Validate Power: d2.1

February 25, 2022

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

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

d_m codes: d2.1_m2fc, d2.1_m2ff, d2.1_m2fr

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
- $R_1^2 = 0.1, 0.1, 0.1$
- $\text{ICC}_2 = 0.2, 0.2, 0.2$

Parameters by model type:

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

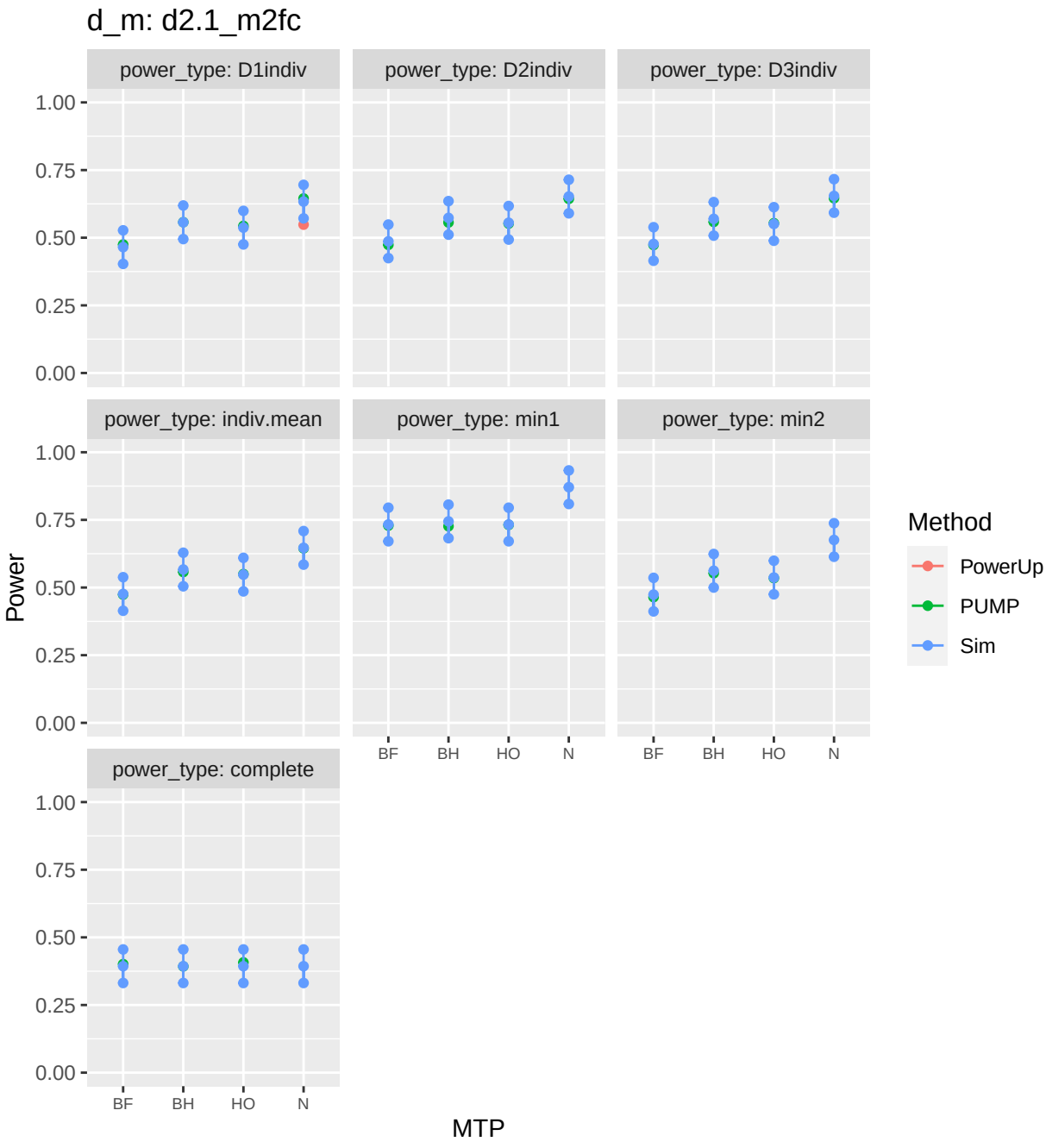
Assumptions:

