

**crossnma:**  
To synthesize cross-design evidence and cross-format data using network meta-analysis

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**NMA/NMR**

**IPD + AD** (not ignore AD)

**RCT + NRS** (twice)

- IPD:**
  - Lengthy process, increased costs, inability to include IPD from all trials
  - Overcome the AD shortcomings - a gold standard
  - Standardize the analysis
- AD:**
  - Data is accessible in the published literature
  - Heterogeneity across trials
  - MR on aggregate information
  - Ecological bias
- RCT/NRS:**
  - Idealized settings, Restricted inclusion criteria, Limit: generalizability
  - 'Low' Bias
  - Most reliable
  - More available
  - Reflect the reality
  - Bias
  - Confounders are not addressed
  - Concern about transitivity and consistency

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**Cross-NMA Model**

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- IPD vs AD models for a single study
- ... for multiple studies
- Combine IPD and AD for multiple studies

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**IPD vs AD model 1-study**

**AD Likelihood**  
 $r \sim \text{Bin}(p, n)$   
 $n=16, r=4$

What is the probability of disease?  
 $\hat{p}^{AD} = 0.25$     $\hat{p}^{IPD} = 0.25$

**IPD Likelihood**  
 $y \sim \text{Bernoulli}(p)$   
For estimation  $\sum_n \text{Bernoulli}(p) = \text{Bin}(p, n)$

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**IPD vs AD model 1-study**

**AD Likelihood**  
 $r \sim \text{Bin}(p, n)$   
 $n=16, r=4$

What is the treatment effect?  
 $\hat{\sigma}^{AD}$    ?    $\hat{\sigma}^{IPD}$

**IPD Likelihood**  
 $y \sim \text{Bernoulli}(p)$   
For estimation  $\sum_n \text{Bernoulli}(p) = \text{Bin}(p, n)$

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### IPD vs AD model 1-study

**AD Likelihood**

$$r \sim \text{Bin}(p, n)$$

$$\text{logit}(p^A) = \text{logit}(p^B) + \log(OR^{BA})$$

What is the treatment effect?

$$\overline{OR}_{AD} \stackrel{?}{=} \overline{OR}_{IPD}$$

**IPD Likelihood**

$$y \sim \text{Bernoulli}(p)$$

$$\text{logit}(p_1^A) = \text{logit}(p_1^B) + \log(OR_1^{BA})$$

$$\text{logit}(p_2^A) = \text{logit}(p_2^B) + \log(OR_2^{BA})$$

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### IPD vs AD model multiple studies

**AD Likelihood**

Study 1:  $r_1 \sim \text{Bin}(p_1, n_1)$   
 $\text{logit}(p_1^A) = \text{logit}(p_1^B) + \log(OR_1^{BA})$

Study 2:  $r_2 \sim \text{Bin}(p_2, n_2)$   
 $\text{logit}(p_2^A) = \text{logit}(p_2^B) + \log(OR_2^{BA})$

Study 3:  $r_3 \sim \text{Bin}(p_3, n_3)$   
 $\text{logit}(p_3^A) = \text{logit}(p_3^B) + \log(OR_3^{BA})$

Study 4:  $r_4 \sim \text{Bin}(p_4, n_4)$   
 $\text{logit}(p_4^A) = \text{logit}(p_4^B) + \log(OR_4^{BA})$

What is the treatment effect?

$$\overline{OR}_{AD} \stackrel{?}{=} \overline{OR}_{IPD}$$

**IPD Likelihood**

Study 1:  $y_{11} \sim \text{Bern}(p_{11}), \dots, y_{1n_1} \sim \text{Bern}(p_{1n_1})$   
 $\text{logit}(p_{11}^A) = \text{logit}(p_{11}^B) + \log(OR_1^{BA})$   
 $\text{logit}(p_{1n_1}^A) = \text{logit}(p_{1n_1}^B) + \log(OR_1^{BA})$

Study 2:  $y_{21} \sim \text{Bern}(p_{21}), \dots, y_{2n_2} \sim \text{Bern}(p_{2n_2})$   
 $\text{logit}(p_{21}^A) = \text{logit}(p_{21}^B) + \log(OR_2^{BA})$   
 $\text{logit}(p_{2n_2}^A) = \text{logit}(p_{2n_2}^B) + \log(OR_2^{BA})$

