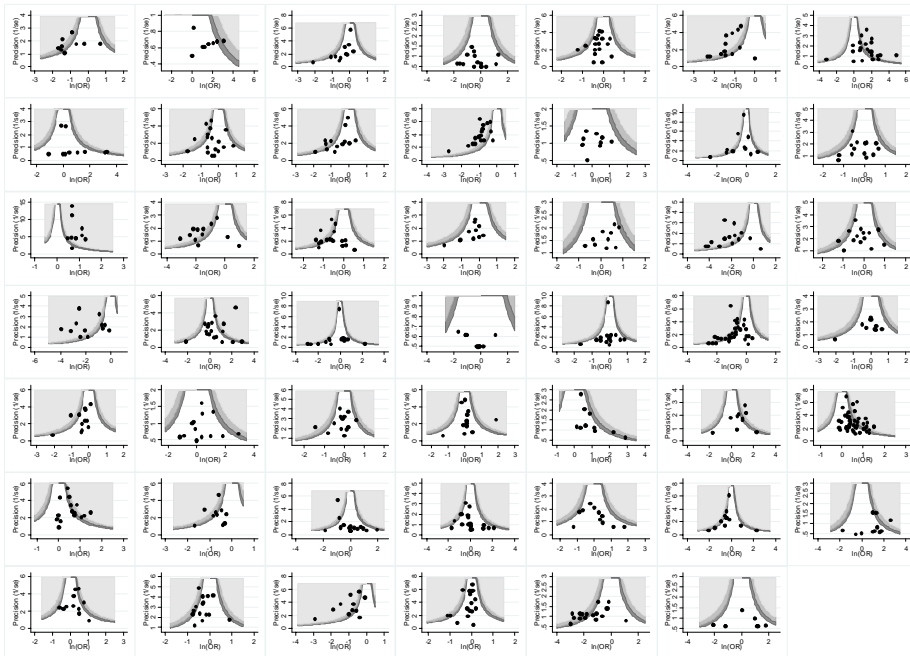
- Consider a funnel plot with axes *effect size*  $v$  (some function of) *standard error*
- Significance of any loci on the plot can be calculated as  $\Phi(\text{effect size}/\text{standard error})$ ,  
(where  $\Phi$  is the cdf for standard norm. dbn.)
- Contours for boundaries of milestones in statistical significance can be defined
- Help decide whether asymmetry is more likely to be caused by publication bias or other factors
- Assessing something more specific than “asymmetry”
  - Shape of missing part dependent on the underlying effect size