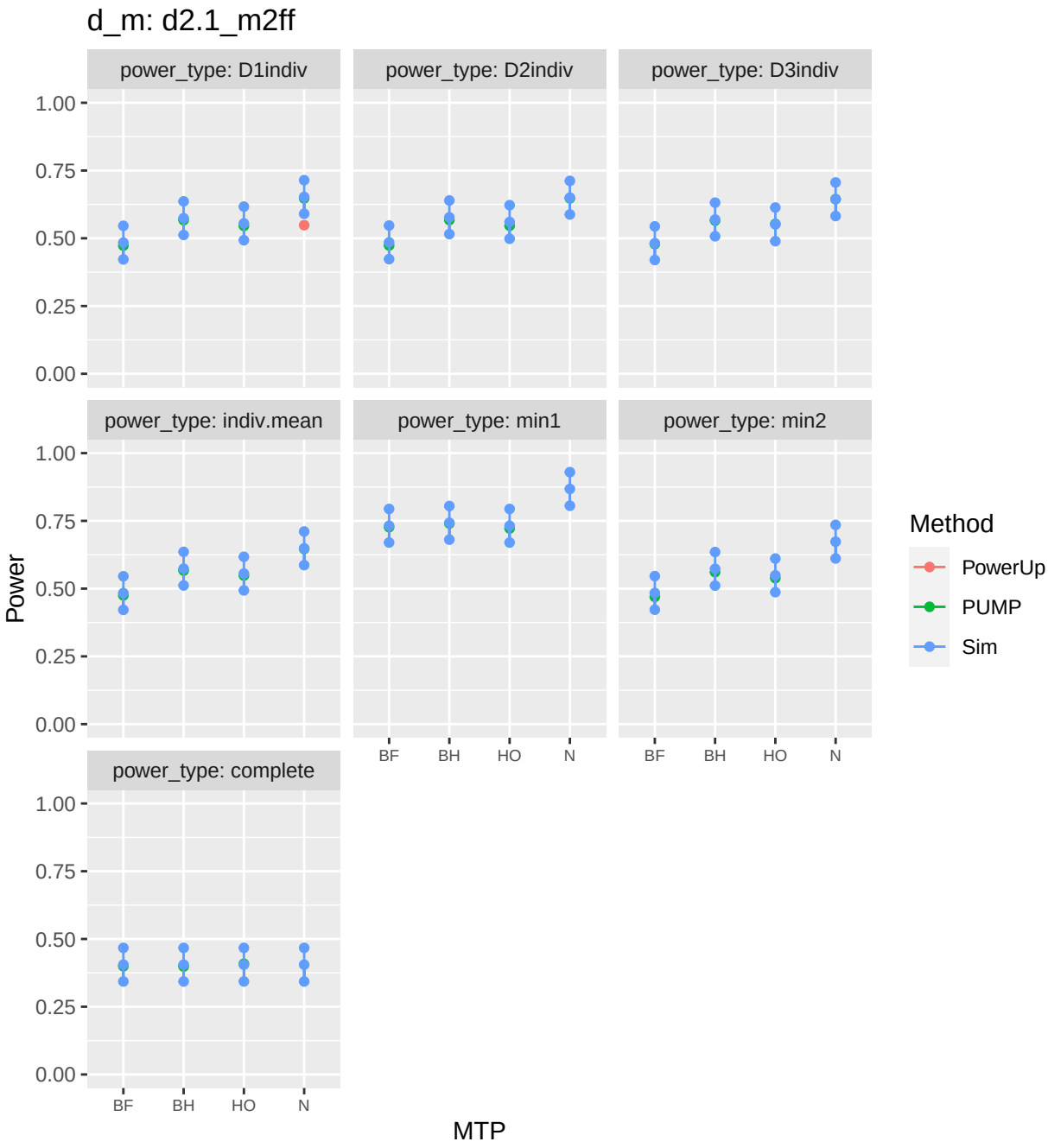
- Two-level design: $\text{ICC}_3 = 0$, $\omega_3 = 0$, $K = 1$