Study 3:  $y_{31} \sim \text{Bern}(p_{31}), \dots, y_{3n_3} \sim \text{Bern}(p_{3n_3})$   
 $\text{logit}(p_{31}^A) = \text{logit}(p_{31}^B) + \log(OR_3^{BA})$   
 $\text{logit}(p_{3n_3}^A) = \text{logit}(p_{3n_3}^B) + \log(OR_3^{BA})$

Study 4:  $y_{41} \sim \text{Bern}(p_{41}), \dots, y_{4n_4} \sim \text{Bern}(p_{4n_4})$   
 $\text{logit}(p_{41}^A) = \text{logit}(p_{41}^B) + \log(OR_4^{BA})$   
 $\text{logit}(p_{4n_4}^A) = \text{logit}(p_{4n_4}^B) + \log(OR_4^{BA})$

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### IPD vs AD model multiple studies

**AD Likelihood**

Study 1:  $r_1 \sim \text{Bin}(p_1, n_1)$   
 $\text{logit}(p_1^A) = \text{logit}(p_1^B) + \log(OR_1^{BA})$

Study 2:  $r_2 \sim \text{Bin}(p_2, n_2)$   
 $\text{logit}(p_2^A) = \text{logit}(p_2^B) + \log(OR_2^{BA})$

Study 3:  $r_3 \sim \text{Bin}(p_3, n_3)$   
 $\text{logit}(p_3^A) = \text{logit}(p_3^B) + \log(OR_3^{BA})$

Study 4:  $r_4 \sim \text{Bin}(p_4, n_4)$   
 $\text{logit}(p_4^A) = \text{logit}(p_4^B) + \log(OR_4^{BA})$

What is the treatment effect?

$$\overline{OR}_{AD} \stackrel{?}{=} \overline{OR}_{IPD}$$

(Network) meta-analysis

Heterogeneity across trials  
Trials are conducted under different settings

Different populations  
Individual data

Adjust for potential interactions

**IPD Likelihood**

Study 1:  $y_{11} \sim \text{Bern}(p_{11}), \dots, y_{1n_1} \sim \text{Bern}(p_{1n_1})$   
 $\text{logit}(p_{11}^A) = \text{logit}(p_{11}^B) + \log(OR_1^{BA})$   
 $\text{logit}(p_{1n_1}^A) = \text{logit}(p_{1n_1}^B) + \log(OR_1^{BA})$

Study 2:  $y_{21} \sim \text{Bern}(p_{21}), \dots, y_{2n_2} \sim \text{Bern}(p_{2n_2})$   
 $\text{logit}(p_{21}^A) = \text{logit}(p_{21}^B) + \log(OR_2^{BA})$   
 $\text{logit}(p_{2n_2}^A) = \text{logit}(p_{2n_2}^B) + \log(OR_2^{BA})$

Study 3:  $y_{31} \sim \text{Bern}(p_{31}), \dots, y_{3n_3} \sim \text{Bern}(p_{3n_3})$   
 $\text{logit}(p_{31}^A) = \text{logit}(p_{31}^B) + \log(OR_3^{BA})$   
 $\text{logit}(p_{3n_3}^A) = \text{logit}(p_{3n_3}^B) + \log(OR_3^{BA})$

Study 4:  $y_{41} \sim \text{Bern}(p_{41}), \dots, y_{4n_4} \sim \text{Bern}(p_{4n_4})$   
 $\text{logit}(p_{41}^A) = \text{logit}(p_{41}^B) + \log(OR_4^{BA})$   
 $\text{logit}(p_{4n_4}^A) = \text{logit}(p_{4n_4}^B) + \log(OR_4^{BA})$

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### Meta-regression model

**AD**

Study 1:  $r_1 \sim \text{Bin}(p_1, n_1)$   
 $\text{logit}(p_1^A) = \text{logit}(p_1^B) + \log(OR_1^{BA}) + \beta^A \frac{1}{\sqrt{a_1^2}}$

Study 2:  $r_2 \sim \text{Bin}(p_2, n_2)$   
 $\text{logit}(p_2^A) = \text{logit}(p_2^B) + \log(OR_2^{BA}) + \beta^A \frac{1}{\sqrt{a_2^2}}$

Association between studies

The interaction between  $\log(OR^{BA})$  and age?

