

Validate Power: d2.1

December 27, 2021

d_m: Blocked RCT, with 2 levels, and randomization done at level 1 (individual level).

Models: Constant treatment effects, fixed treatment effects, and random treatment effects.

Note: we expect a discrepancy when ICC is not zero between powerup and pump.

Default parameters:

- $M = 3$
- $J = 20$
- $\rho = 0.5$
- $MDES = 0.125, 0.125, 0.125$
- $R_1^2 = 0.1, 0.1, 0.1$
- $ICC_2 = 0.2, 0.2, 0.2$

Parameters by model type:

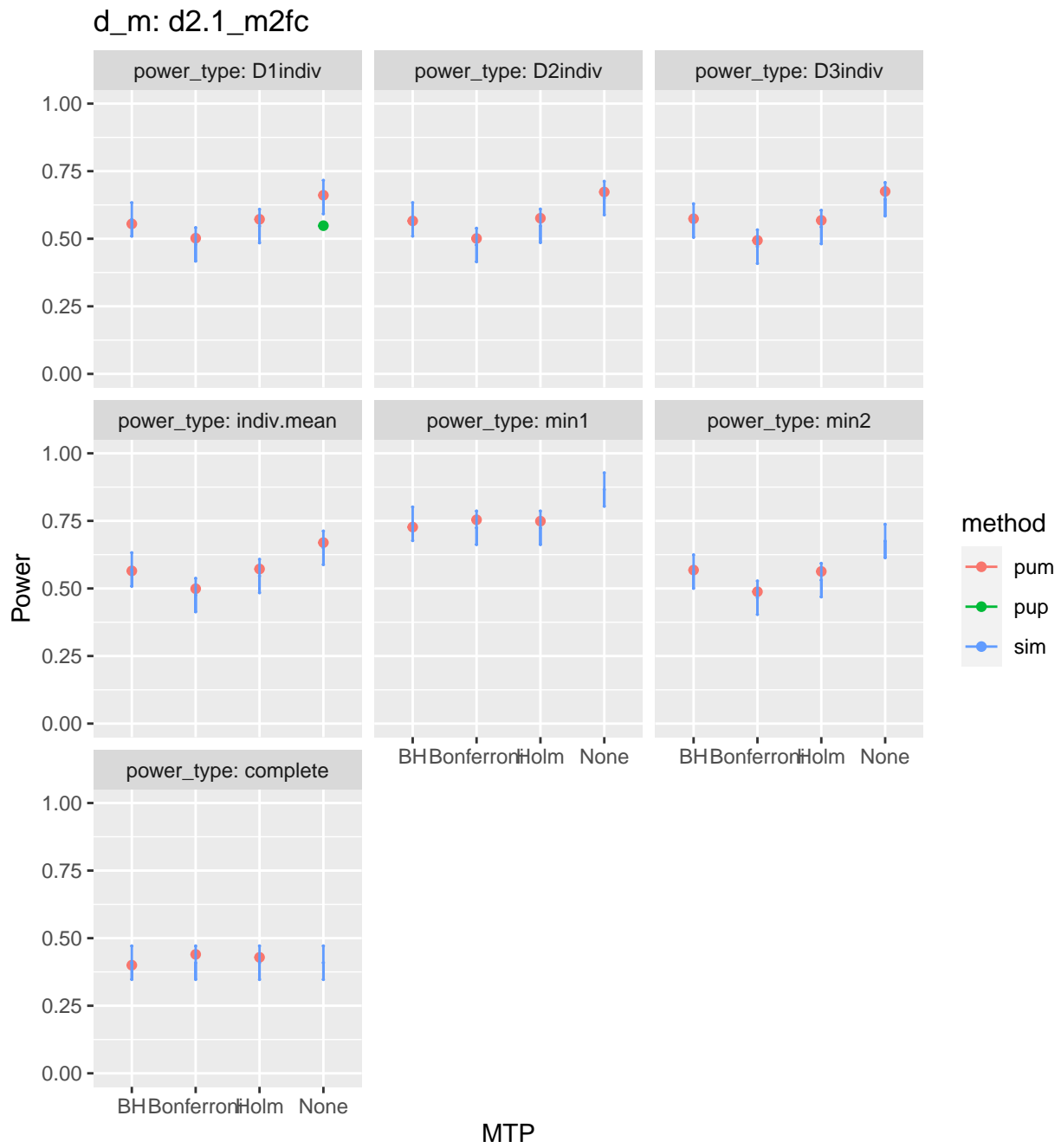
- Omega: $\omega_2 = 0$ for constant effects, $\omega_2 = 0.1, 0.1, 0.1$ for fixed and random

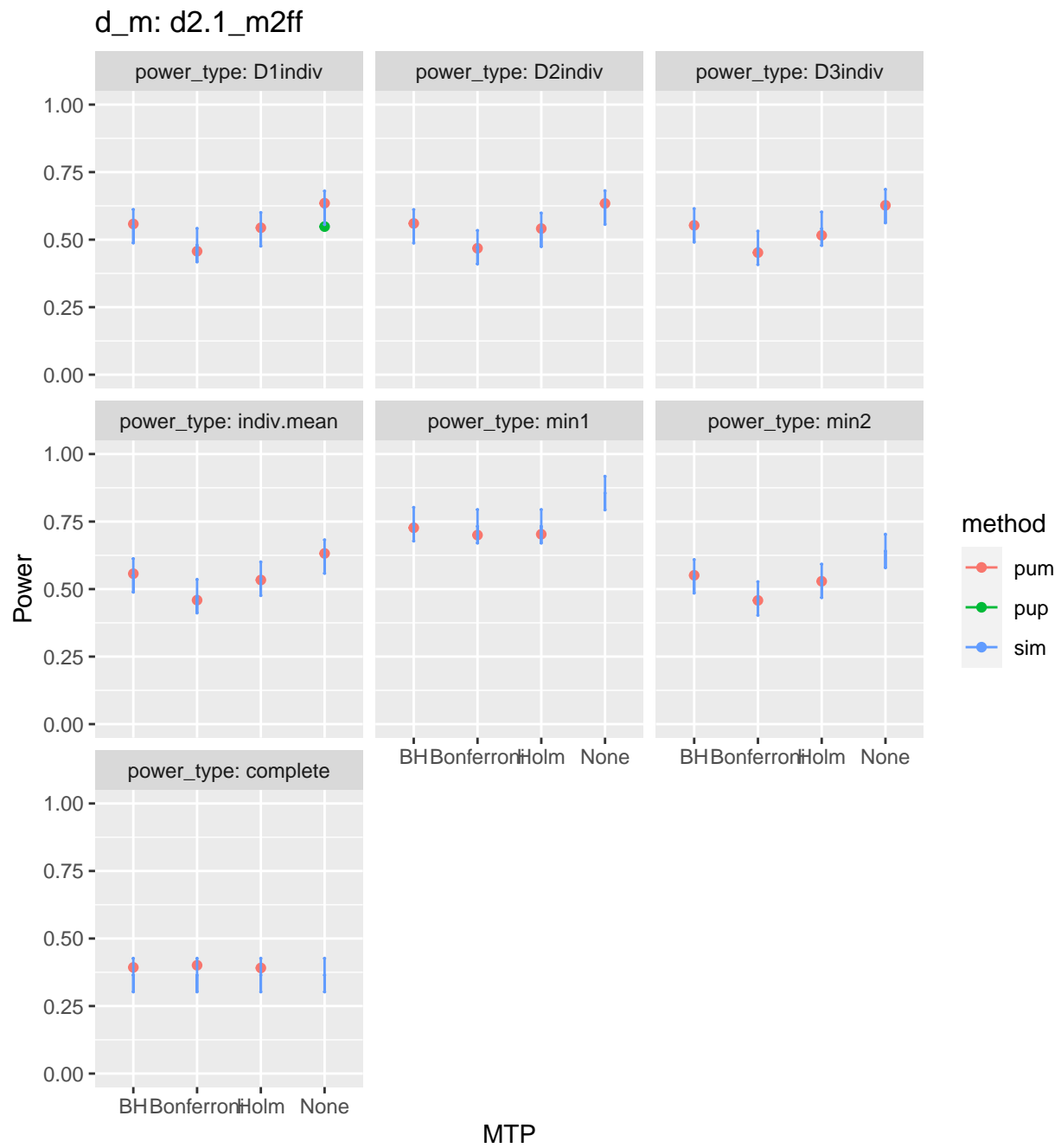
Assumptions:

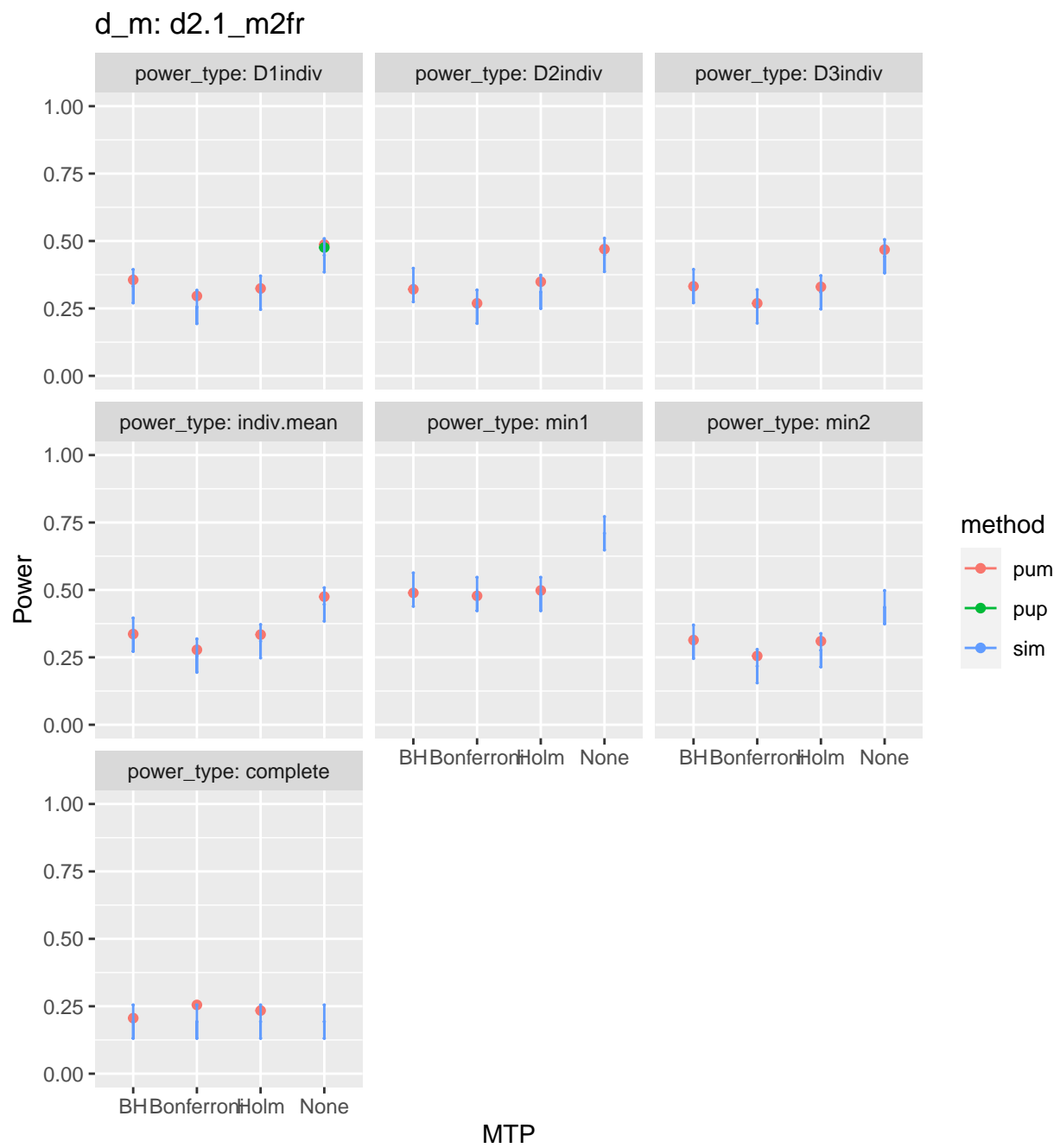
- Two-level design: $ICC_3 = 0, \omega_3 = 0, K = 1$