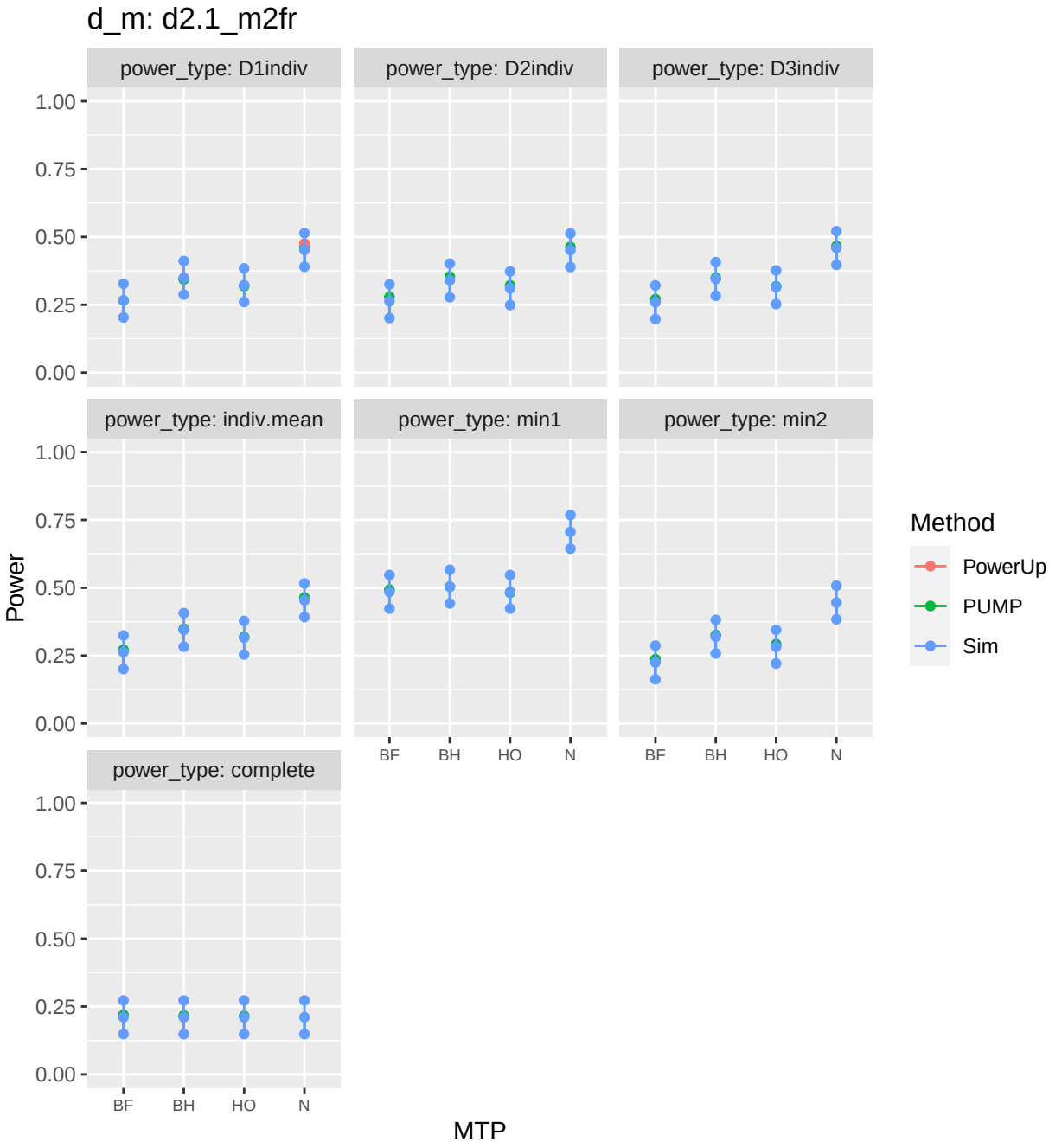
Remark. For all $d2.1$ designs and models, PowerUpR! assumes $ICC.2 = 0$, but we do not make that assumption here. Thus, we expect to see a discrepancy betweeen PUMP and Powerup except for the setting when we assume $ICC.2 = 0$.