**IPD**

Study 3:  $y_{31} \sim \text{Bern}(p_{31}), \dots, y_{3n_3} \sim \text{Bern}(p_{3n_3})$   
 $\text{logit}(p_{31}^A) = \text{logit}(p_{31}^B) + \log(OR_3^{BA}) + \beta^A (\text{age}_{31} - \text{age}_3) + \beta^A \frac{1}{\sqrt{a_3^2}}$   
 $\text{logit}(p_{3n_3}^A) = \text{logit}(p_{3n_3}^B) + \log(OR_3^{BA}) + \beta^A (\text{age}_{3n_3} - \text{age}_3) + \beta^A \frac{1}{\sqrt{a_3^2}}$

Study 4:  $y_{41} \sim \text{Bern}(p_{41}), \dots, y_{4n_4} \sim \text{Bern}(p_{4n_4})$   
 $\text{logit}(p_{41}^A) = \text{logit}(p_{41}^B) + \log(OR_4^{BA}) + \beta^A (\text{age}_{41} - \text{age}_4) + \beta^A \frac{1}{\sqrt{a_4^2}}$   
 $\text{logit}(p_{4n_4}^A) = \text{logit}(p_{4n_4}^B) + \log(OR_4^{BA}) + \beta^A (\text{age}_{4n_4} - \text{age}_4) + \beta^A \frac{1}{\sqrt{a_4^2}}$

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### Meta-regression model

**AD**

Study 1:  $r_1 \sim \text{Bin}(p_1, n_1)$   
 $\text{logit}(p_1^A) = \text{logit}(p_1^B) + \log(OR_1^{BA}) + \beta^A \frac{1}{\sqrt{a_1^2}}$

Study 2:  $r_2 \sim \text{Bin}(p_2, n_2)$   
 $\text{logit}(p_2^A) = \text{logit}(p_2^B) + \log(OR_2^{BA}) + \beta^A \frac{1}{\sqrt{a_2^2}}$

Association between studies

The interaction between  $\log(OR^{BA})$  and age?

mean age  $\uparrow$  logOR  $\uparrow$

**IPD**

Study 3:  $y_{31} \sim \text{Bern}(p_{31}), \dots, y_{3n_3} \sim \text{Bern}(p_{3n_3})$   
 $\text{logit}(p_{31}^A) = \text{logit}(p_{31}^B) + \log(OR_3^{BA}) + \beta^A (\text{age}_{31} - \text{age}_3) + \beta^A \frac{1}{\sqrt{a_3^2}}$   
 $\text{logit}(p_{3n_3}^A) = \text{logit}(p_{3n_3}^B) + \log(OR_3^{BA}) + \beta^A (\text{age}_{3n_3} - \text{age}_3) + \beta^A \frac{1}{\sqrt{a_3^2}}$

Study 4:  $y_{41} \sim \text{Bern}(p_{41}), \dots, y_{4n_4} \sim \text{Bern}(p_{4n_4})$   
 $\text{logit}(p_{41}^A) = \text{logit}(p_{41}^B) + \log(OR_4^{BA}) + \beta^A (\text{age}_{41} - \text{age}_4) + \beta^A \frac{1}{\sqrt{a_4^2}}$   
 $\text{logit}(p_{4n_4}^A) = \text{logit}(p_{4n_4}^B) + \log(OR_4^{BA}) + \beta^A (\text{age}_{4n_4} - \text{age}_4) + \beta^A \frac{1}{\sqrt{a_4^2}}$

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### Meta-regression model

**AD**

Study 1:  $r_1 \sim \text{Bin}(p_1, n_1)$   
 $\text{logit}(p_1^A) = \text{logit}(p_1^B) + \log(OR_1^{BA}) + \beta^A \frac{1}{\sqrt{a_1^2}}$

Study 2:  $r_2 \sim \text{Bin}(p_2, n_2)$   
 $\text{logit}(p_2^A) = \text{logit}(p_2^B) + \log(OR_2^{BA}) + \beta^A \frac{1}{\sqrt{a_2^2}}$

Association within studies

The interaction between  $\log(OR^{BA})$  and age?