Power Validation

Base case



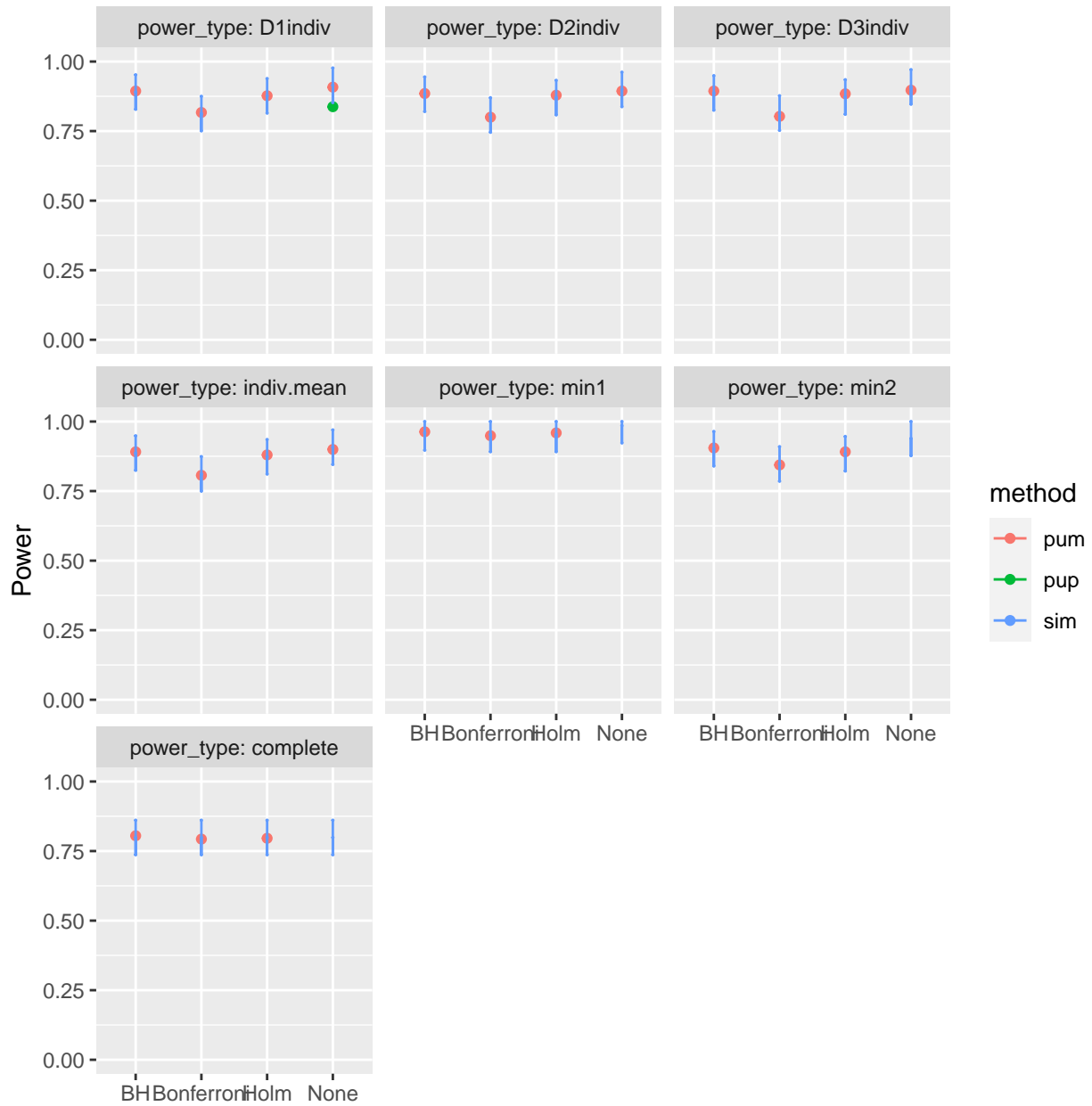




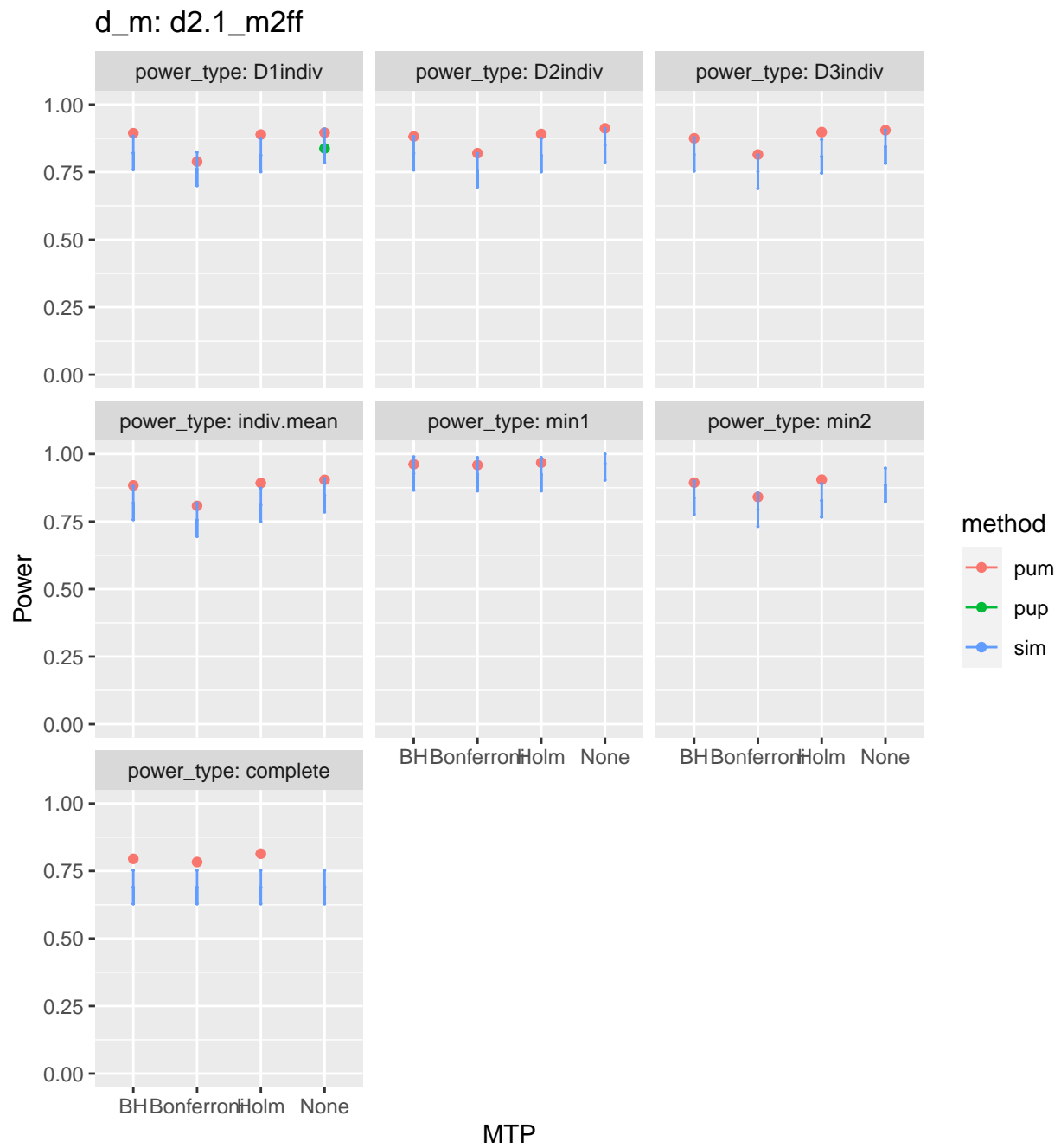
Varying school size

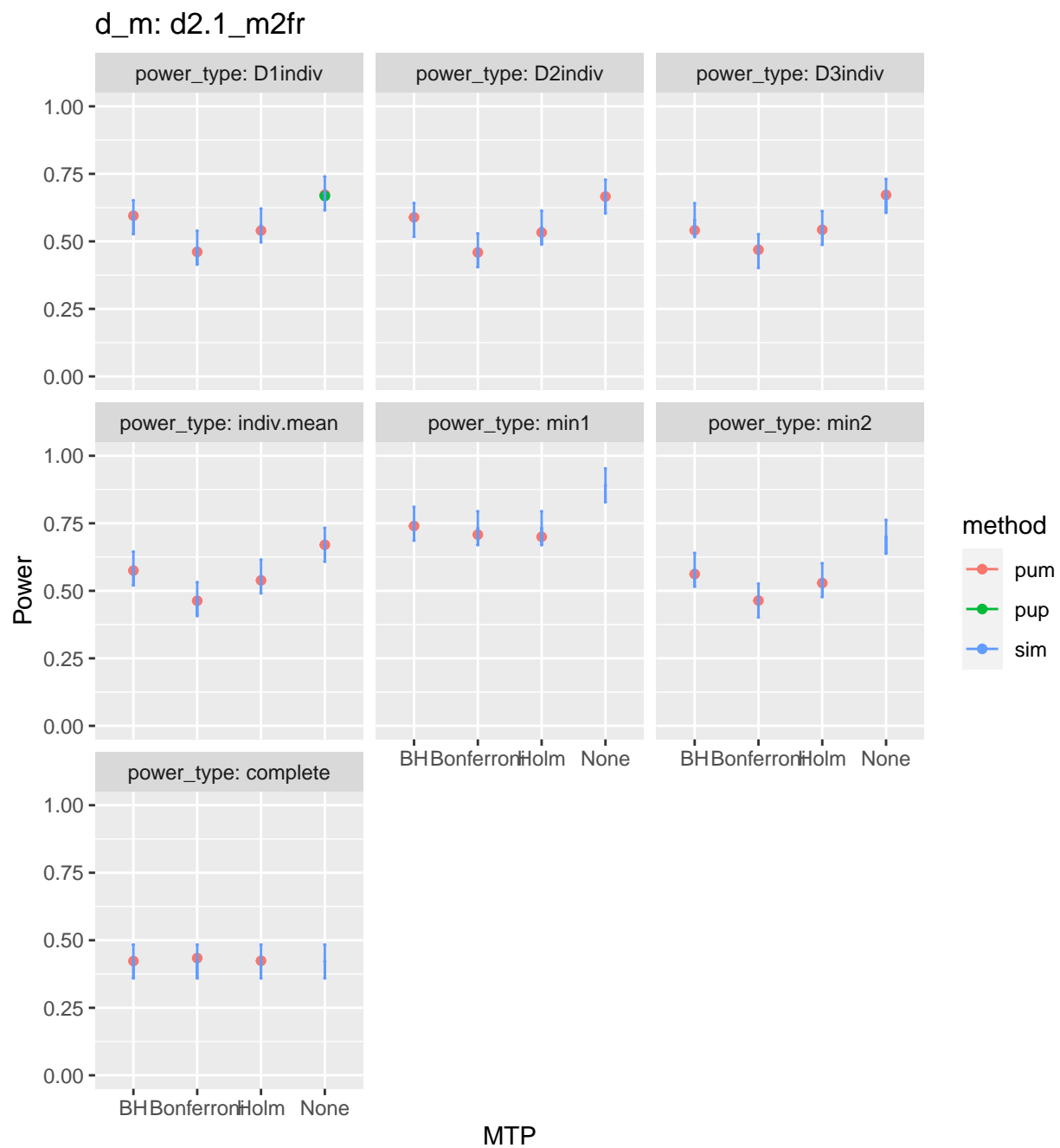
$\bar{n} = 100$

d_m: d2.1_m2fc

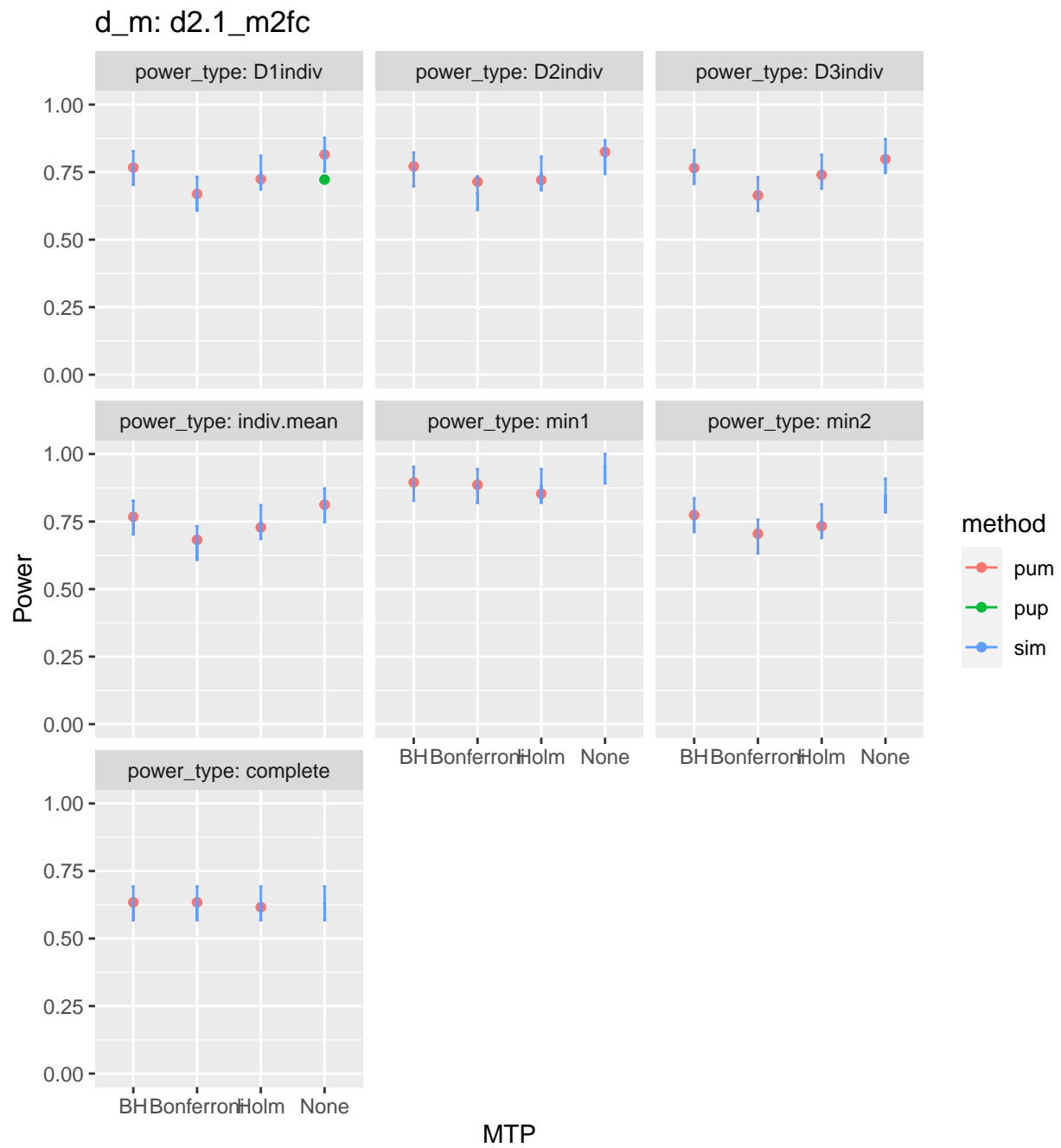


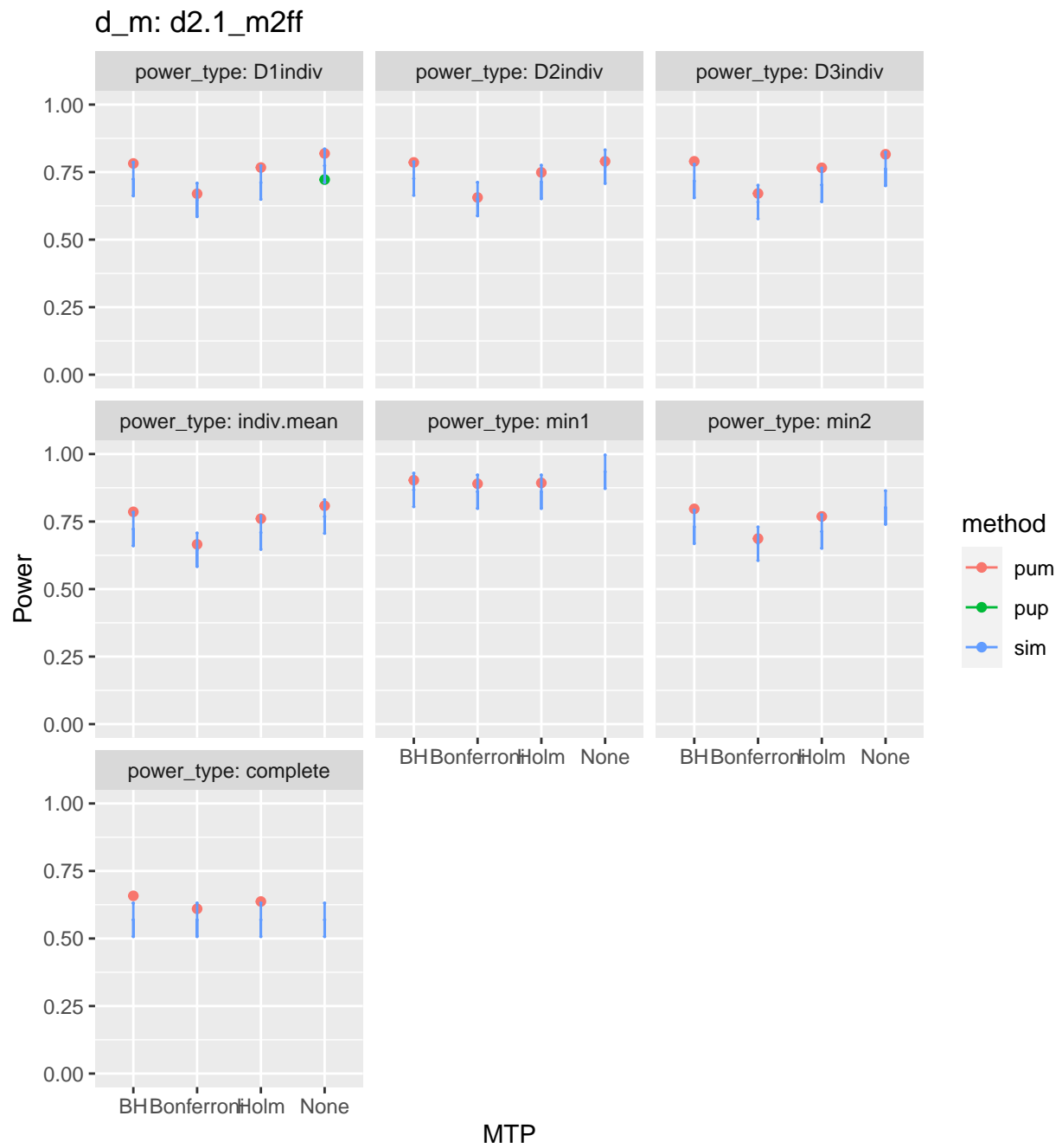
MTP

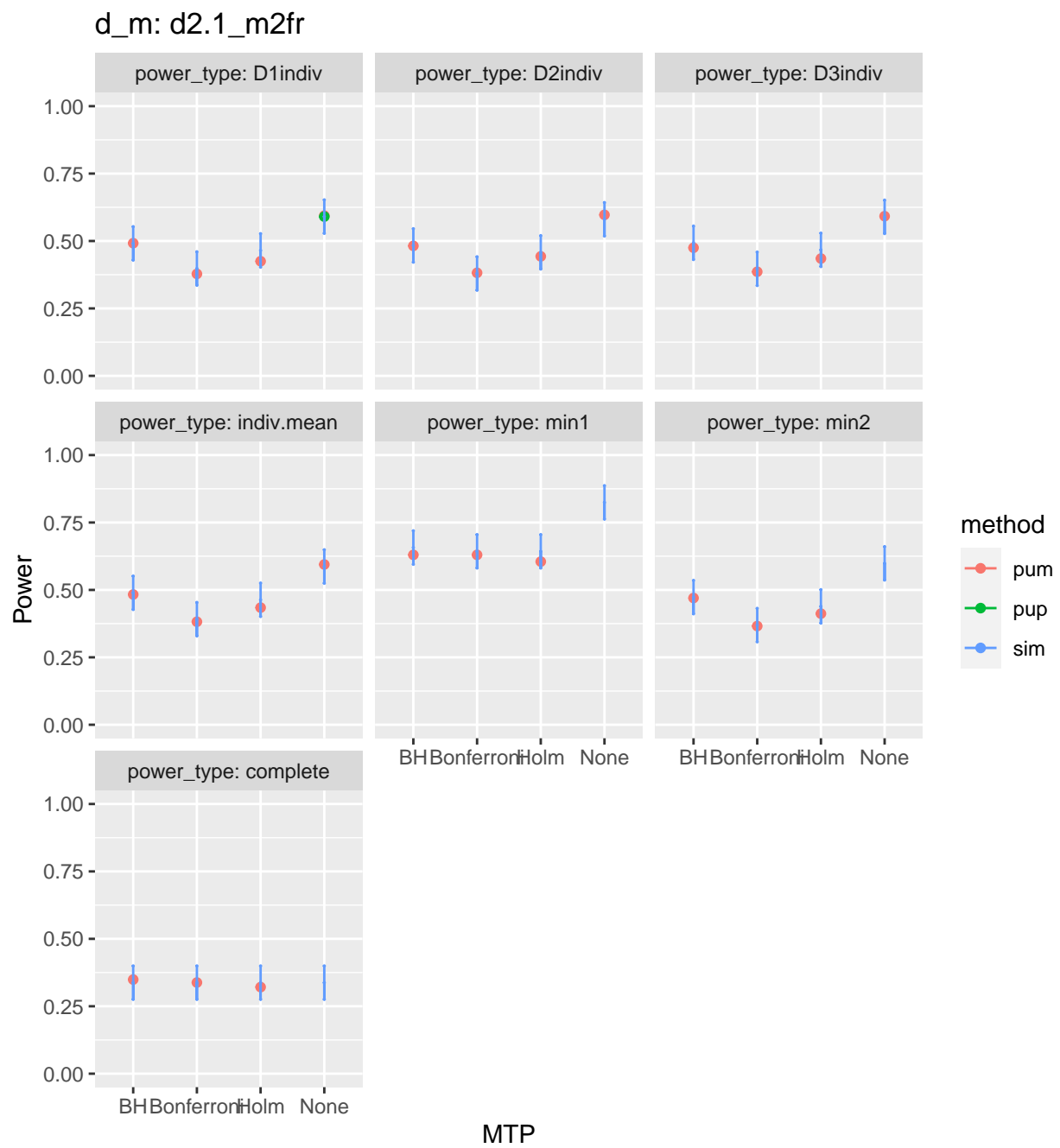




$\bar{n} = 75$





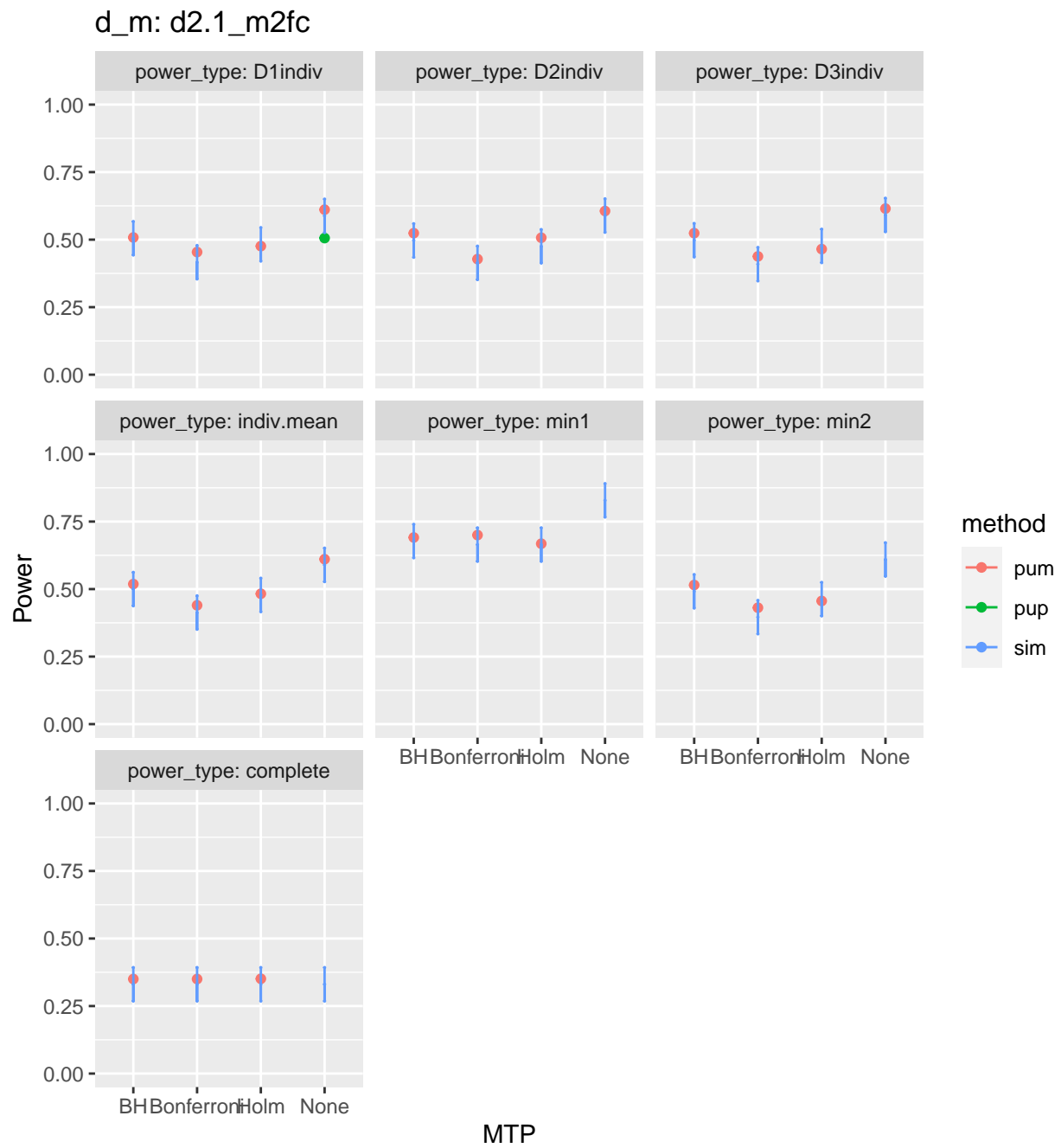


$$R_1^2 = 0.6, 0.6, 0.6$$
$$R_1^2 = 0.6, 0.6, 0.6$$

Figure 1 displays the power of the p-value test across different power types and methods. The figure is organized into a 3x3 grid of plots. The rows represent different power types: 'D1indiv', 'D2indiv', and 'D3indiv' (top row); 'indiv.mean', 'min1', and 'min2' (middle row); and 'complete' (bottom row). The columns represent different methods: 'BH', 'Bonferroni', 'Holm', and 'None'. The y-axis for all plots is 'Power', ranging from 0.00 to 1.00. The legend indicates three methods: 'pum' (red), 'pup' (green), and 'sim' (blue). Each plot shows the power for each method, with error bars indicating variability. In the 'complete' row, the power is consistently high (around 0.85) for all methods. In the 'indiv.mean' row, power is also high (around 0.90). In the 'D1indiv' row, power is around 0.90 for 'pum' and 'sim', but 'pup' is around 0.85. In the 'D2indiv' and 'D3indiv' rows, power is around 0.90 for 'pum' and 'sim', but 'pup' is around 0.85. In the 'min1' and 'min2' rows, power is consistently high (around 0.95) for all methods.