Power Validation

Base case

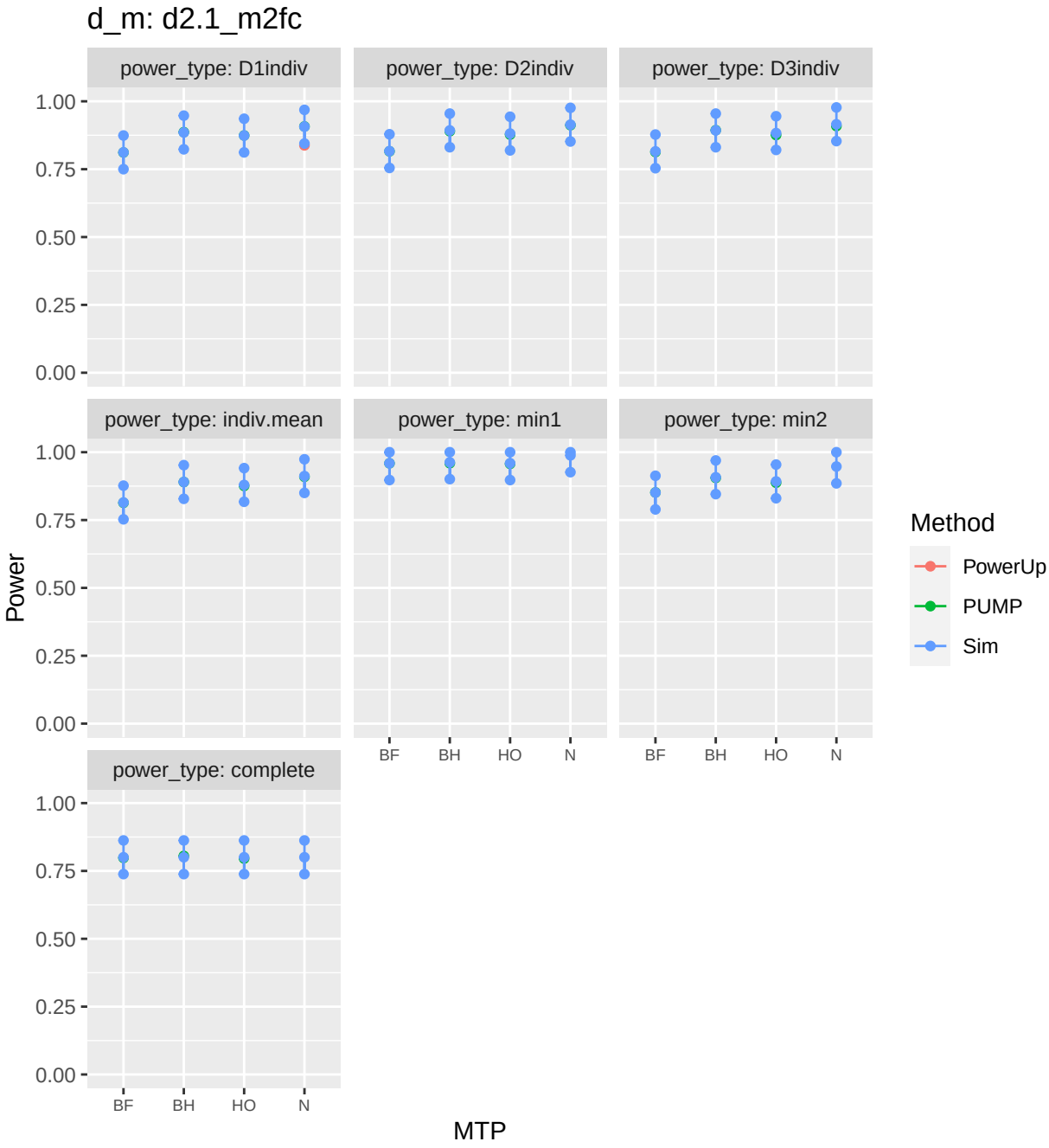


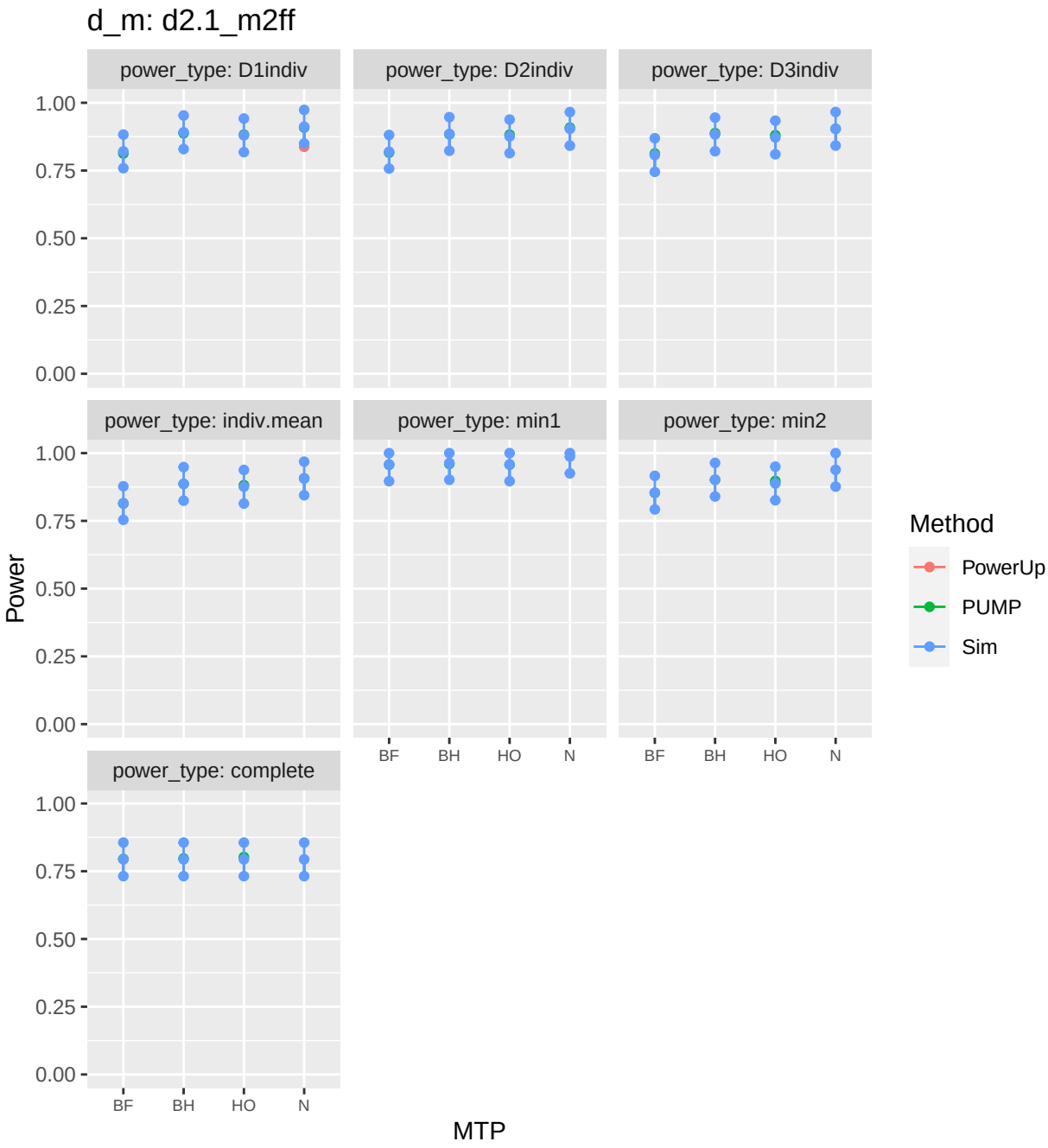

d_m: d2.1_m2ff
power_type: D1indiv
power_type: D2indiv
power_type: D3indiv
power_type: indiv.mean
power_type: min1
power_type: min2
power_type: complete
Power
1.00
0.75
0.50
0.25
0.00
BF
BH
HO
N
MTP
Method
PowerUp
PUMP
Sim