age  $\downarrow$  logOR  $\uparrow$

**IPD**

Study 3:  $y_{31} \sim \text{Bern}(p_{31}), \dots, y_{3n_3} \sim \text{Bern}(p_{3n_3})$   
 $\text{logit}(p_{31}^A) = \text{logit}(p_{31}^B) + \log(OR_3^{BA}) + \beta^A (\text{age}_{31} - \text{age}_3) + \beta^A \frac{1}{\sqrt{a_3^2}}$   
 $\text{logit}(p_{3n_3}^A) = \text{logit}(p_{3n_3}^B) + \log(OR_3^{BA}) + \beta^A (\text{age}_{3n_3} - \text{age}_3) + \beta^A \frac{1}{\sqrt{a_3^2}}$

Study 4:  $y_{41} \sim \text{Bern}(p_{41}), \dots, y_{4n_4} \sim \text{Bern}(p_{4n_4})$   
 $\text{logit}(p_{41}^A) = \text{logit}(p_{41}^B) + \log(OR_4^{BA}) + \beta^A (\text{age}_{41} - \text{age}_4) + \beta^A \frac{1}{\sqrt{a_4^2}}$   
 $\text{logit}(p_{4n_4}^A) = \text{logit}(p_{4n_4}^B) + \log(OR_4^{BA}) + \beta^A (\text{age}_{4n_4} - \text{age}_4) + \beta^A \frac{1}{\sqrt{a_4^2}}$

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### Meta-regression model

Combine parameters across studies

**AD**

Study 1

$$r_1 \sim \text{Bin}(n_1, \pi_1)$$

$$\text{logit}(\pi_1^A) = \text{logit}(p_1^A) + \text{log}(OR_1^{A^A}) + \beta^A \alpha_1 \epsilon_1$$

Study 2

$$r_2 \sim \text{Bin}(n_2, \pi_2)$$

$$\text{logit}(\pi_2^A) = \text{logit}(p_2^A) + \text{log}(OR_2^{A^A}) + \beta^A \alpha_2 \epsilon_2$$

**IPD**

Study 3

$$y_{3i} \sim \text{Bern}(\pi_{3i})$$

$$\text{logit}(\pi_{3i}) = \text{logit}(p_{3i}) + \text{log}(OR_{3i}^A) + \beta^A (\alpha_{3i} \pi_{3i} - \alpha_{3i}) + \beta^A \epsilon_{3i}$$

$$\text{logit}(\pi_{3i}^A) = \text{logit}(p_{3i}^A) + \text{log}(OR_{3i}^A) + \beta^A (\alpha_{3i} \pi_{3i}^A - \alpha_{3i}^A) + \beta^A \epsilon_{3i}^A$$

Study 4

$$y_{4i} \sim \text{Bern}(\pi_{4i})$$

$$\text{logit}(\pi_{4i}) = \text{logit}(p_{4i}) + \text{log}(OR_{4i}^A) + \beta^A (\alpha_{4i} \pi_{4i} - \alpha_{4i}) + \beta^A \epsilon_{4i}$$

$$\text{logit}(\pi_{4i}^A) = \text{logit}(p_{4i}^A) + \text{log}(OR_{4i}^A) + \beta^A (\alpha_{4i} \pi_{4i}^A - \alpha_{4i}^A) + \beta^A \epsilon_{4i}^A$$

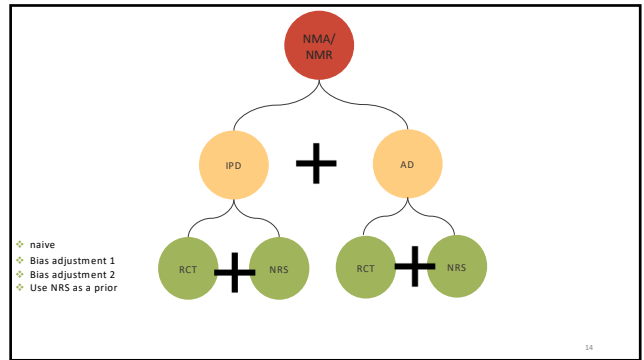
**Treatment effect**  
 $\text{log}(OR^{A^A}) \sim N(\text{log}(OR^{A^A}), \tau^2)$