# Contour Enhanced Funnel Plot

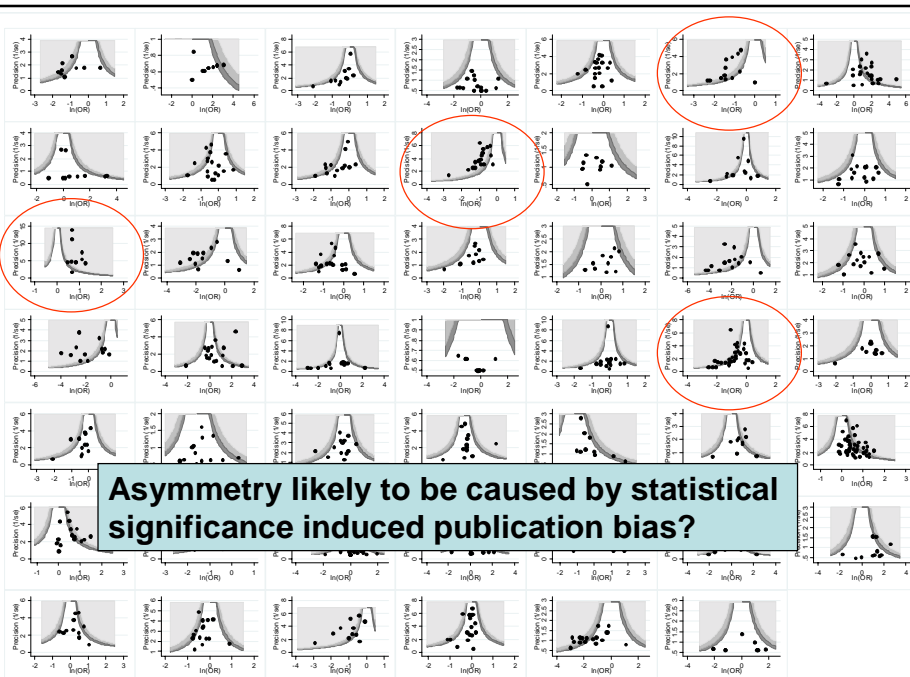


## Example 2



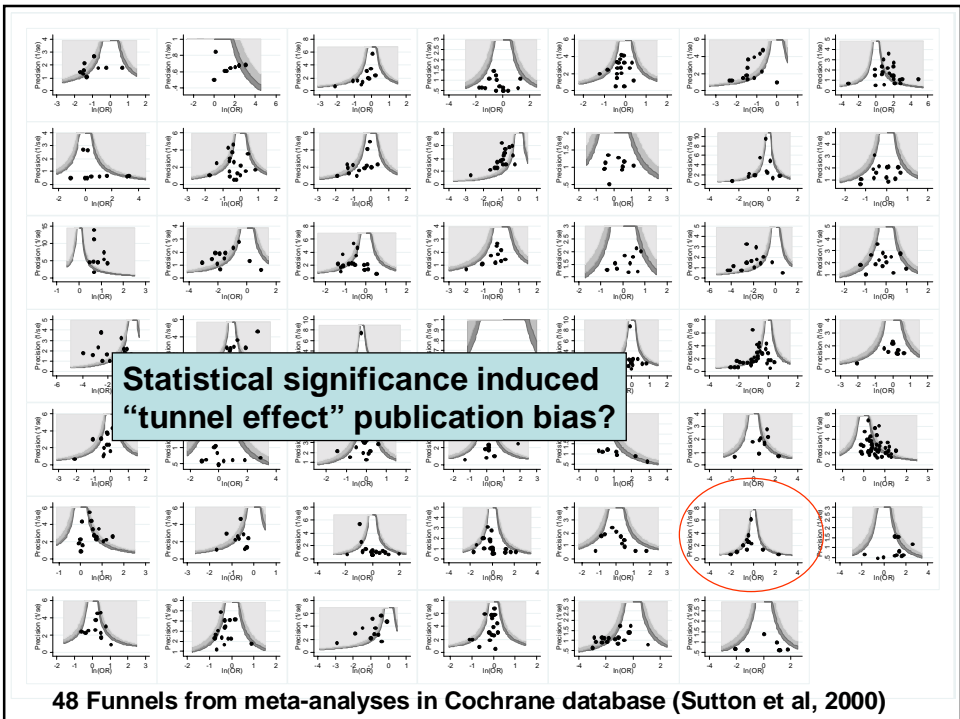
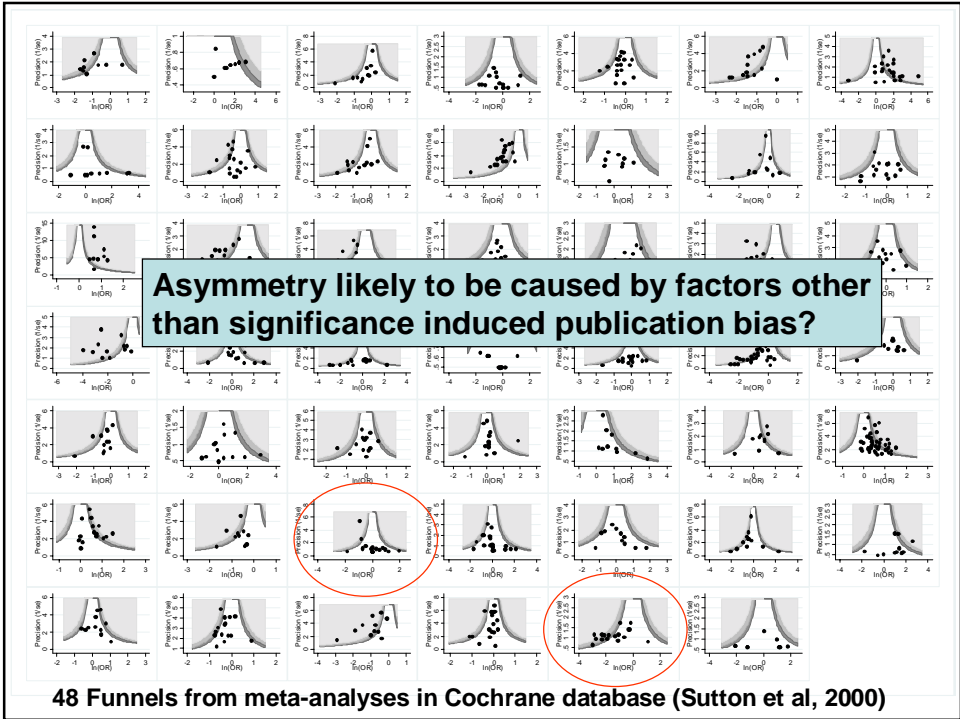


