



Finnish Institute of  
Occupational Health



# Data Synthesis

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# A systematic review

1. Well-formulated question (PICO)
2. Thorough search
3. Objective selection of studies
4. Critical assessment of methodological quality
5. Objective data extraction
6. Synthesis of the data
  - a) appropriate comparisons of interventions and controls
  - b) meta-analysis per comparison
7. Conclusions for practice and research

# Quantitative versus qualitative synthesis

- In many (Cochrane) Reviews Data Synthesis part is missing
- Data-synthesis / Meta-analysis
  - Pros
    - answer to review research question
    - more precise answer (smaller 95% Confidence Interval)
    - increased power
    - allows subgroup analysis
  - Cons
    - risk of combining apples and pears
    - does not remove bias (from primary studies, publication)
    - more work
    - some understanding of epidemiology and statistics needed
  - Alternative
    - narrative or qualitative synthesis

# Narrative Synthesis

- Synonyms:
  - narrative
  - qualitative
  - no (statistical) pooling
    - do not confuse with qualitative research
- Meaning
  - a story about how we think the studies add to a joint conclusion
  - Popay et al 2006: Four main elements
    - Developing a theory of how the intervention works, why and for whom
    - Developing a preliminary synthesis of findings of included studies
    - Exploring relationships in the data
    - Assessing the robustness of the synthesis

# Qualitative synthesis

- Pros
  - keep apples and pears possibly separated
  - can be more flexible
- Cons
  - risk of using authors conclusions and not based on data
  - apples and pears are 'tentatively' combined with 'great caution'
  - overlooking comparisons and not making them
  - small negative studies have too big impact
  - no real methods available
    - back review group qualitative levels of evidence
  - confused with grading of evidence

# Data synthesis: outcomes

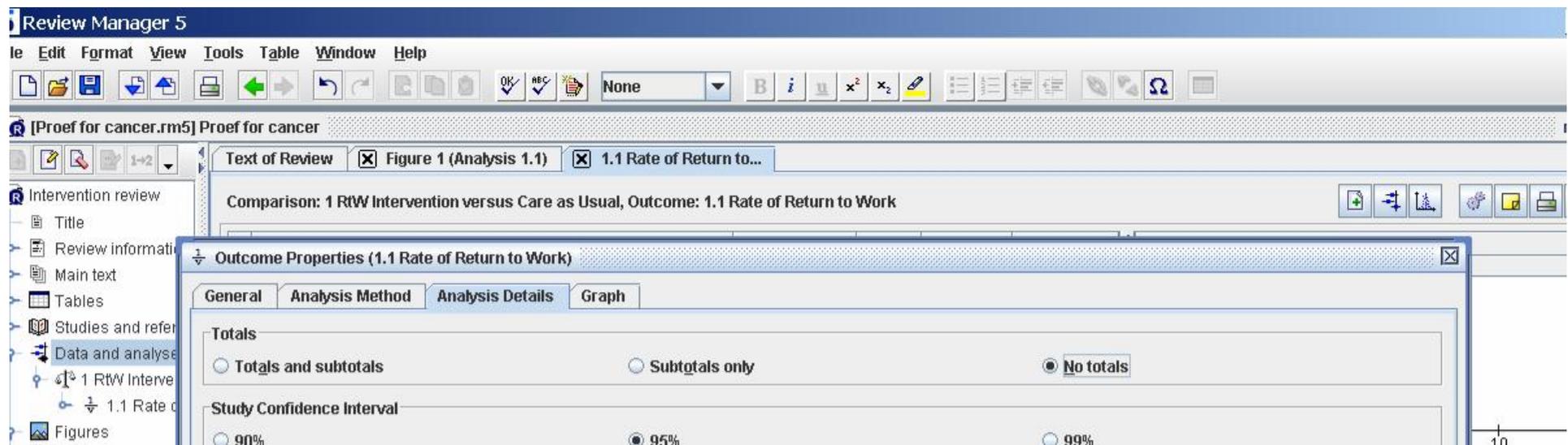
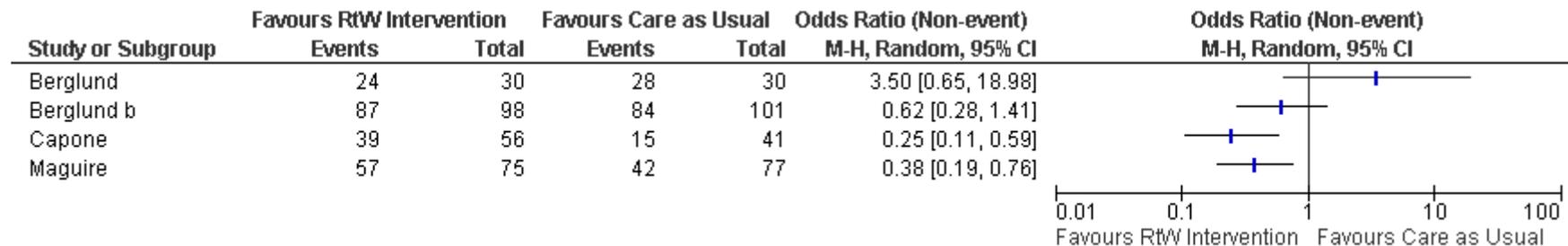
- Worker training to prevent injuries
- Outcome
  - Study 1:
    - intervention: 15 injuries / 45 workers
    - control: 18 injuries / 37 workers
    - RR 0.69 (95% CI 0.4 to 1.2)
    - author's conclusions: not significant outcome
  - Study 2:
    - intervention: 16 injuries / 201.000 working hours
    - control 24 injuries / 193.000 working hours
    - RR 0.64 (95% CI 0.40 to 1.2)
    - author's conclusions: no significant outcome
- No quantitative analysis possible we combined studies qualitatively:
  - conclusion: based on two studies with a non-significant outcome we found no evidence of effectiveness