**Covariate effect**

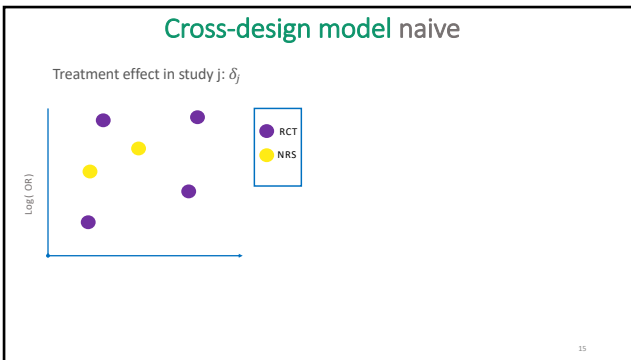
**Between-study covariate effect**  
 $\beta^A \sim N(0, 10^{-4})$

**Within-study covariate effect**  
 RE:  $\beta_j^W \sim N(\beta^W, \tau_j^W)$   
 FE:  $\beta_j^W = \beta^W$

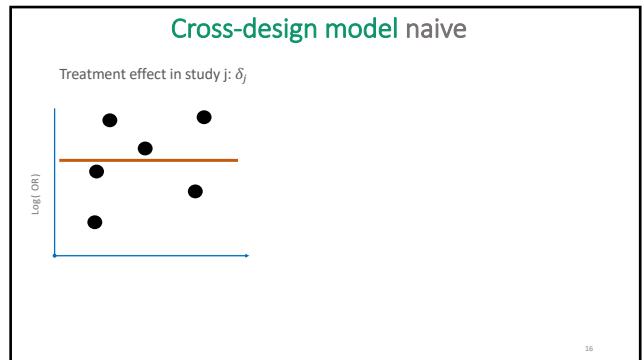
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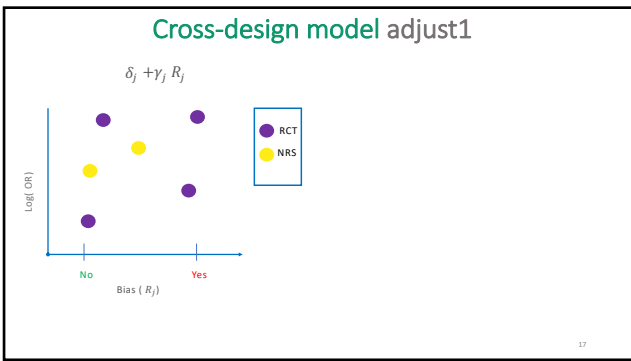
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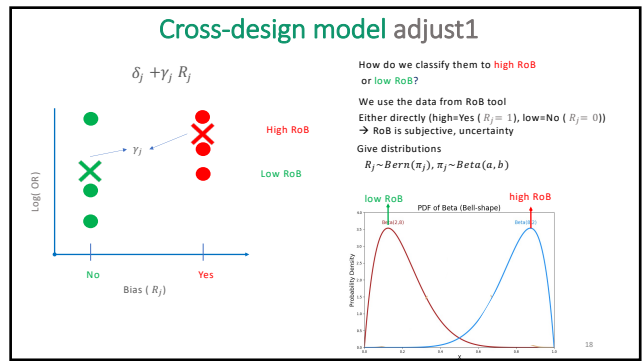
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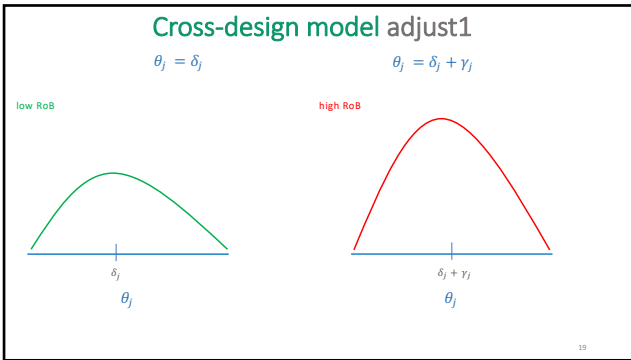
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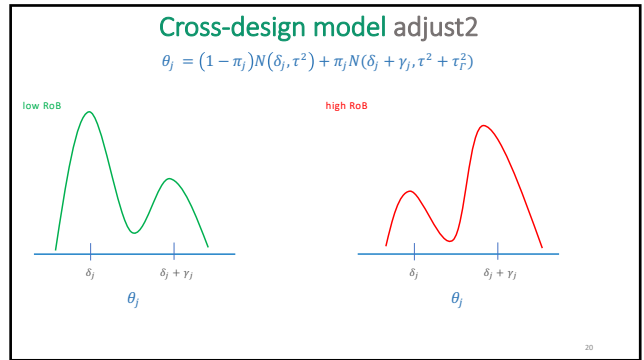
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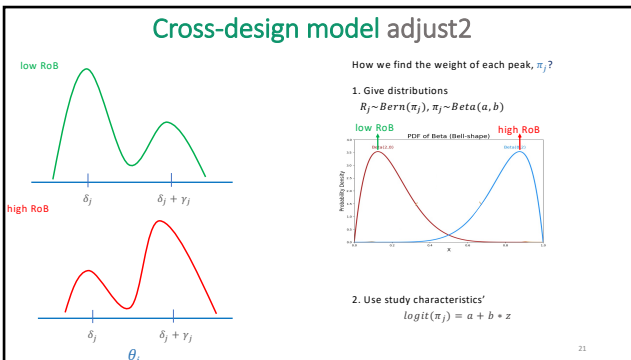
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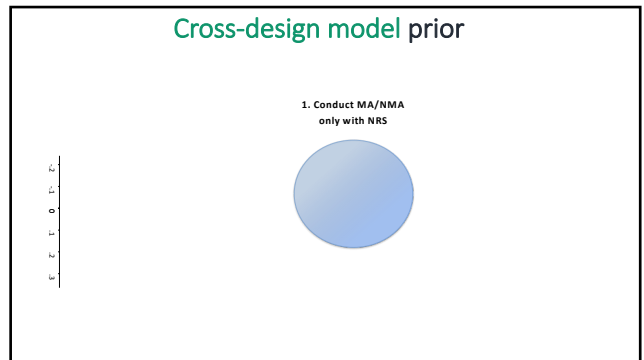
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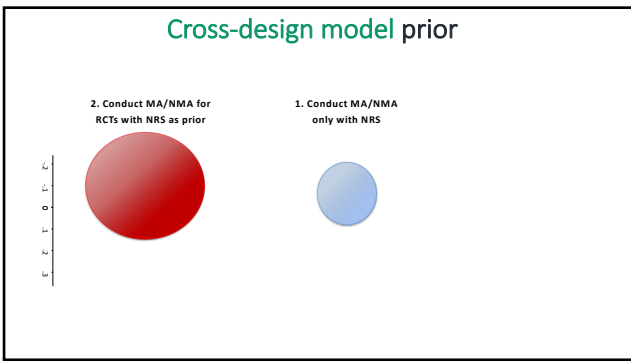
