Combining Confidence Distributions for Rare Event Meta-Analysis

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Overview

What Is a Meta-Analysis?
What Is a Confidence Distribution?
Confidence Distributions in Meta-Analysis
Improvements
What Is a Meta-Analysis?

### Study 1
- \( n = 82 \)
- \( \hat{OR}_1 = 2.27 \)
- \( \text{pval} = 0.51 \)

### Study 2
- \( n = 88 \)
- \( \hat{OR}_2 = 1.00 \)
- \( \text{pval} = 1.00 \)

### Study 3
- \( n = 217 \)
- \( \hat{OR}_3 = 1.57 \)
- \( \text{pval} = 0.49 \)

### Study 6
- \( n = 300 \)
- \( \hat{OR}_6 = 2.73 \)
- \( \text{pval} = 0.09 \)

**Combined Info**
- \( \hat{OR}_C = 1.76 \)
- \( \text{pval} = 0.05 \)

Average Treatment Event Rate: 6.6%

Average Control Event Rate: 3.8%
What Is a Meta-Analysis?

Rare Events
(baseline probability: 0.7%)

Can we lower the Type I Error rate by using methods better suited for meta-analyses with rare events?

What Is a Confidence Distribution?

Population Parameter

Point estimate

Interval estimate

Distribution estimate
Confidence Distributions in Meta-Analysis

\[ p_c(\theta) = F(c)[w_1h(p_1(\theta)) + \ldots + w_6h(p_6(\theta))] \]

Singh et al. (2005), Tian et al. (2009), and Liu et al. (2014)
Improvements

Rare Events (baseline probability: 0.7%)

\[ p_c(\theta) = F(c)[w_1h(p_1(\theta)) + \cdots + w_6h(p_6(\theta))]. \]

Can we lower the Type I Error rate by using methods better suited for meta-analyses with rare events?

YES!

Rates Differ Between TRT and CTRL

Type 1 Error = 0, \(k = 10\), \(\mu = -5\), sd = 0.1, min \(n = 50\), max \(n = 200\), reps = 1000

Traditional Methods
- Liu et al. (Normal CDF)
- Fisher (Sum Logs)
- Tian et al. (Logit)
- Extension (Tian w/ Liu Weights)

Thank you!