MTP

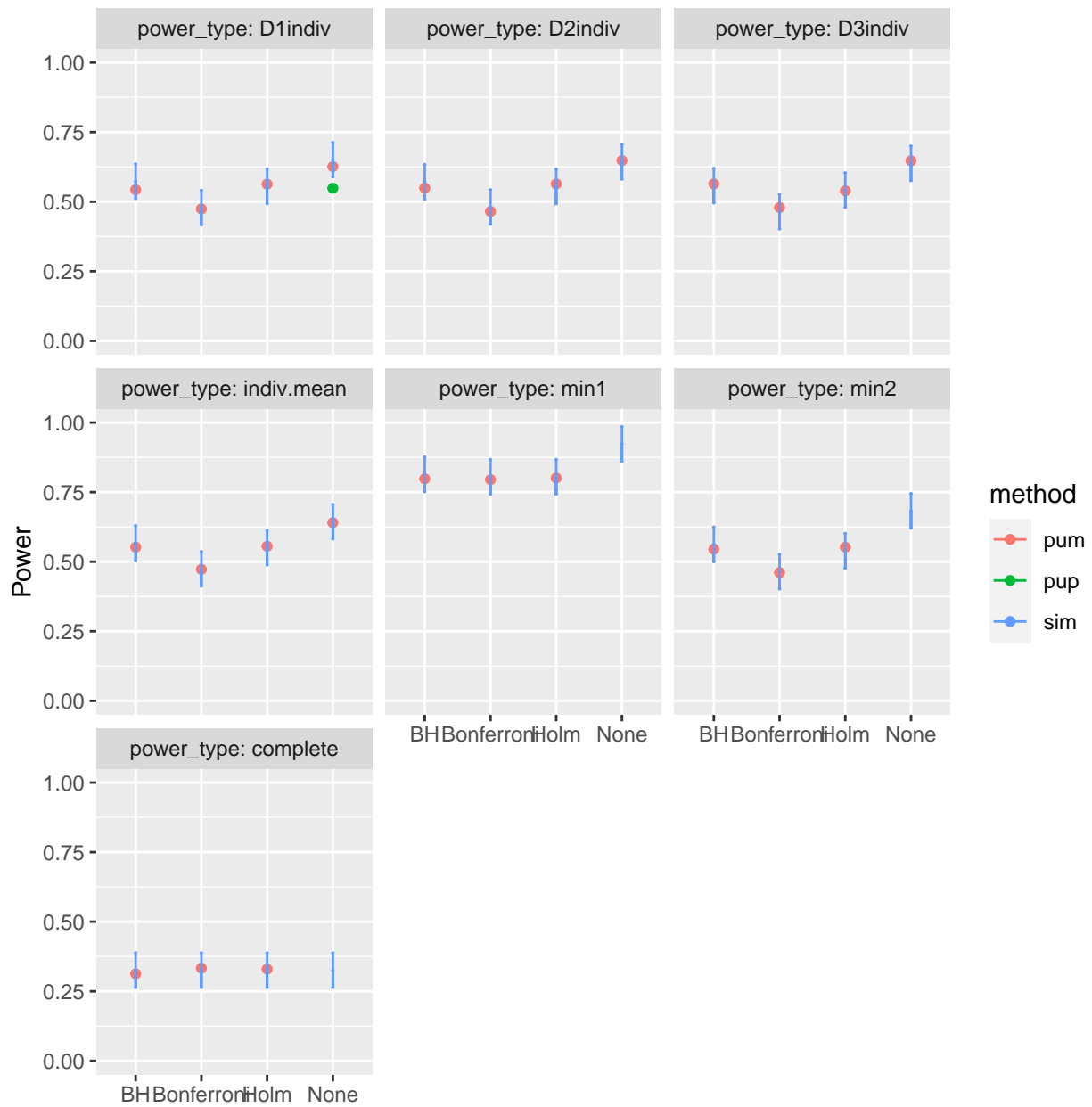
$$R_1^2 = 0, 0, 0$$



Varying rho

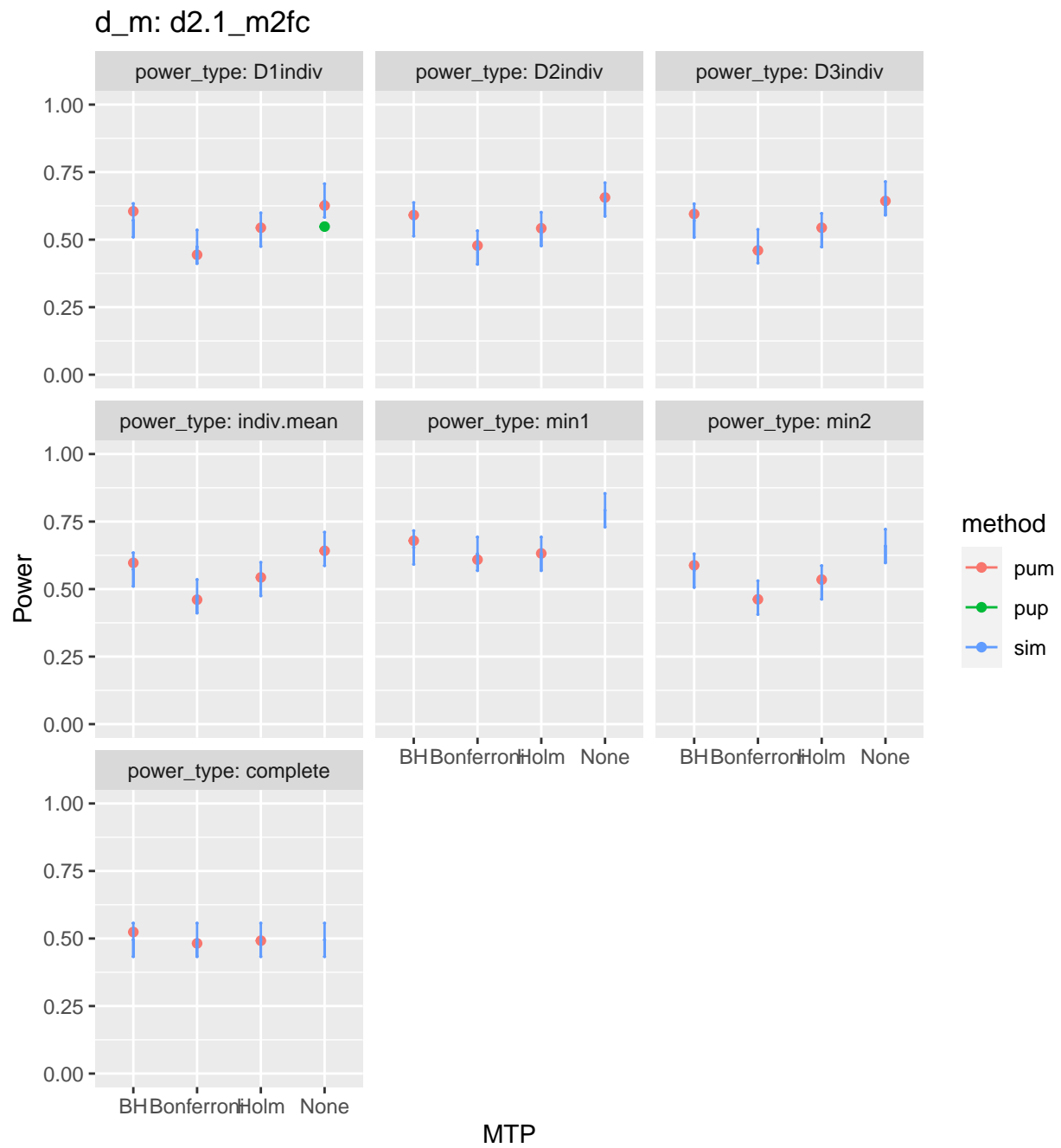
$\rho = 0.2$

d_m: d2.1_m2fc



MTP

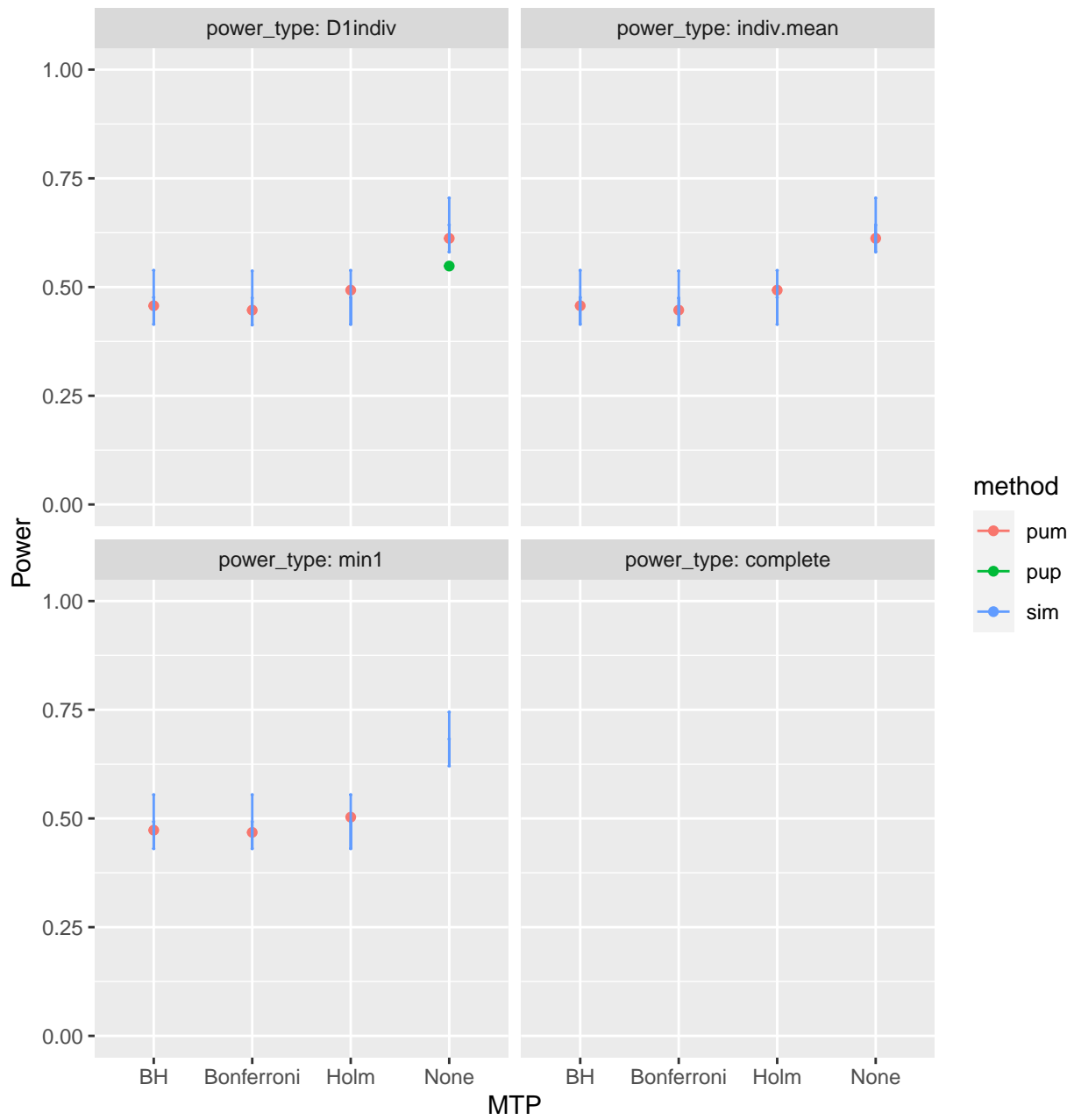
$\rho = 0.8$



Varying true positives

MDES = 0.125, 0, 0

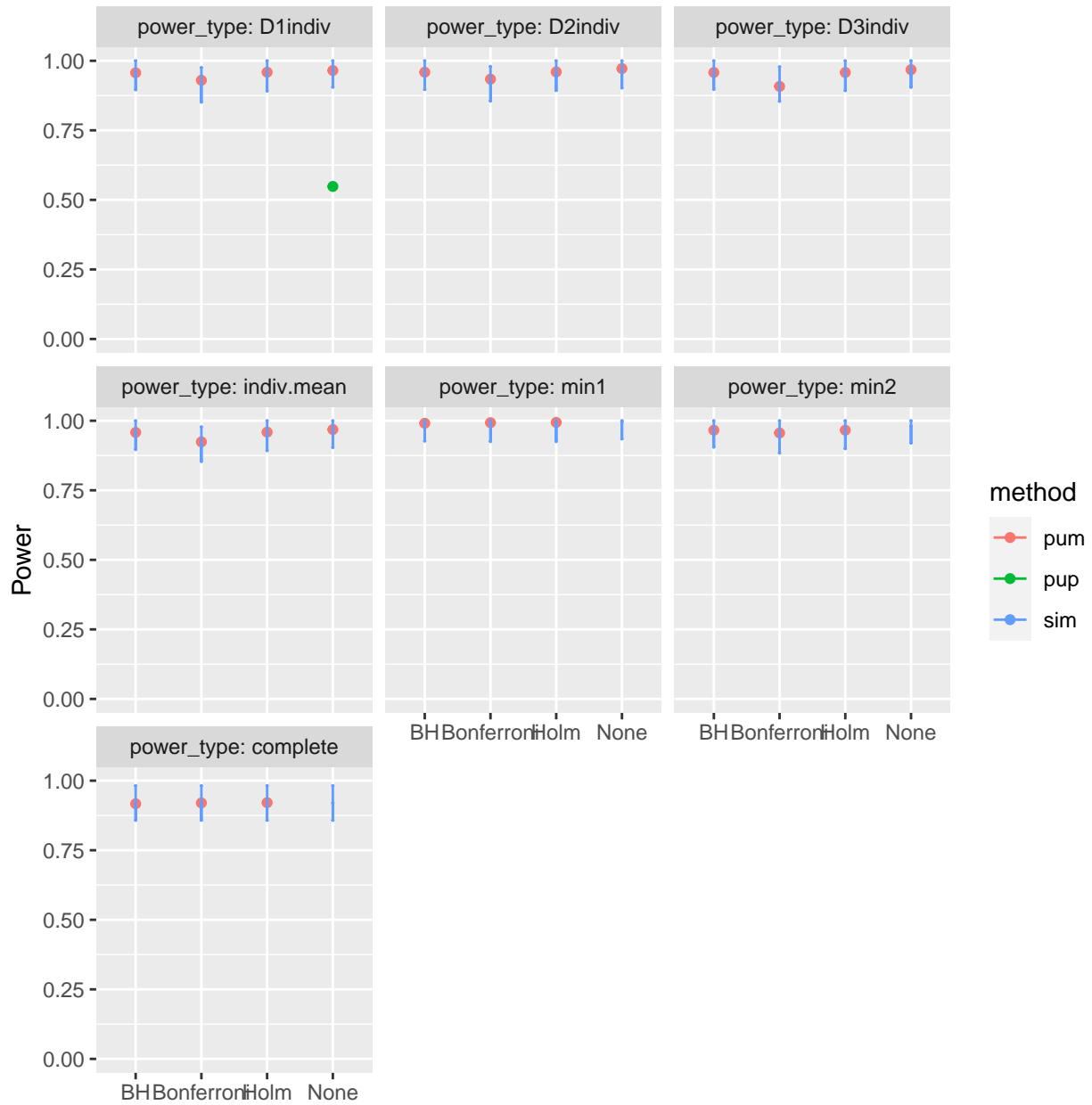
d_m: d2.1_m2fc



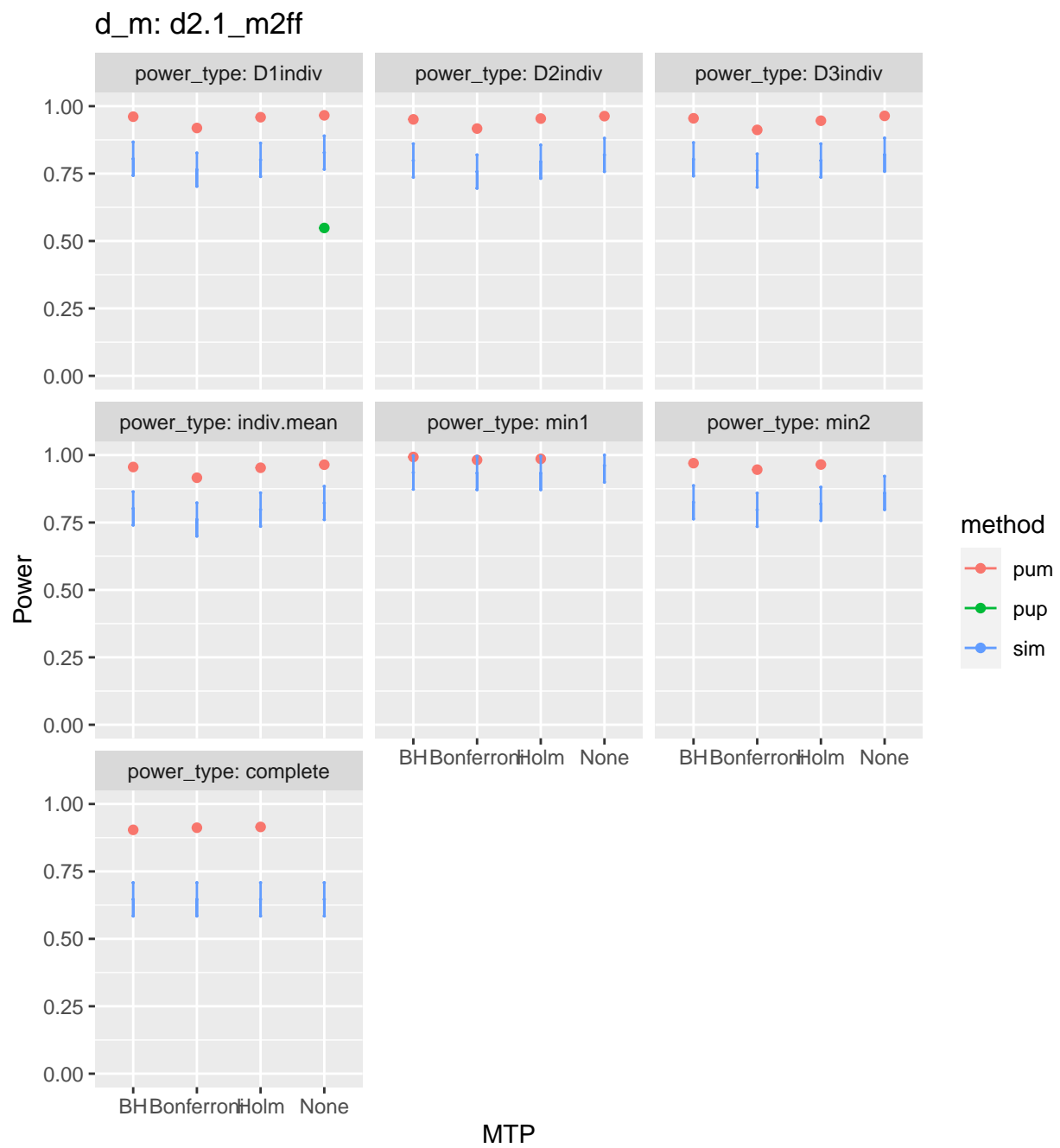
Varying ICC

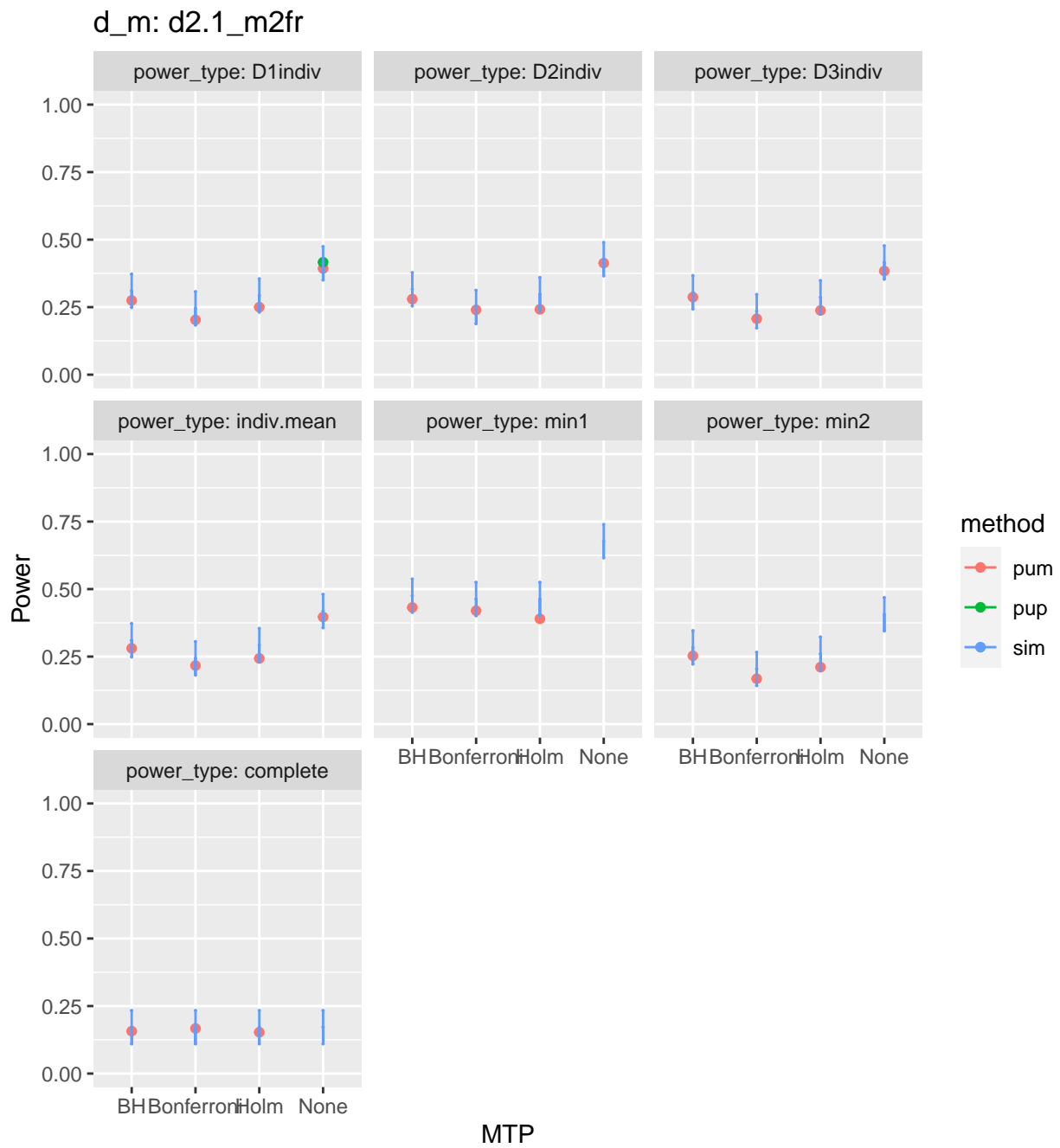
$ICC_2 = 0.7, 0.7, 0.7$

d_m: d2.1_m2fc

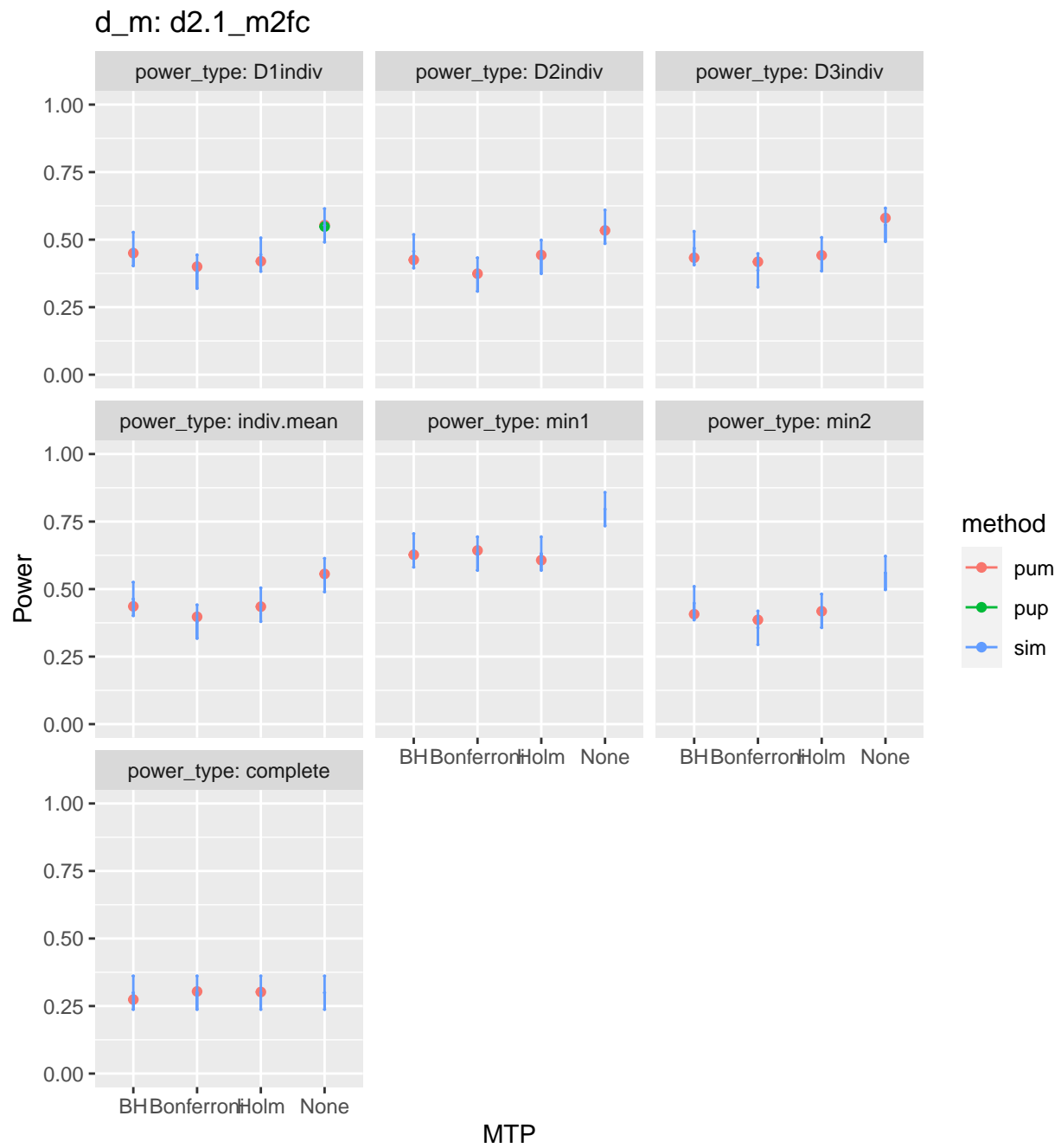


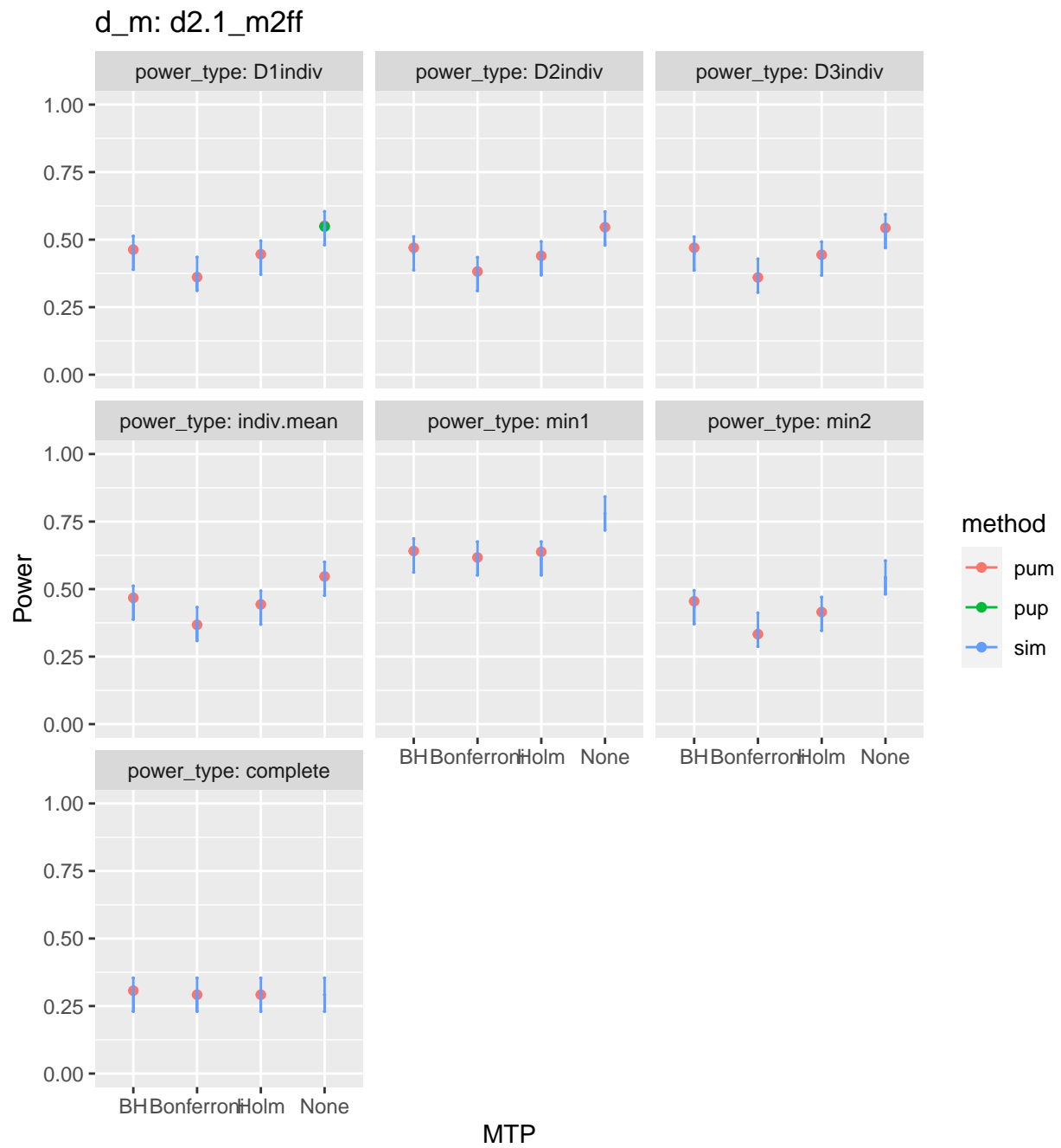
MTP

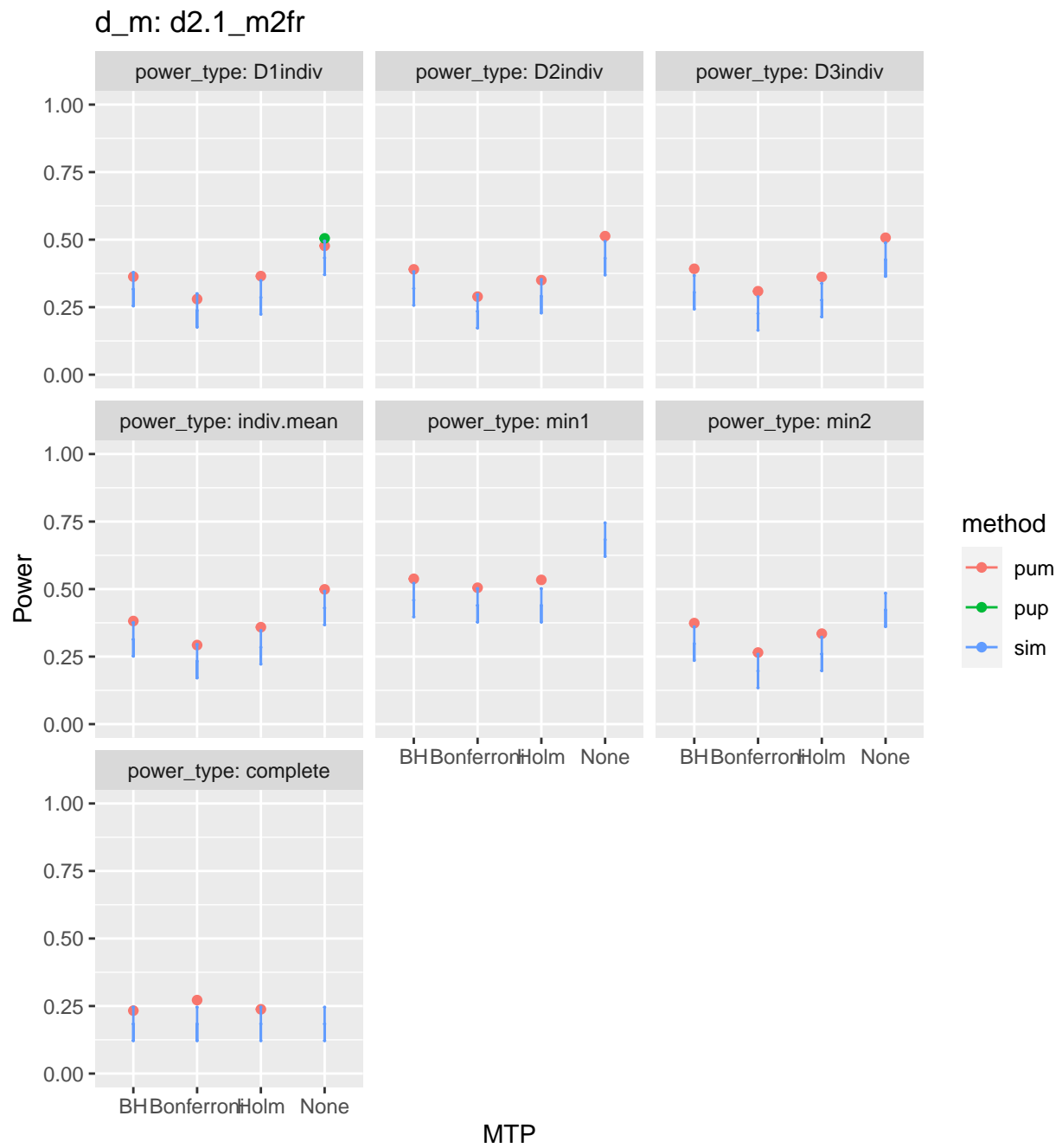




ICC₂ = 0, 0, 0



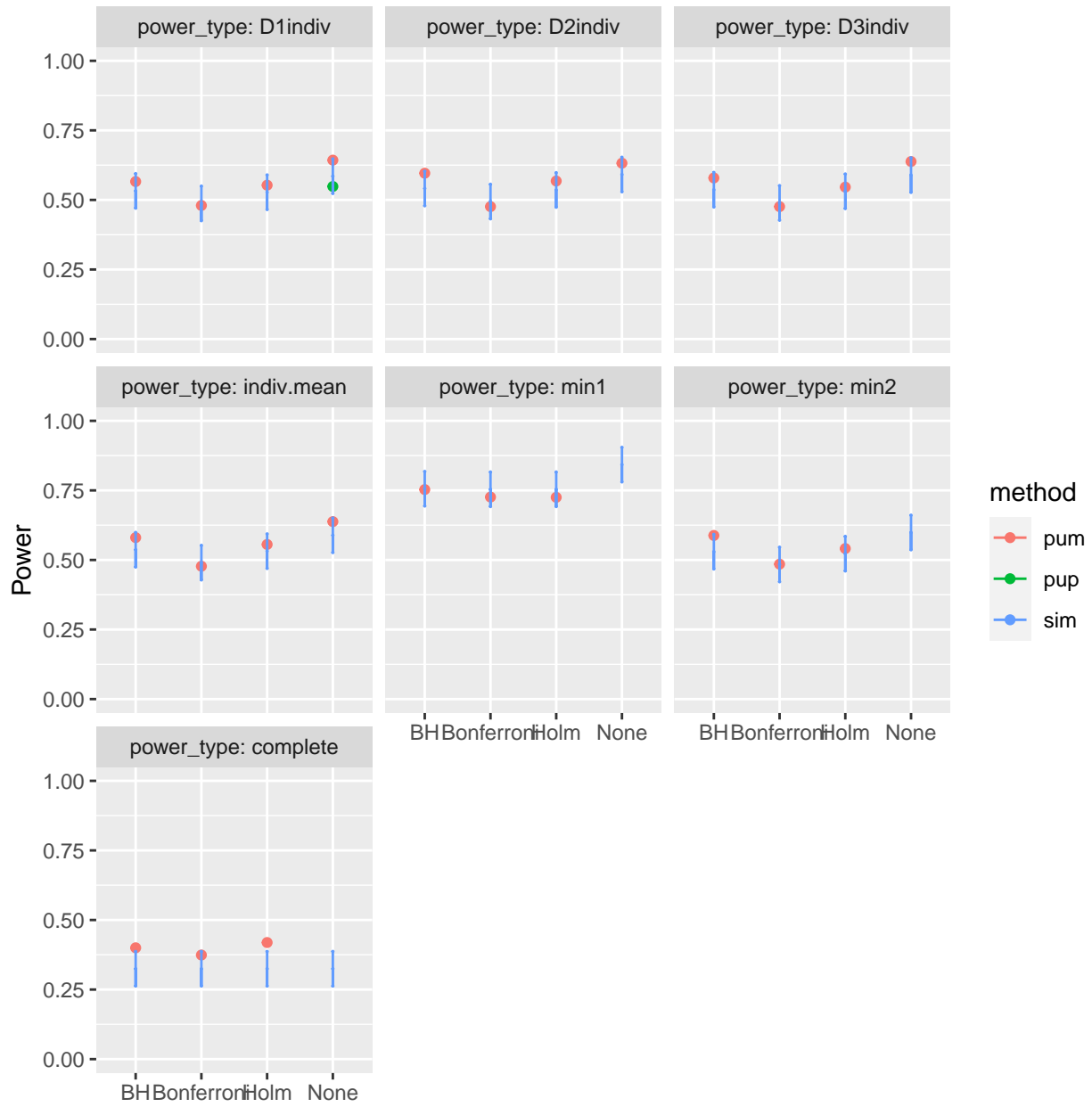




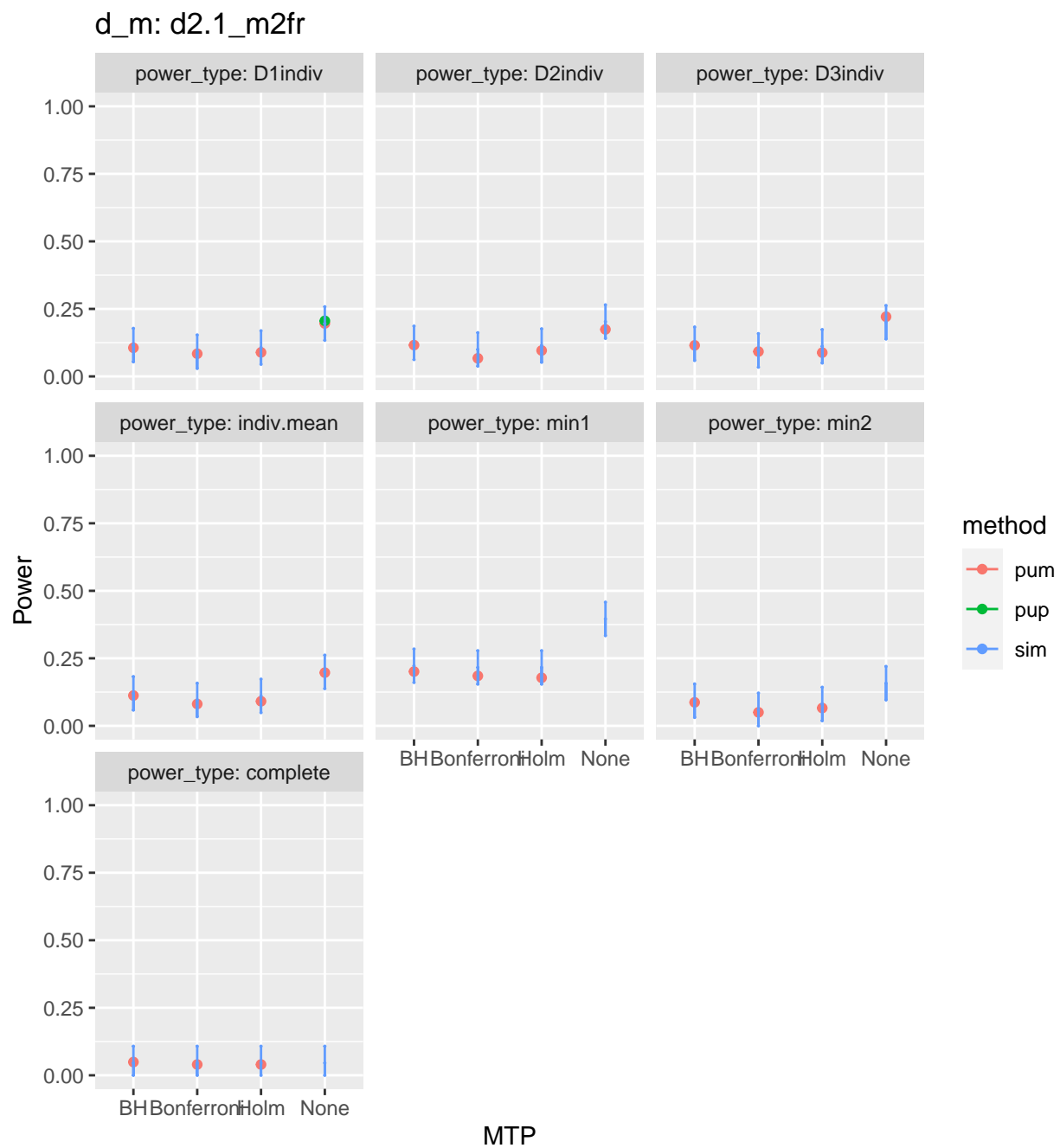
Varying Omega

$\omega_2 = 0.8, 0.8, 0.8$

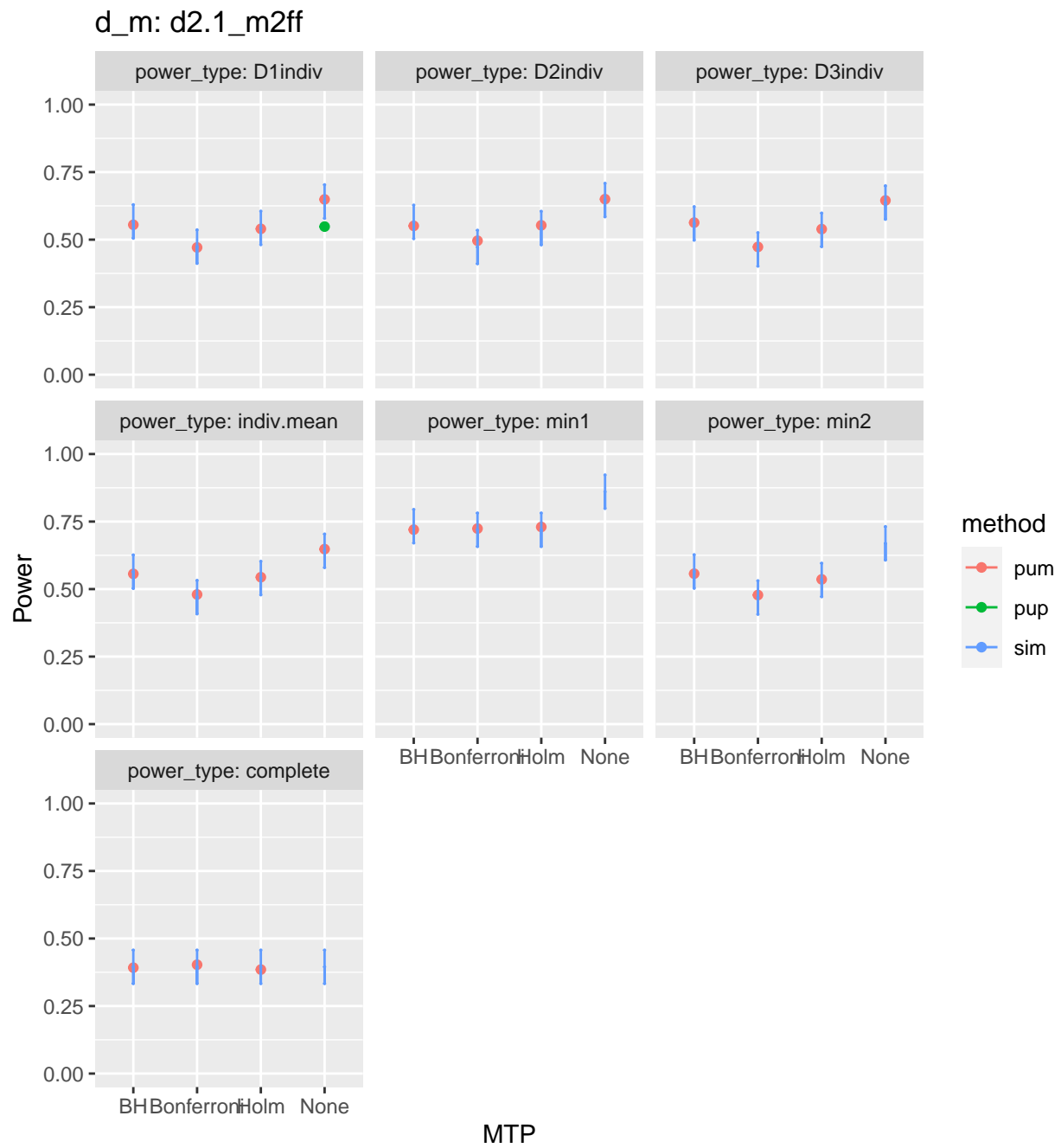
d_m: d2.1_m2ff

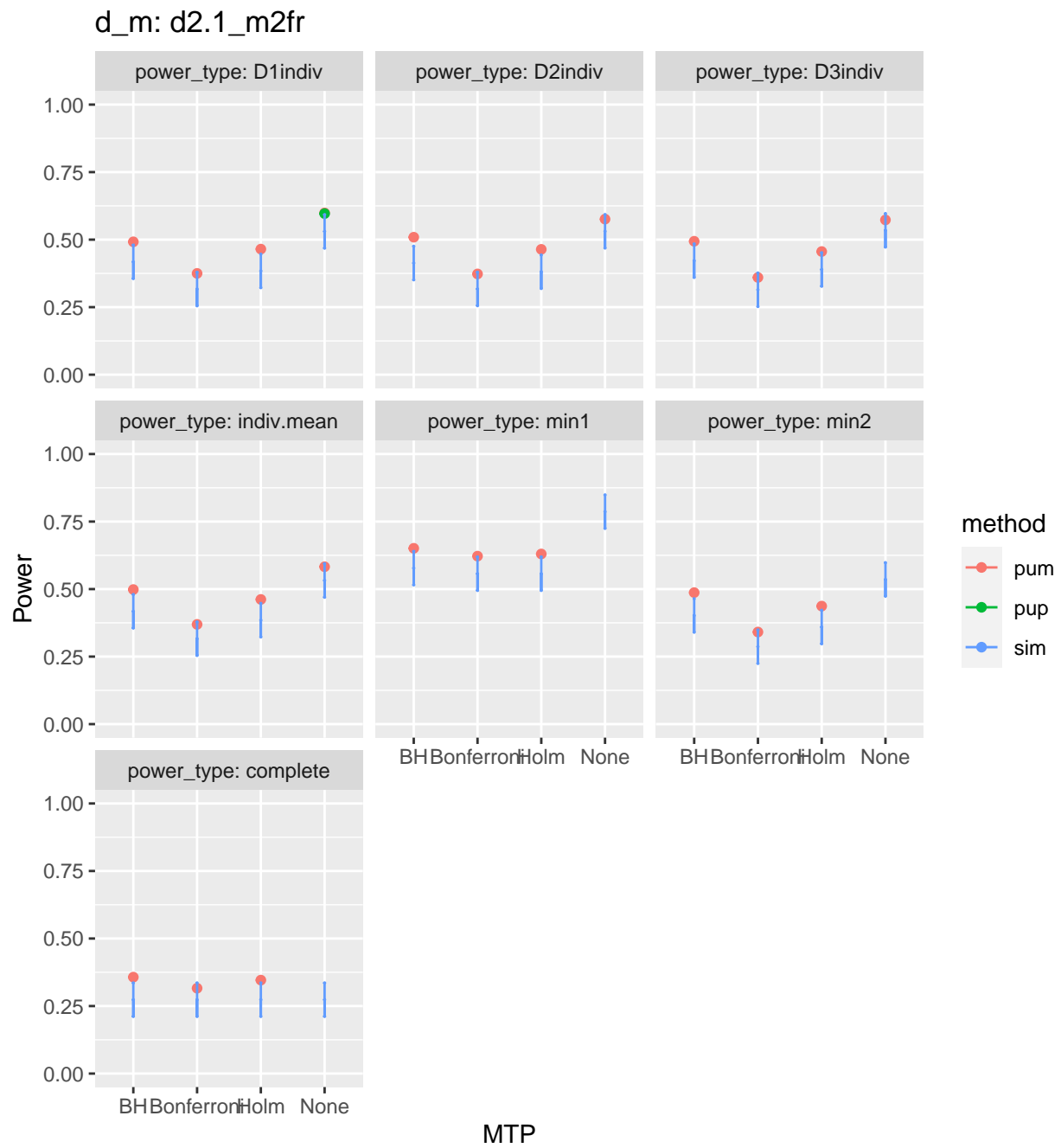


MTP



$\omega_2 = 0, 0, 0$

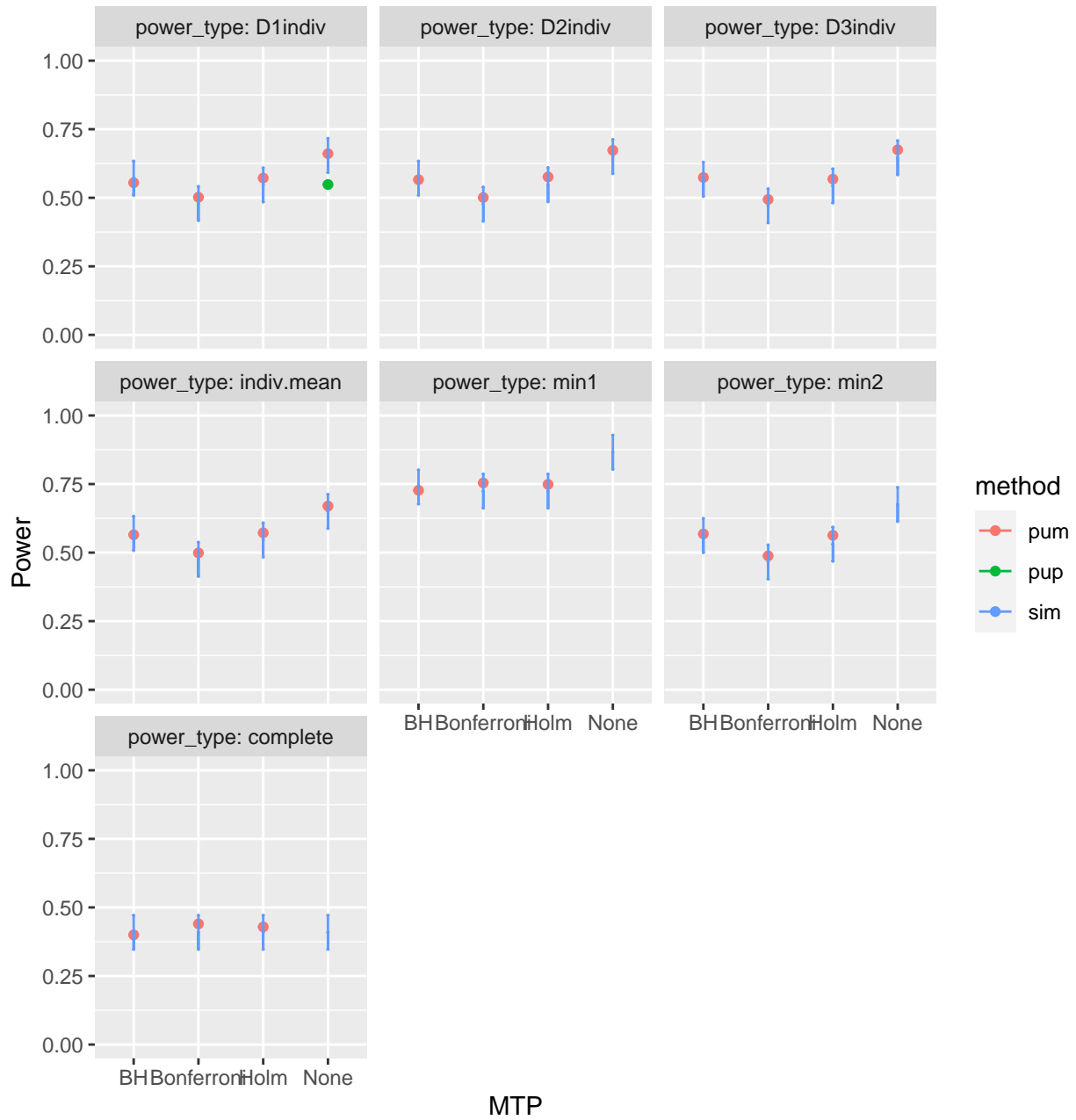


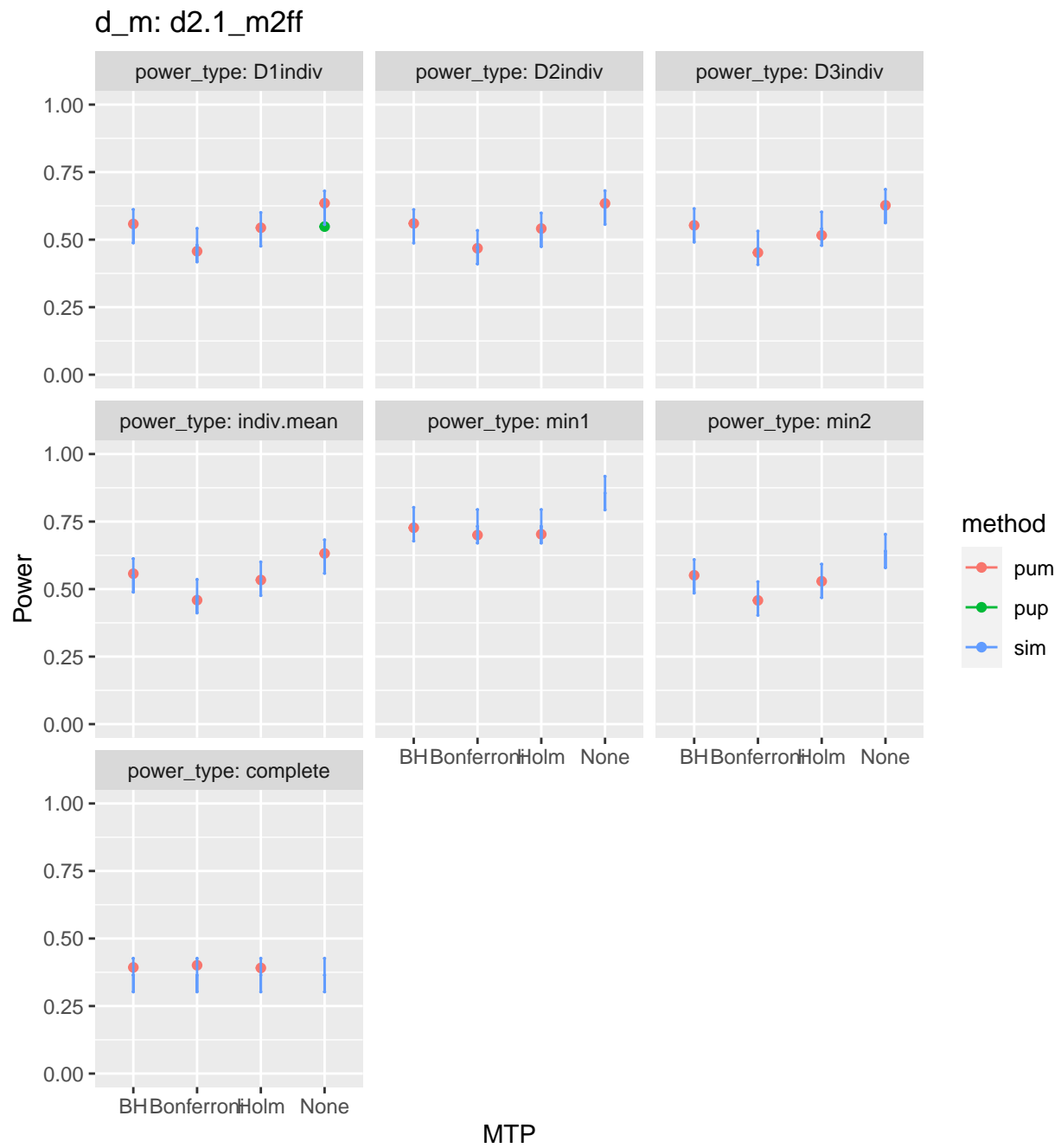


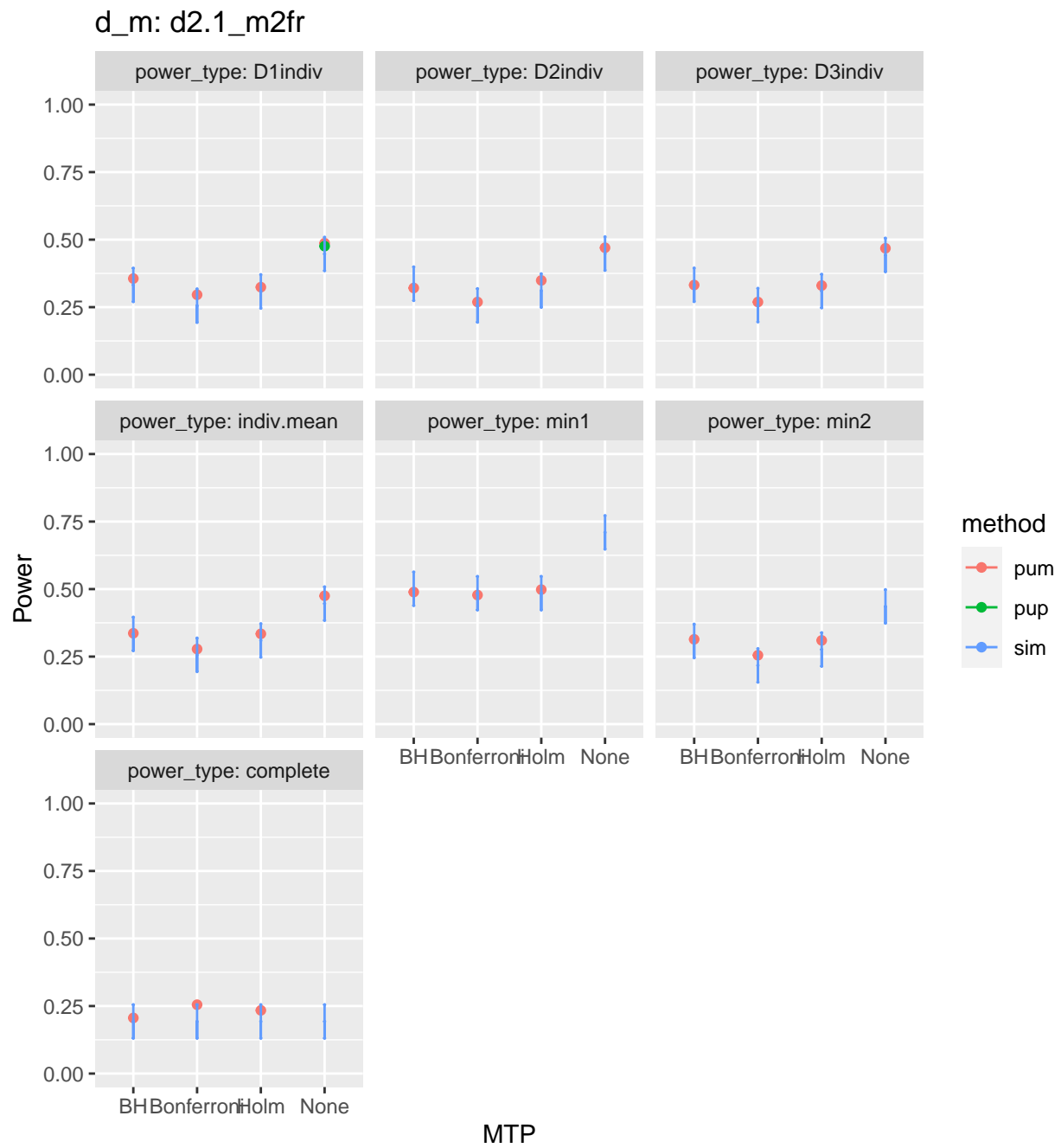
Kappa

$\kappa = 0.4$