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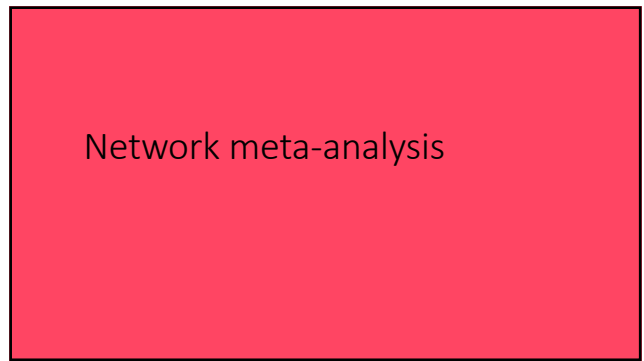
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### IPD + AD NMR model multiple treatments

<p style="text-align: center; font-size: small;">AD Likelihood, logistic</p> <p>For j study with k treatment</p> $r_{jk} \sim \text{Bin}(p_{jk}, n_{jk})$ $\text{logit}(p_{jk}) = u_{jb} + \beta_{2,bk}^B x_j + \delta_{j bk}$	<p style="text-align: center; font-size: small;">IPD Likelihood, logistic</p> <p>For i individual in j study with k treatment</p> $y_{ijk} \sim \text{Bernoulli}(p_{ijk})$ $\text{logit}(p_{ijk}) = u_{jb} + \beta_{1j} x_{ij} + \beta_{2,bk}^W (x_{ij} - x_j) + \beta_{2,bk}^B x_j + \delta_{j bk}$
<p style="font-size: x-small;">Combine AD and IPD</p> $\delta_{j bk} \sim N(d_{Ak} - d_{Ab}, \tau^2), \beta_{2,bk}^B \sim N(B_{Ak}^B - B_{Ab}^B, \sigma_B^2), \beta_{2,bk}^W \sim N(B_{Ak}^W - B_{Ab}^W, \sigma_W^2), \text{ and } u_{jb}, \beta_{1j} \sim N(0, 10^2)$	

