Meta-analysis of clinical prediction models

Incorporating known univariable coefficients when analyzing multivariable data

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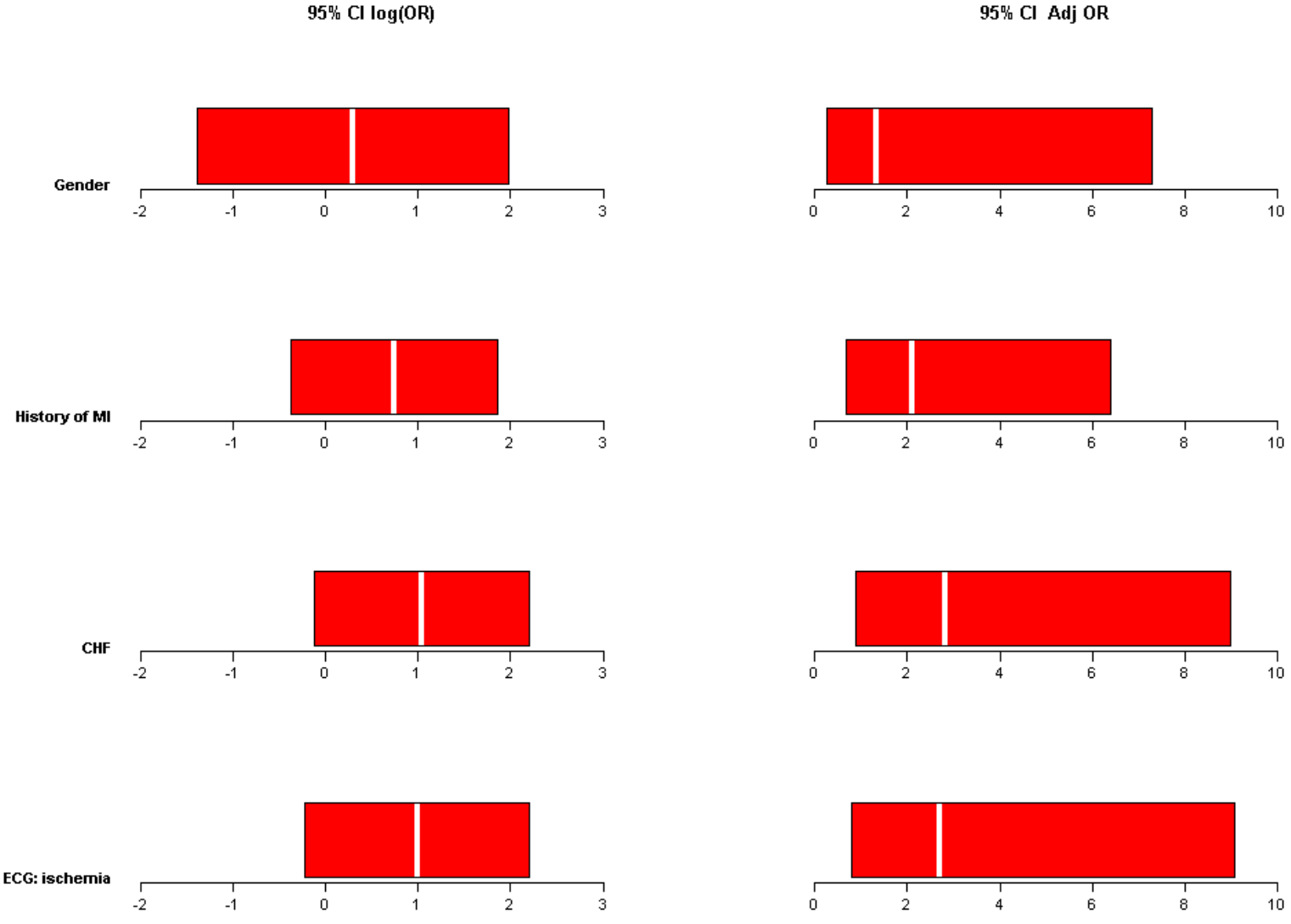
Introduction

