



Finnish Institute of
Occupational Health



Data Synthesis

Jos Verbeek

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

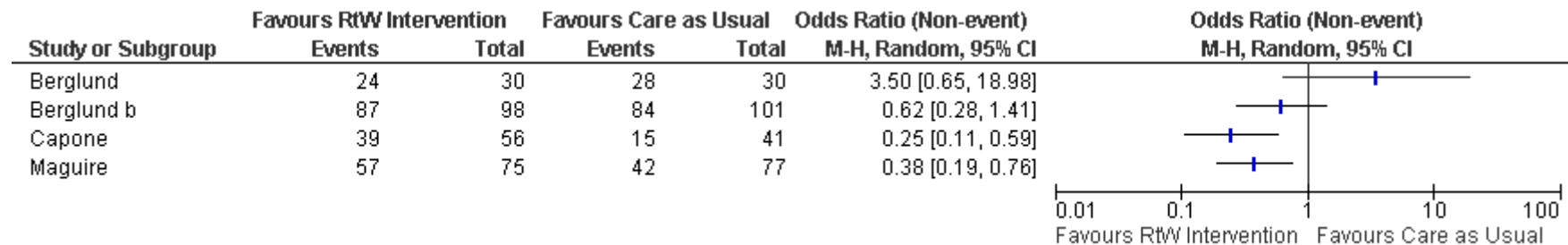
- Worker training to prevent injuries
- Outcome
 - Study 1:
 - intervention: 15 injuries / 45 workers
 - control: 18 injuries / 37 workers
 - RR 0.69 (95% CI 0.4 to 1.2)
 - author's conclusions: not significant outcome
 - Study 2:
 - intervention: 16 injuries / 201.000 working hours
 - control 24 injuries / 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



Review Manager 5

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[Proef for cancer.rm5] Proef for cancer

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

Comparison: 1 RtW Intervention versus Care as Usual, Outcome: 1.1 Rate of Return to Work

Outcome Properties (1.1 Rate of Return to Work)

General Analysis Method Analysis Details Graph

Totals

Totals and subtotals Subtotals only No totals

Study Confidence Interval

90% 95% 99%

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

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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:

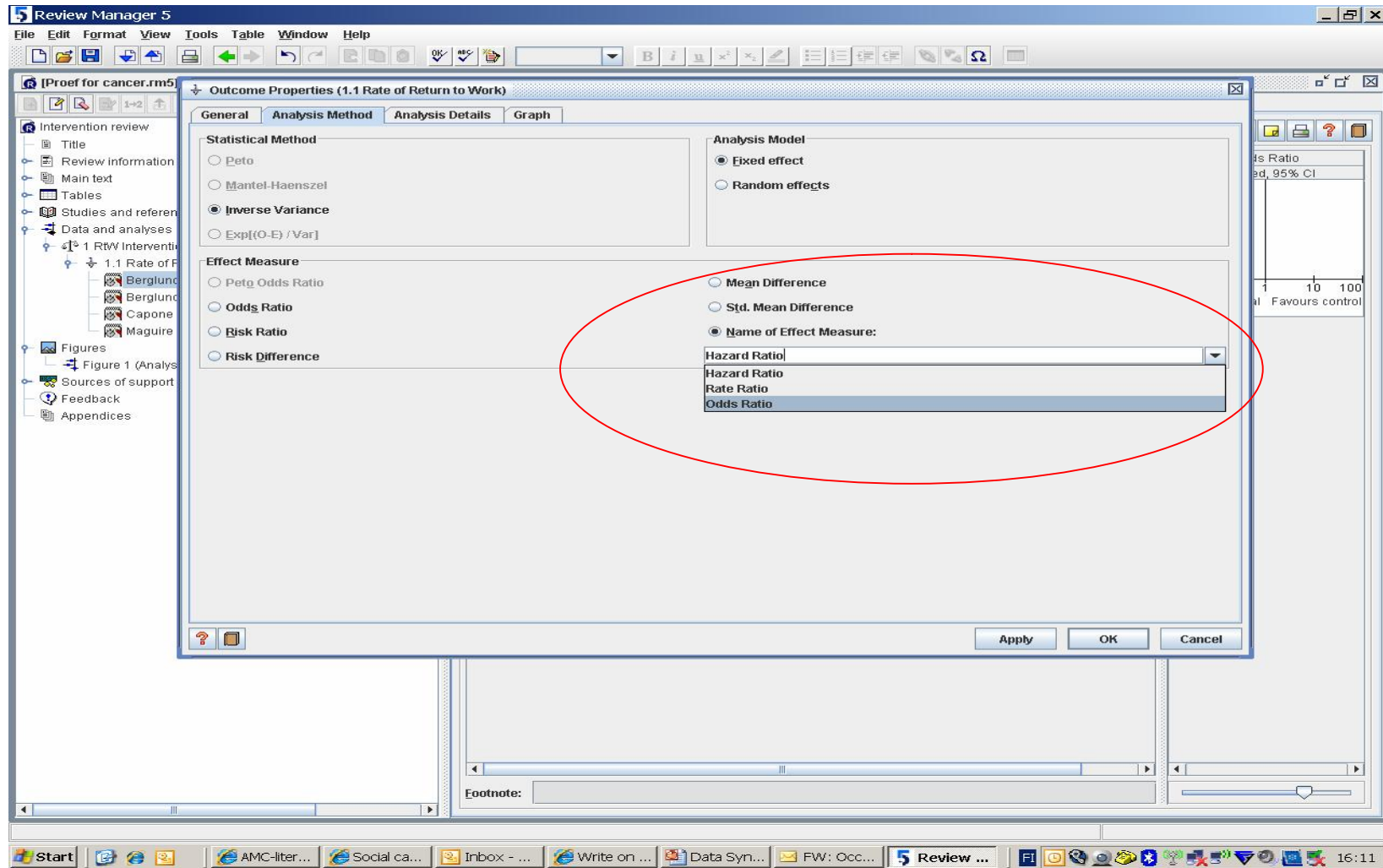
Hazard Ratio

Continuous outcomes

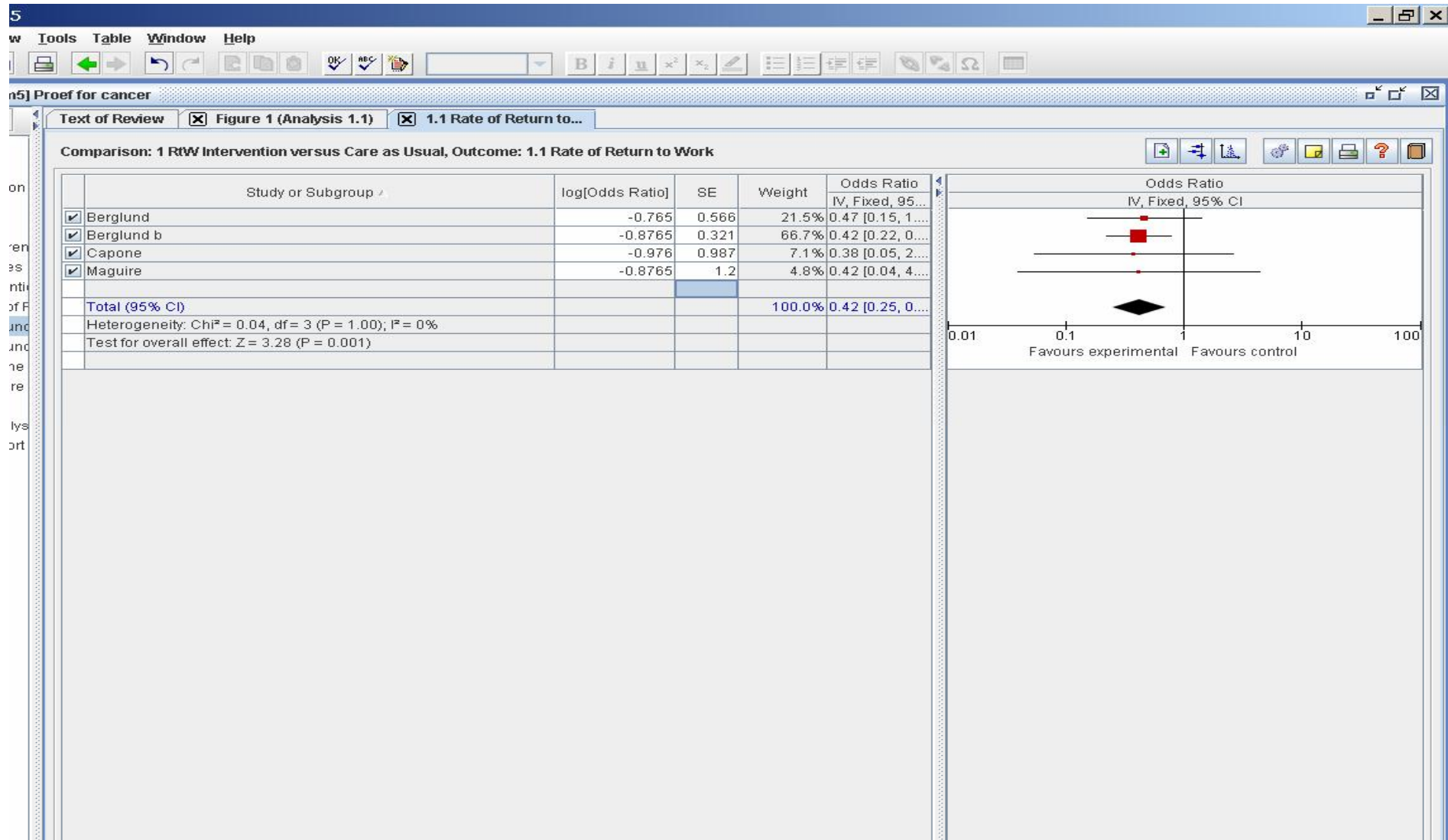
Dichotomous outcomes

Other outcomes: Hazard Ratios etc

Quantitative Synthesis Outcomes



Quan Syn Generic Inverse Variance

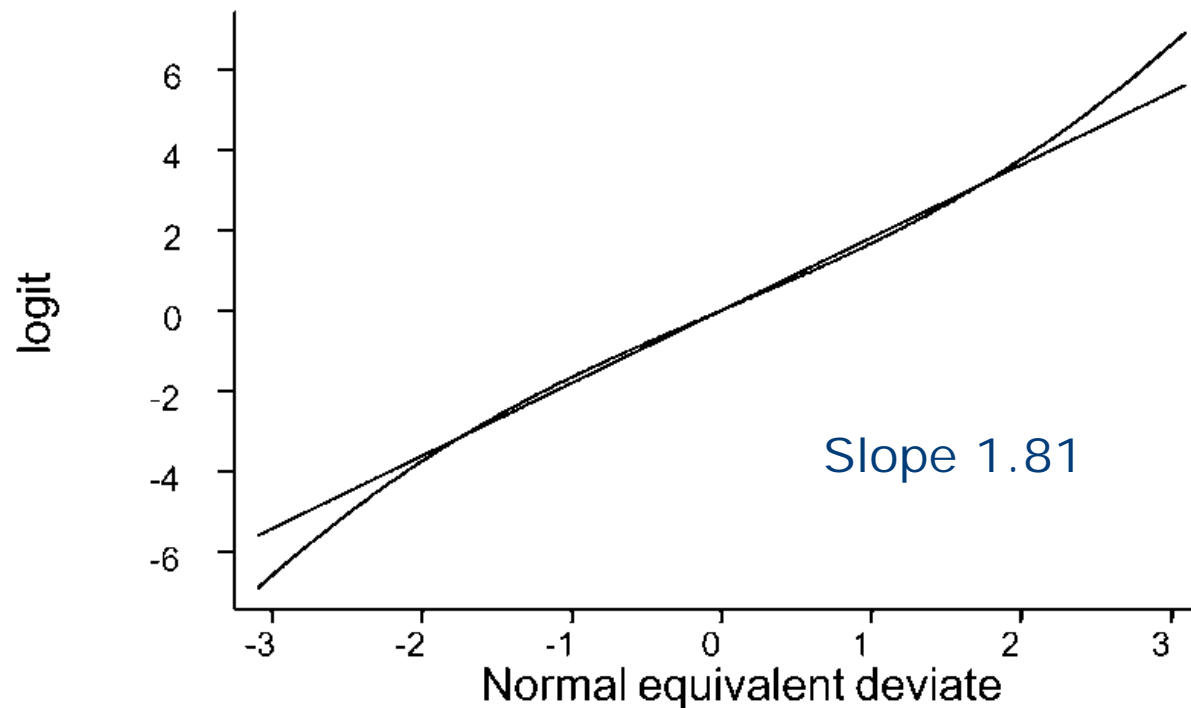


Dichotomous and Continuous Outcomes

- 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 ± 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%

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 ± 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
 - $\ln(\text{OR}) = 1.81 * \text{SMD}$
 - $= \ln(0.43) / 1.81 = -0.466$
 - $\text{SE} = (\ln(0.78) - \ln(0.23)) / 3.92 / 1.81 = 0.172$
- Combine SMDs in RevMan using Inverse Variance Method
 - Pooled Effect Size: -0.62 [-0.89, -0.36]