



# 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 forestplot without clicking totals diamond

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# 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!

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## Quantitative Synthesis Outcomes



# Quan Syn Generic Inverse Variance

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# 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 ± 45 days
  - Study B: rate of return to work at 12 months
    - Intervention (N=90): 65%
    - Control (N=89): 45%



Relation between OR and Effect Size (Chinn 2000)
 In (OR) = 1.81 \* SMD



## Calculations

- Combining studies
  - Study A: average days to return to work
    - Intervention (N=110): 90 ± 35 days
    - Control (N=109): 120 ± 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
  - In(OR) = 1.81\* SMD
  - $= \ln(0.43) / 1.81 = -0.466$
  - 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]