48 Funnels from meta-analyses in Cochrane database (Sutton et al, 2000)



**Asymmetry likely to be caused by statistical significance induced publication bias?**

48 Funnels from meta-analyses in Cochrane database (Sutton et al, 2000)

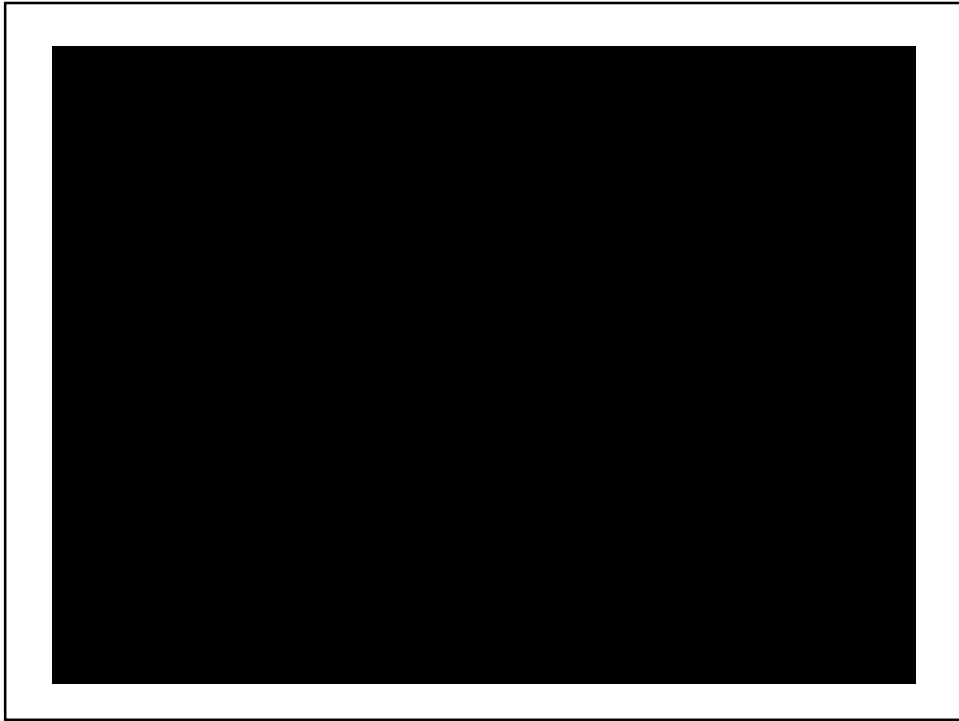


## Discussion

- Firmly believe a contour enhanced funnel is a valuable tool
  - Delighted it made the latest edition of the Cochrane Handbook(!)
  - Changes the emphasis on what you are assessing
  - Reconciles evidence about selection mechanisms with data
  - i.e. not just assessing asymmetry, but also distribution of studies with respect to statistical significance
  - Whether we need a formal associated test is up for debate
- Tests have low power and should be interpreted with such knowledge
- Detecting publication bias does not deal with the problem
  - We have to go beyond this in a decision making context
  - Provisional work suggests adjustments conditional on test have poor statistical properties
  - Still some way to go!

## For the Future

- Power usually limited in any pair-wise comparison
  - More global assessment sensible?
    - E.g. all drugs in a class
    - Since looking for distribution of studies wrt boundaries on a contour funnel – still interpretable etc
- Consistent with more global assessments in evidence synthesis
  - E.g. umbrella reviews, mixed treatment comparisons



# References

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