d_m: d2.1_m2fc







MDES validation

```
##
##
## +-----+-----+-----+-----+
## |      MTP      | Adjusted MDES | D1indiv Power | Target MDES |
## +=====+=====+=====+=====+
## | Bonferroni |      0.129     |      0.502     |      0.125     |
## +-----+-----+-----+-----+
## |      BH      |      0.125     |      0.562     |      0.125     |
## +-----+-----+-----+-----+
## |      Holm     |      0.129     |      0.577     |      0.125     |
## +-----+-----+-----+-----+
##
## Table: d2.1_m2fc
##
##
## +-----+-----+-----+-----+
## |      MTP      | Adjusted MDES | D1indiv Power | Target MDES |
## +=====+=====+=====+=====+
## | Bonferroni |      0.123     |      0.457     |      0.125     |
## +-----+-----+-----+-----+
## |      BH      |      0.123     |      0.553     |      0.125     |
## +-----+-----+-----+-----+
## |      Holm     |      0.126     |      0.55      |      0.125     |
## +-----+-----+-----+-----+
##
## Table: d2.1_m2ff
##
##
## +-----+-----+-----+-----+
## |      MTP      | Adjusted MDES | D1indiv Power | Target MDES |
## +=====+=====+=====+=====+
## | Bonferroni |      0.13      |      0.296     |      0.125     |
## +-----+-----+-----+-----+
## |      BH      |      0.126     |      0.358     |      0.125     |
## +-----+-----+-----+-----+
## |      Holm     |      NA        |      NA        |      0.125     |
## +-----+-----+-----+-----+
##
## Table: d2.1_m2fr
```

Sample size validation

```
##
##
## +-----+-----+-----+-----+
## |      MTP      | Sample.type | Sample.size | D1indiv.power |
## +=====+=====+=====+=====+
## | Bonferroni |      J      |      21      |      0.502      |
## +-----+-----+-----+-----+
## |      BH      |      J      |      20      |      0.548      |
## +-----+-----+-----+-----+
## |      Holm     |      J      |      21      |      0.566      |
## +-----+-----+-----+-----+
##
## Table: d2.1_m2fc
##
##
## +-----+-----+-----+-----+
## |      MTP      | Sample.type | Sample.size | D1indiv.power |
## +=====+=====+=====+=====+
## | Bonferroni |      nbar    |      54.04    |      0.502      |
## +-----+-----+-----+-----+
## |      BH      |      nbar    |      50      |      0.563      |
## +-----+-----+-----+-----+
## |      Holm     |      nbar    |      53      |      0.576      |
## +-----+-----+-----+-----+
##
## Table: d2.1_m2fc
##
##
## +-----+-----+-----+-----+
## |      MTP      | Sample.type | Sample.size | D1indiv.power |
## +=====+=====+=====+=====+
## | Bonferroni |      J      |      19      |      0.457      |
## +-----+-----+-----+-----+
## |      BH      |      J      |      20      |      0.561      |
## +-----+-----+-----+-----+
## |      Holm     |      J      |      21      |      0.544      |
## +-----+-----+-----+-----+
##
## Table: d2.1_m2ff
##
##
## +-----+-----+-----+-----+
## |      MTP      | Sample.type | Sample.size | D1indiv.power |
## +=====+=====+=====+=====+
## | Bonferroni |      nbar    |      49.16    |      0.457      |
## +-----+-----+-----+-----+
## |      BH      |      nbar    |      49      |      0.551      |
## +-----+-----+-----+-----+
## |      Holm     |      nbar    |      51      |      0.55      |
## +-----+-----+-----+-----+
```

```
##
## Table: d2.1_m2ff
##
##
## +-----+-----+-----+-----+
## |      MTP      | Sample.type | Sample.size | D1indiv.power |
## +=====+=====+=====+=====+
## | Bonferroni |      J      |      21      |      0.296      |
## +-----+-----+-----+-----+
## |      BH      |      J      |      21      |      0.357      |
## +-----+-----+-----+-----+
## |      Holm      |      J      |      20      |      0.318      |
## +-----+-----+-----+-----+
##
## Table: d2.1_m2fr
##
##
## +-----+-----+-----+-----+
## |      MTP      | Sample.type | Sample.size | D1indiv.power |
## +=====+=====+=====+=====+
## | Bonferroni |      J      |      21      |      0.296      |
## +-----+-----+-----+-----+
## |      BH      |      J      |      21      |      0.357      |
## +-----+-----+-----+-----+
## |      Holm      |      J      |      20      |      0.318      |
## +-----+-----+-----+-----+
##
## Table: d2.1_m2fr
```