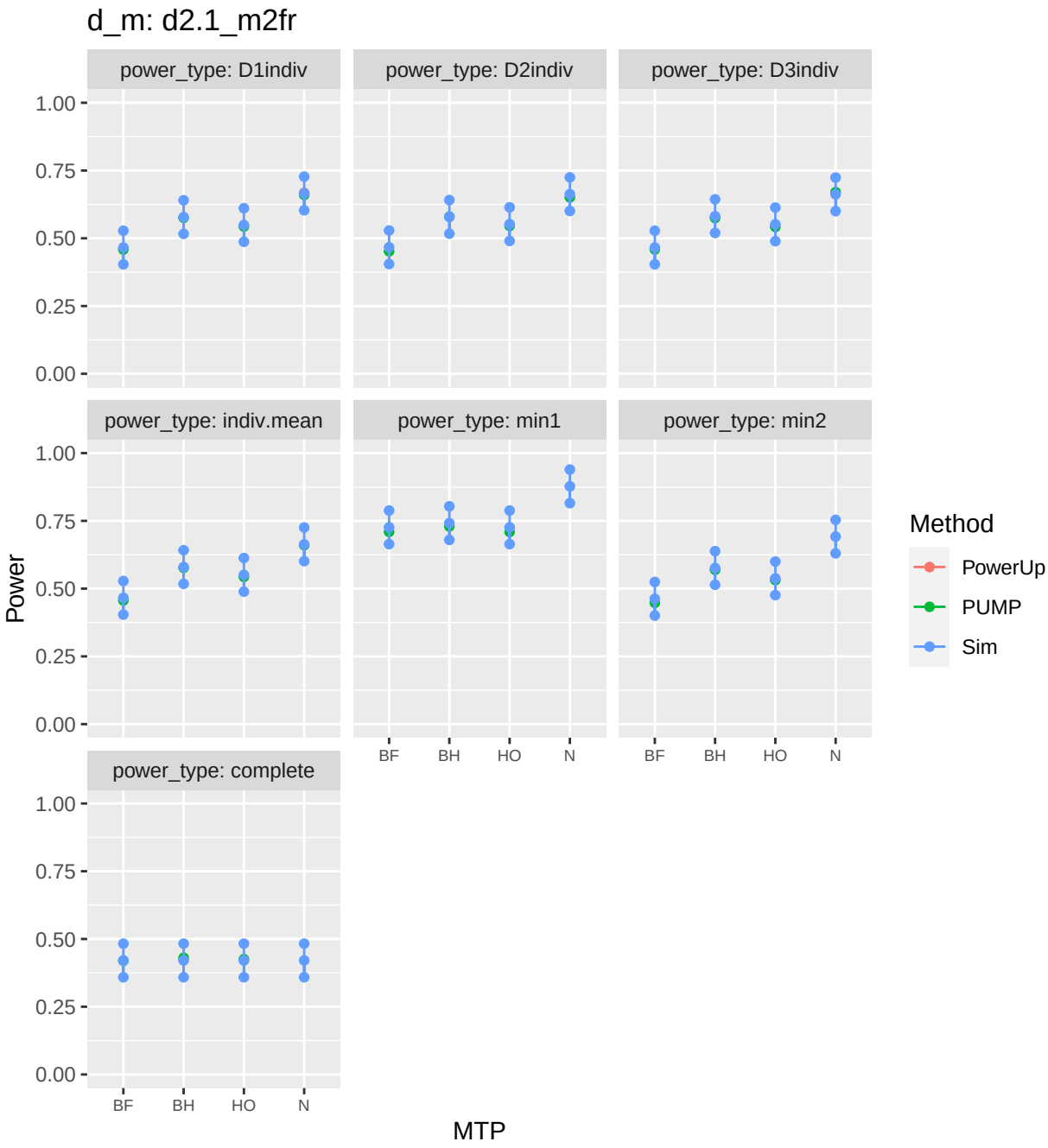

d_m: d2.1_m2fr
power_type: D1indiv
power_type: D2indiv
power_type: D3indiv
power_type: indiv.mean
power_type: min1
power_type: min2
power_type: complete
1.00
0.75
0.50
0.25
0.00
Power
BF
BH
HO
N
MTP
Method
PowerUp
PUMP
Sim