- Multivariable data analysis
- Logistic regression modeling
- Regression coefficients and odds ratios

Practical example : prediction of peri-operative mortality after elective abdominal aortic aneurysm surgery (AAA) – IPD: 238 patients including 18 deaths

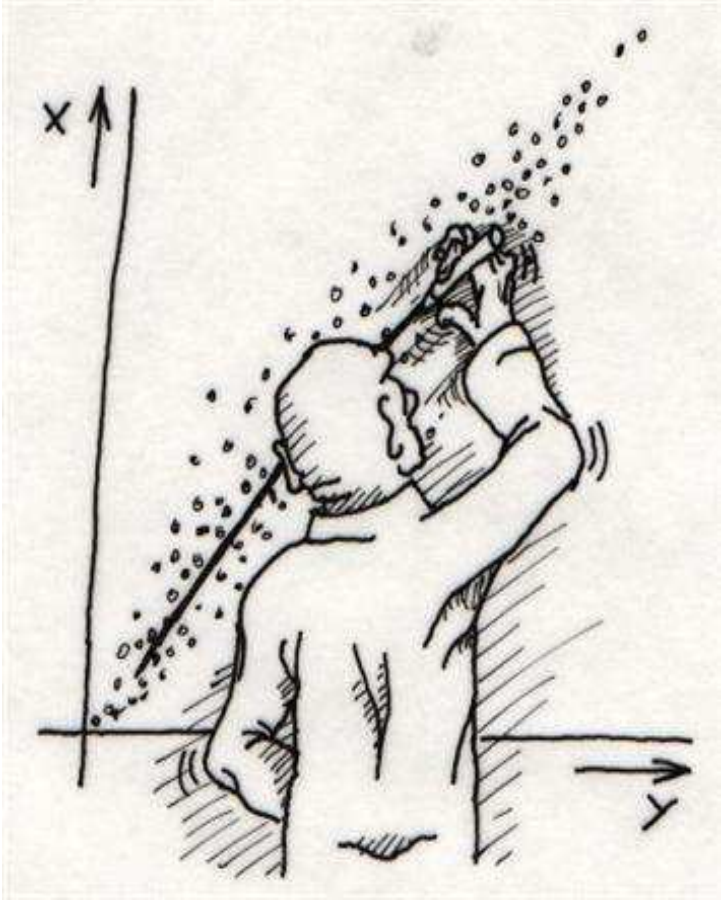
Introduction

Multivariable Data Analysis of AAA



Improving Generalization

- Updating prediction models
  - Combines IPD with prior knowledge
  - Improves external validity
  - May re-estimate slope, regression coefficient or extend the model