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### Cross NMR model naive

<p style="text-align: center; font-size: x-small;">AD RCT and NRS</p> <p>For j study with k treatment</p> $r_{jk} \sim \text{Bin}(p_{jk}, n_{jk})$ $\text{logit}(p_{jk}) = u_{jb} + \beta_{2,bk}^B x_j + \delta_{j bk}$	<p style="text-align: center; font-size: x-small;">IPD RCT and NRS</p> <p>For i individual in j study with k treatment</p> $y_{ijk} \sim \text{Bernoulli}(p_{ijk})$ $\text{logit}(p_{ijk}) = u_{jb} + \beta_{1j} x_{ij} + \beta_{2,bk}^W (x_{ij} - x_j) + \beta_{2,bk}^B x_j + \delta_{j bk}$
<p style="font-size: x-small;">Combine AD and IPD</p> $\delta_{j bk} \sim N(d_{Ak} - d_{Ab}, \tau^2), \beta_{2,bk}^B \sim N(B_{Ak}^B - B_{Ab}^B, \sigma_B^2), \beta_{2,bk}^W \sim N(B_{Ak}^W - B_{Ab}^W, \sigma_W^2), \text{ and } u_{jb}, \beta_{1j} \sim N(0, 10^2)$	

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### Cross NMR model naive

<p style="text-align: center; font-size: x-small;">AD RCT and NRS</p> <p>For j study with k treatment</p> $r_{jk} \sim \text{Bin}(p_{jk}, n_{jk})$ $\text{logit}(p_{jk}) = u_{jb} + \beta_{2,bk}^B x_j + \delta_{j bk}$	<p style="text-align: center; font-size: x-small;">IPD RCT and NRS</p> <p>For i individual in j study with k treatment</p> $y_{ijk} \sim \text{Bernoulli}(p_{ijk})$ $\text{logit}(p_{ijk}) = u_{jb} + \beta_{1j} x_{ij} + \beta_{2,bk}^W (x_{ij} - x_j) + \beta_{2,bk}^B x_j + \delta_{j bk}$
<p style="background-color: #f08080; padding: 5px;">This assumes NRS and RCTs of high risk bias contribute the same (according to their precision) with low risk of bias RCTs</p>	<p style="background-color: #90ee90; padding: 5px; text-align: center;">We introduce <math>R_j</math> which reflects the risk of bias in study j</p>
<p style="font-size: x-small;">Combine AD and IPD</p> $\delta_{j bk} \sim N(d_{Ak} - d_{Ab}, \tau^2), \beta_{2,bk}^B \sim N(B_{Ak}^B - B_{Ab}^B, \sigma_B^2), \beta_{2,bk}^W \sim N(B_{Ak}^W - B_{Ab}^W, \sigma_W^2), \text{ and } u_{jb}, \beta_{1j} \sim N(0, 10^2)$	

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### Cross NMR model adjust 1

<p style="text-align: center; font-size: x-small;">AD RCT and NRS</p> <p>For j study with k treatment</p> $r_{jk} \sim \text{Bin}(p_{jk}, n_{jk})$ $\text{logit}(p_{jk}) = u_{jb} + \beta_{2,bk}^B x_j + \delta_{j bk} + \gamma_j R_j$	<p style="text-align: center; font-size: x-small;">IPD RCT and NRS</p> <p>For i individual in j study with k treatment</p> $y_{ijk} \sim \text{Bernoulli}(p_{ijk})$ $\text{logit}(p_{ijk}) = u_{jb} + \beta_{1j} x_{ij} + \beta_{2,bk}^W (x_{ij} - x_j) + \beta_{2,bk}^B x_j + \delta_{j bk} + \gamma_j R_j$
<p style="font-size: x-small;">Combine AD and IPD</p> $\delta_{j bk} \sim N(d_{Ak} - d_{Ab}, \tau^2), \beta_{2,bk}^B \sim N(B_{Ak}^B - B_{Ab}^B, \sigma_B^2), \beta_{2,bk}^W \sim N(B_{Ak}^W - B_{Ab}^W, \sigma_W^2)$ <p style="color: red; font-weight: bold; font-size: small;">Bias assumptions</p> $\gamma_j \sim N(\Gamma, \sigma_\gamma^2), R_j \sim \text{Bern}(\pi_j) \quad \pi_j = \begin{cases} \pi_{\text{low}} \sim \text{beta}(1, 20) \\ \pi_{\text{unclear}} \sim \text{beta}(1, 1) \\ \pi_{\text{high}} \sim \text{beta}(20, 1) \end{cases}$	