# Data synthesis: outcomes

- Recalculate all outcomes on similar scale
  - 2000 working hours = 1 working year (US)
- Combine in meta-analysis
  - Pooled:
    - RR 0.66 (95% CI 0.45 to 0.98)
- Review Conclusion:
  - the intervention reduces injuries with 34%

# Quantitative synthesis

- Synthesize studies only within a comparison
  - NB in addition to PICO also study-design, follow-up time
- Simplest is to put data in RevMan and make a forest-plot without clicking totals diamond



# Quantitative Synthesis Outcomes

- Only similarly measured outcomes can be combined
  - Dichotomous
    - Odds Ratio
    - Risk Ratio
    - Risk Difference
  - Continuous
    - Mean Difference
    - Standardized Mean Difference
  - Other data types
    - Survival Time
      - Hazard Ratio
    - Count data
      - Rates

# Quan Synthesis Outcomes

- Only similarly measured outcomes can be combined!

Review Manager 5

Edit Format View Tools Table Window Help

Prof for cancer.rm5] Prof for cancer

Text of Review [X] Figure 1 (Analysis 1.1) [X] 1.1 Rate of Return to...

Outcome Properties (1.1 Rate of Return to Work)

General Analysis Method Analysis Details Graph

Statistical Method

Peto

Mantel-Haenszel

Inverse Variance

Exp[(0-E) / Var]

Analysis Model

Fixed effect

Random effects

Effect Measure

Peto Odds Ratio

Odds Ratio

Risk Ratio

Risk Difference

Mean Difference

Std. Mean Difference

Name of Effect Measure:

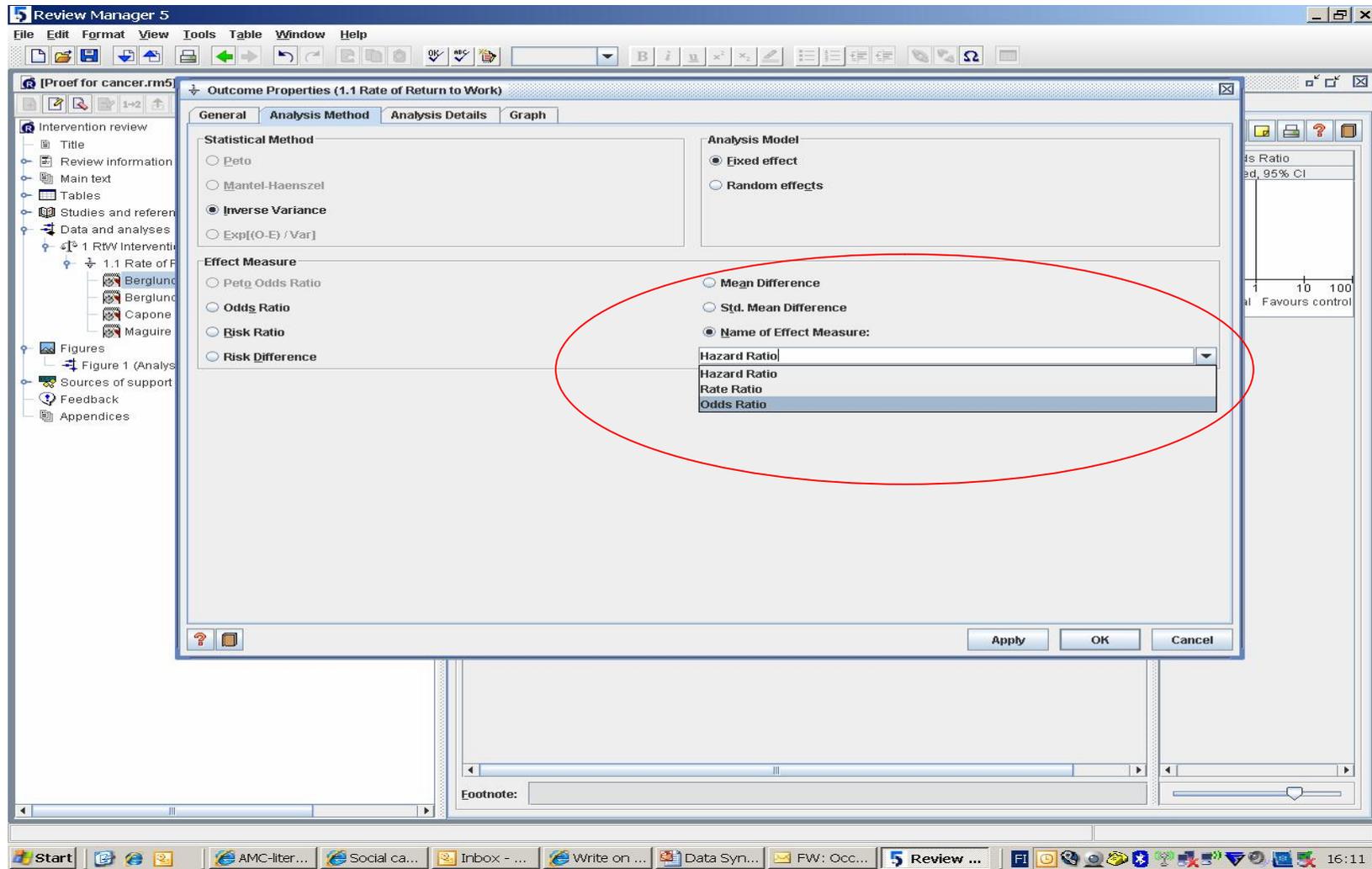
Hazard Ratio

Continuous outcomes

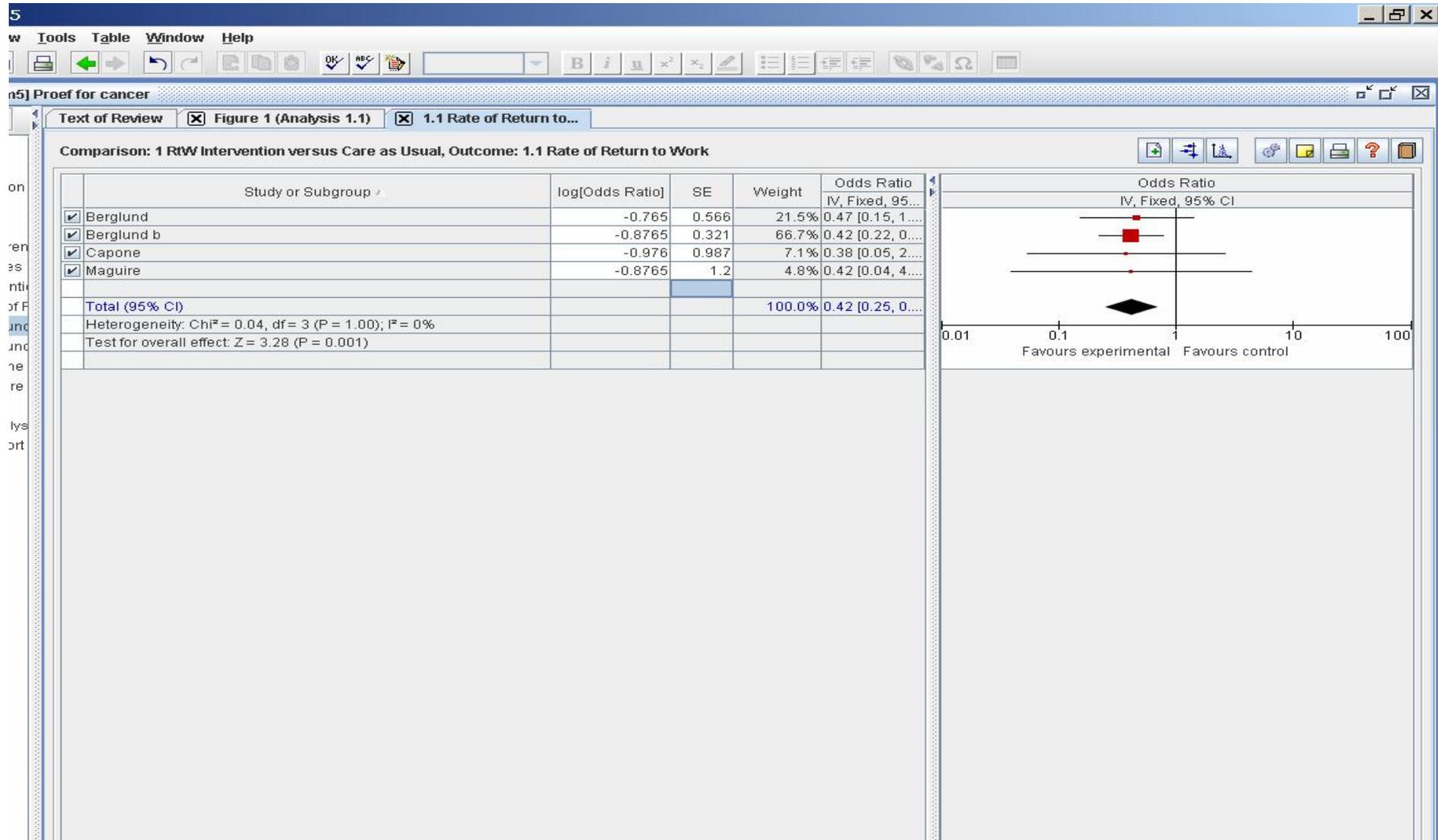
Dichotomous outcomes

Other outcomes: Hazard Ratios etc

# Quantitative Synthesis Outcomes



# Quan Syn Generic Inverse Variance

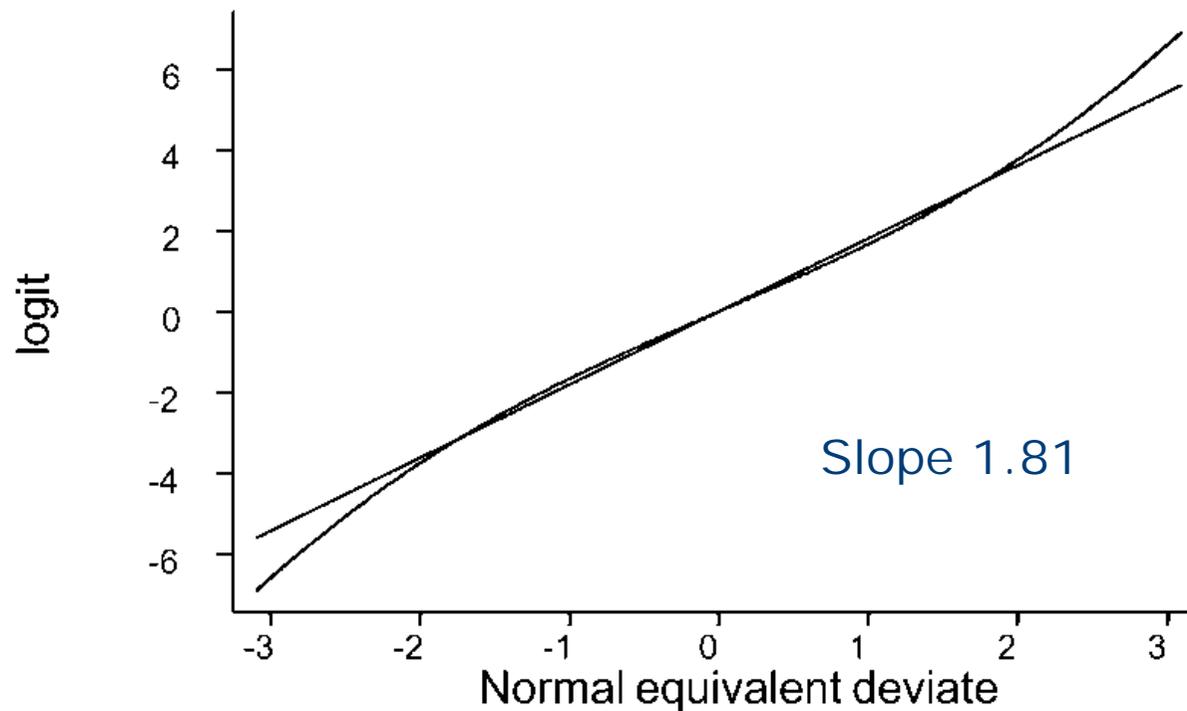


# Dichotomous and Continuous Outcomes

- In many studies outcomes both dichotomous and continuous measurements
  - ml blood loss and > 500 ml blood loss
  - ml FEV1 and more than 20% decrease
  - days to return to work and being at work after 3 months