Adaptation Methods

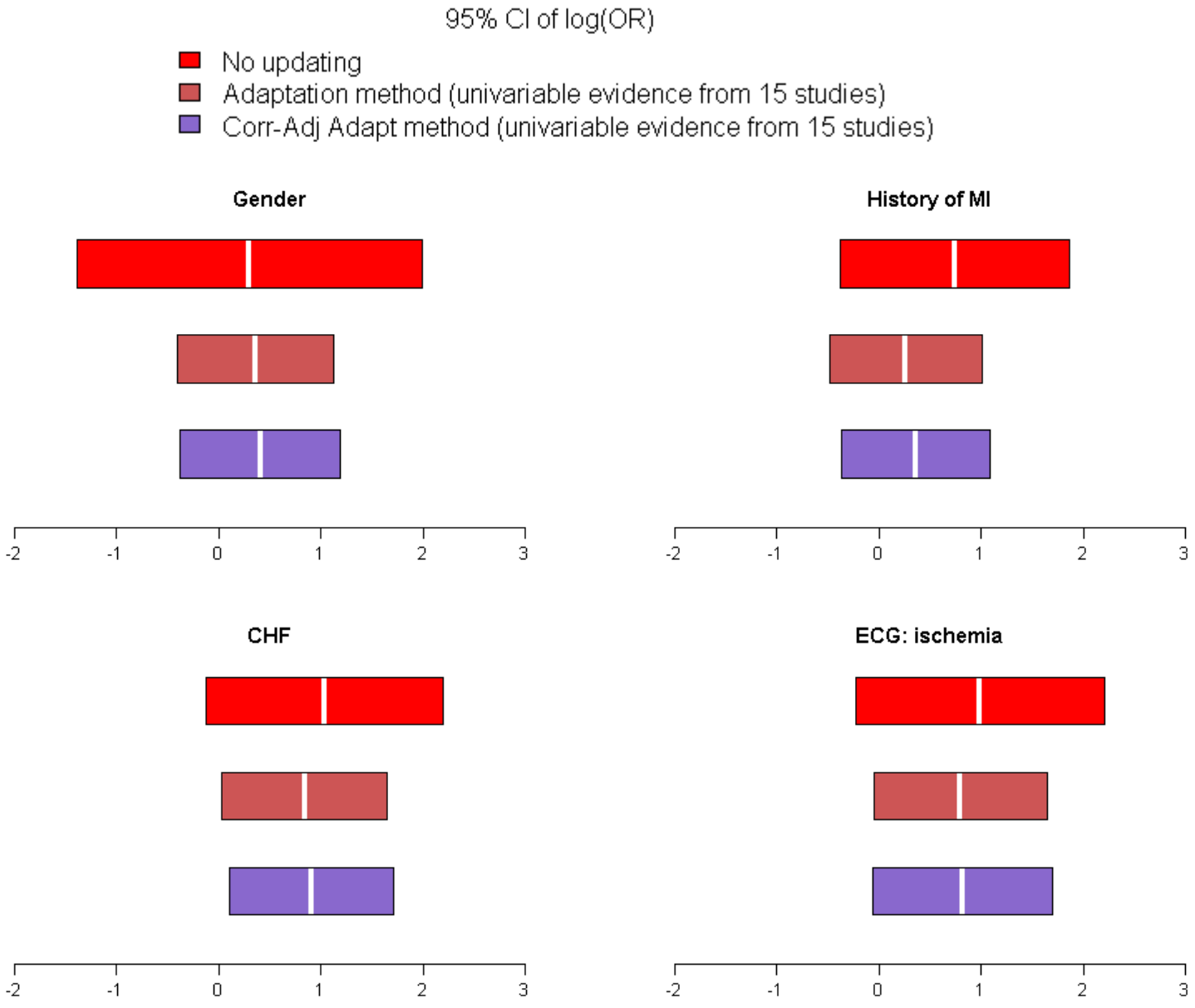
The Adaptation method (Steyerberg/Greenland)

- Re-estimates a multivariable coefficient
- Incorporates known univariable coefficients
- Based on change from uni- to multivariable coefficient