Varying school size

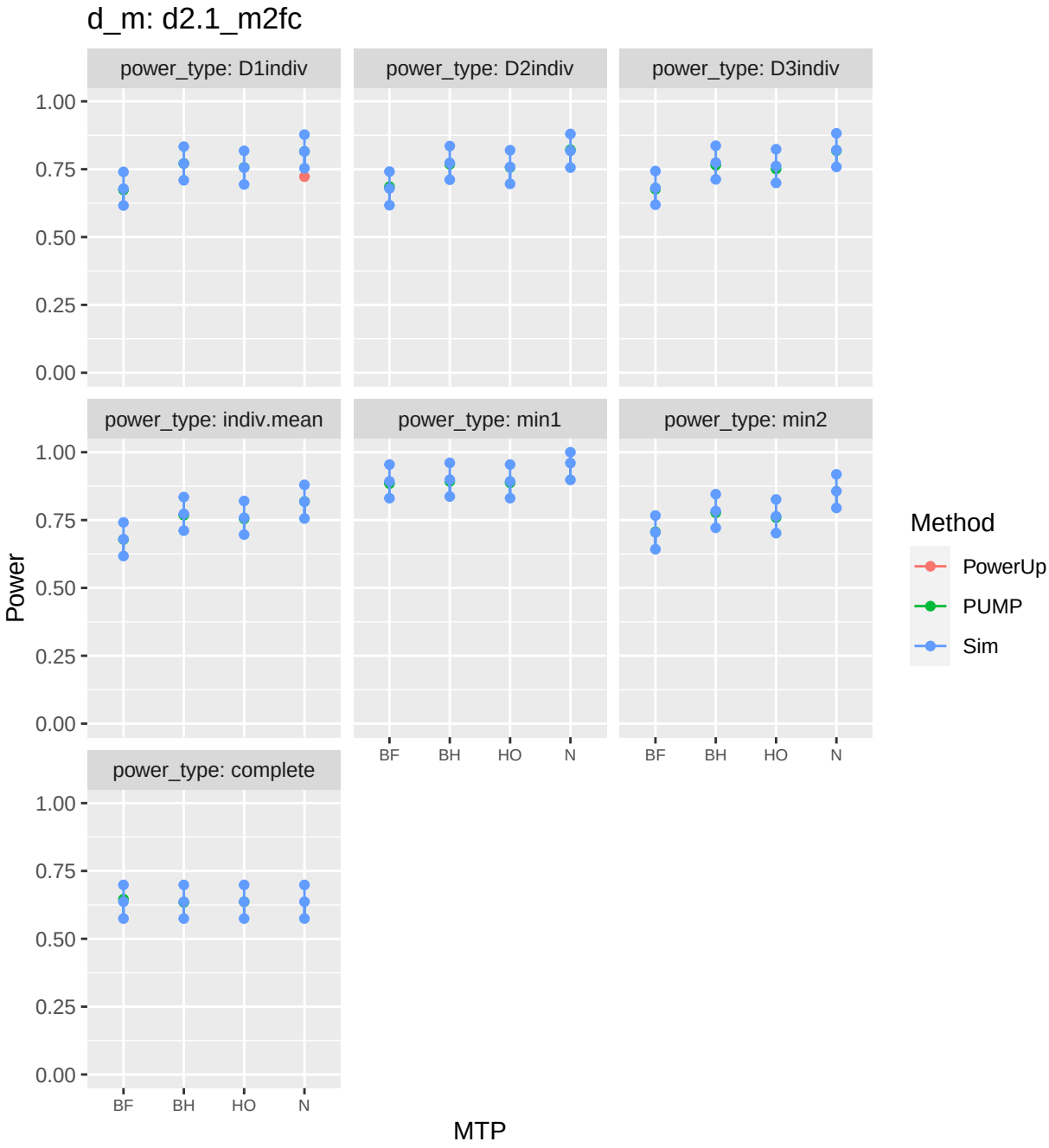