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### Cross NMR model adjust 2

<p style="text-align: center; font-size: x-small;">AD RCT and NRS</p> <p>For j study with k treatment</p> $r_{jk} \sim \text{Bin}(p_{jk}, n_{jk})$ $\text{logit}(p_{jk}) = u_{jb} + \beta_{2,bk}^B x_j + \theta_{j bk}$	<p style="text-align: center; font-size: x-small;">IPD RCT and NRS</p> <p>For i individual in j study with k treatment</p> $y_{ijk} \sim \text{Bernoulli}(p_{ijk})$ $\text{logit}(p_{ijk}) = u_{jb} + \beta_{1j} x_{ij} + \beta_{2,bk}^W (x_{ij} - x_j) + \beta_{2,bk}^B x_j + \theta_{j bk}$
<p style="font-size: x-small;">Combine AD and IPD</p> $\delta_{j bk} \sim N(d_{Ak} - d_{Ab}, \tau^2), \beta_{2,bk}^B \sim N(B_{Ak}^B - B_{Ab}^B, \sigma_B^2), \beta_{2,bk}^W \sim N(B_{Ak}^W - B_{Ab}^W, \sigma_W^2)$ <p style="color: red; font-weight: bold; font-size: small;">Bias assumptions</p> $\theta_{j bk} \sim (1 - \pi_j) N(d_k, \tau^2) + \pi_j N(d_k + \Gamma, \tau^2 + \tau_\Gamma^2) \quad \pi_j = \begin{cases} \pi_{\text{low}} \sim \text{beta}(1, 20) \\ \pi_{\text{unclear}} \sim \text{beta}(1, 1) \\ \pi_{\text{high}} \sim \text{beta}(20, 1) \end{cases}$ <p style="color: red; font-weight: bold; font-size: x-small;">logit(<math>\pi_j</math>) = a + b * z</p>	

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### Cross NMR model prior

<p style="text-align: center; font-size: x-small;">AD RCT and NRS</p> <p>For j study with k treatment</p> $r_{jk} \sim \text{Bin}(p_{jk}, n_{jk})$ $\text{logit}(p_{jk}) = u_{jb} + \beta_{2,bk}^B x_j + \delta_{j bk}$	<p style="text-align: center; font-size: x-small;">IPD RCT and NRS</p> <p>For i individual in j study with k treatment</p> $y_{ijk} \sim \text{Bernoulli}(p_{ijk})$ $\text{logit}(p_{ijk}) = u_{jb} + \beta_{1j} x_{ij} + \beta_{2,bk}^W (x_{ij} - x_j) + \beta_{2,bk}^B x_j + \delta_{j bk}$
<p style="font-size: x-small;">Combine AD and IPD</p> $\delta_{j bk} \sim N(d_k - d_b, \tau^2), \beta_{2,bk}^B \sim N(B_k^B - B_b^B, \sigma_B^2) \text{ and } \beta_{2,bk}^W \sim N(B_k^W - B_b^W, \sigma_W^2)$ <p style="font-weight: bold; font-size: small;">Priors</p> $u_j, B_k^B, B_k^W \sim N(0, 10^4), \tau, \sigma_B, \sigma_W \sim \text{Unif}(0, 10)$ <p style="color: red; font-weight: bold; font-size: x-small;">Second RCT model: <math>d_k \sim N(d_k^{NRS}, V^{NRS})</math></p> <p style="color: red; font-weight: bold; font-size: x-small;">First NRS model: <math>d_k^{NRS}, V^{NRS}</math> are data</p>	

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