The Correlation-Adjusted Adaptation method

- Accounts for correlations
- Applies shrinkage

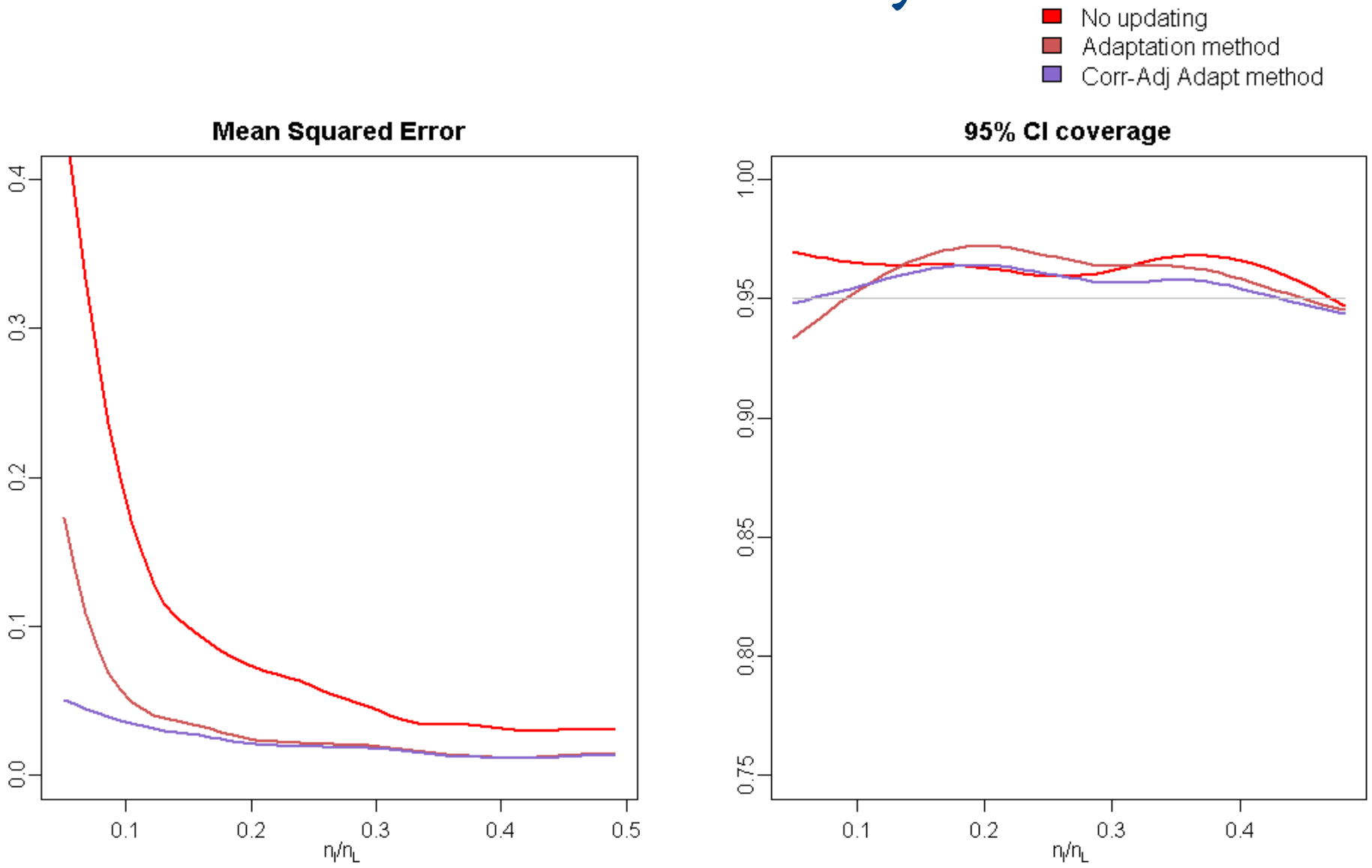
Adaptation Methods



Simulation Study

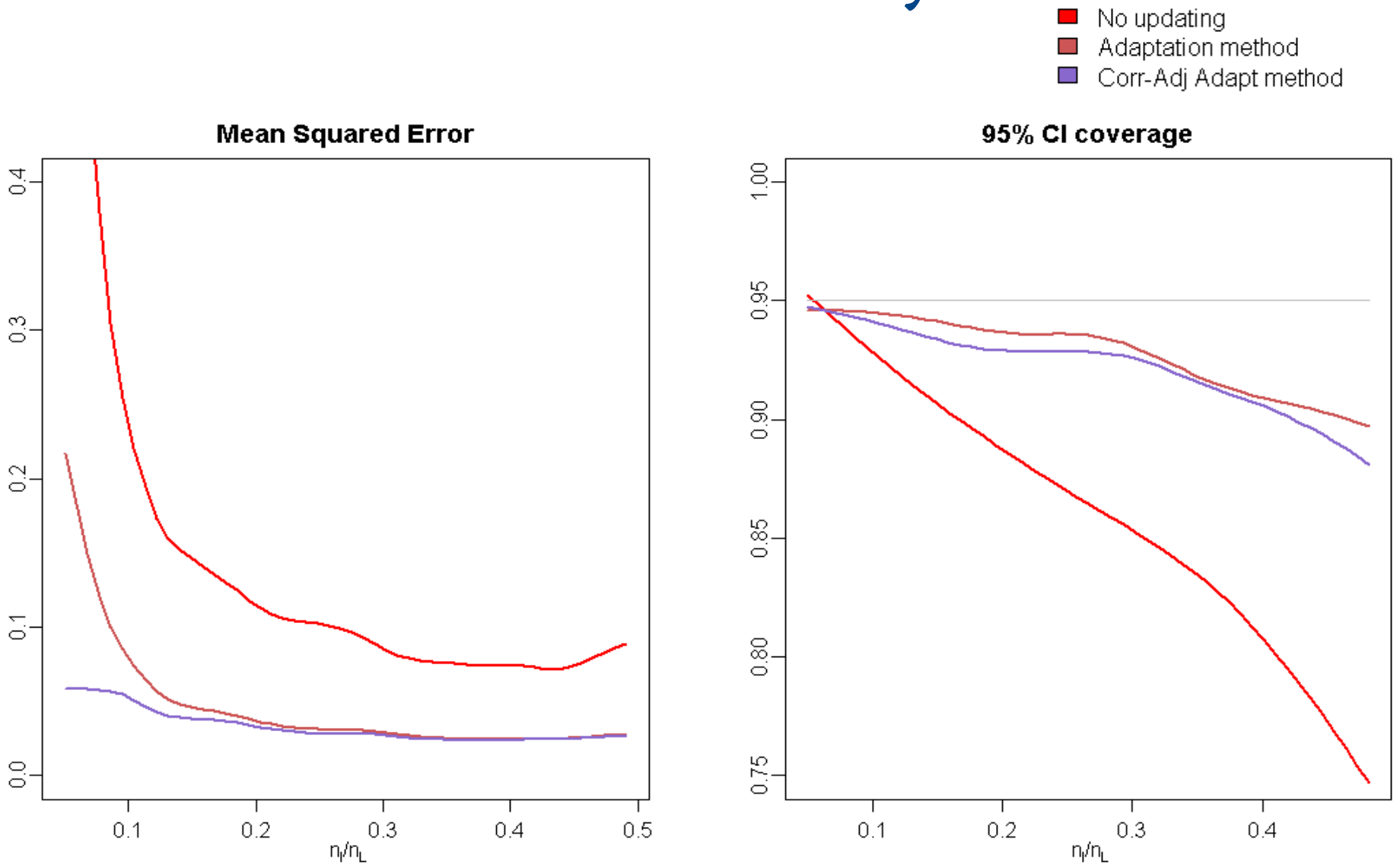
- **Mean Squared Error**: accuracy & stability of estimated regression coefficients
- **95% Confidence Interval**: validity of estimated uncertainty
- Performance with homogeneous and heterogeneous evidence

Simulation Study



Homogeneous evidence (IPD + 4 lit. studies of 500 patients each)

Simulation Study



Heterogeneous evidence (IPD + 4 lit. studies of 500 patients each)

Conclusion

Bias of estimated regression coefficients:

- largest when external evidence ignored
- decreases but remains when large IPD
- smallest when external evidence incorporated (that is not strongly heterogeneous)
  - Correlation-Adjusted Adaptation method: superior performance
  - Steyerberg/Greenland Adaptation method: simpler to apply