- Example Return to work in back pain patients
  - Study A: average days to return to work
    - Intervention (N=110):  $90 \pm 35$  days
    - Control (N=109):  $120 \pm 45$  days
  - Study B: rate of return to work at 12 months
    - Intervention (N=90): 65%
    - Control (N=89): 45%

# How to combine dich and cont?

- Relation between OR and Effect Size (Chinn 2000)
  - $\ln(\text{OR}) = 1.81 * \text{SMD}$



# Calculations

- Combining studies
  - Study A: average days to return to work
    - Intervention (N=110):  $90 \pm 35$  days
    - Control (N=109):  $120 \pm 45$  days
    - SMD = -0.74 (-1.02 to -0.47)
  - Study B: rate of return to work at 12 months
    - Intervention (N=90): 65%
    - Control (N=89): 45%
    - OR = 0.43 (0.23 to 0.78)
- Transform OR into SMD and SE
  - $\ln(\text{OR}) = 1.81 * \text{SMD}$
  - $= \ln(0.43) / 1.81 = -0.466$
  - $\text{SE} = (\ln(0.78) - \ln(0.23)) / 3.92 / 1.81 = 0.172$
- Combine SMDs in RevMan using Inverse Variance Method
  - Pooled Effect Size: -0.62 [-0.89, -0.36]