$\bar{n} = 100$

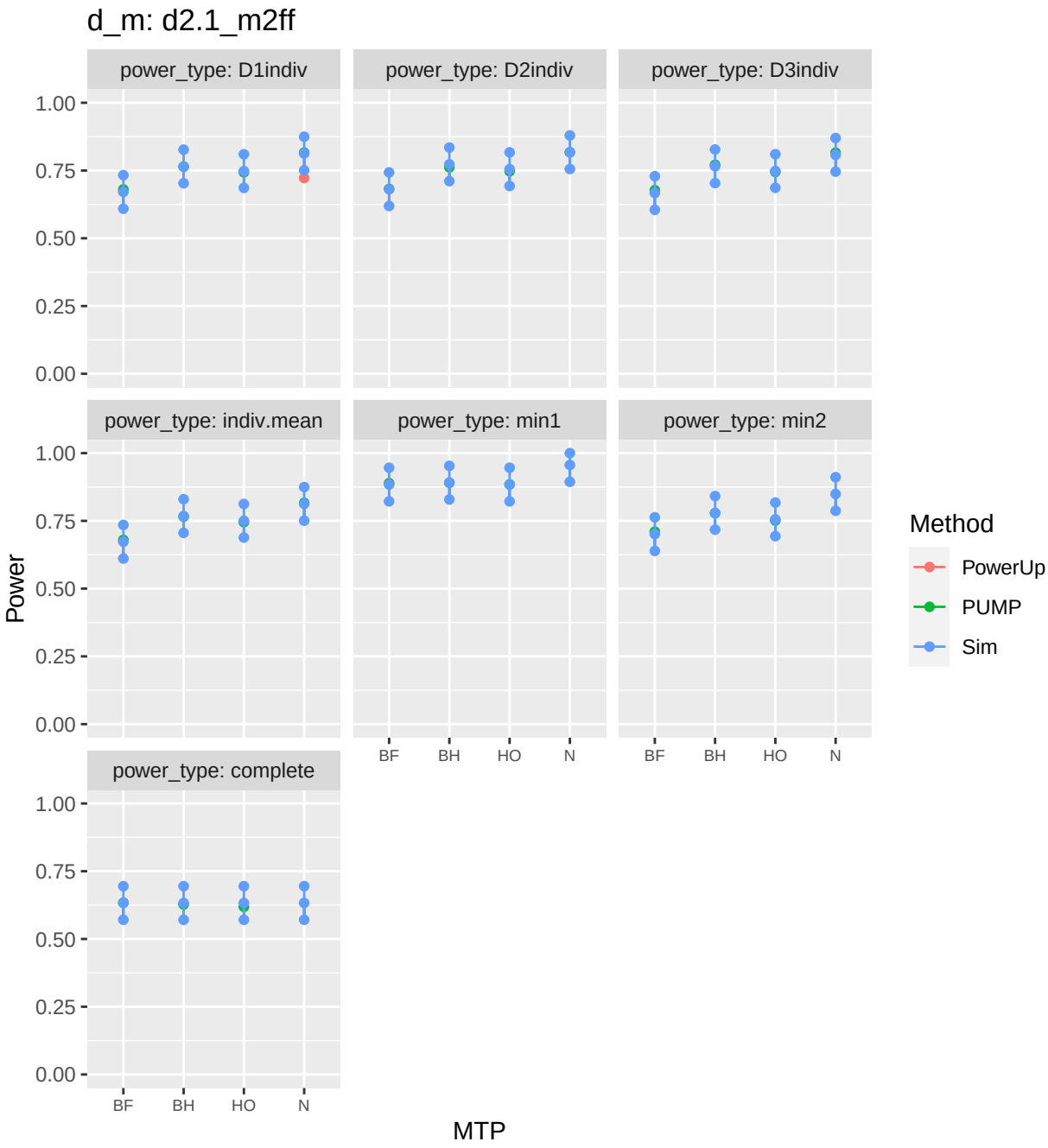


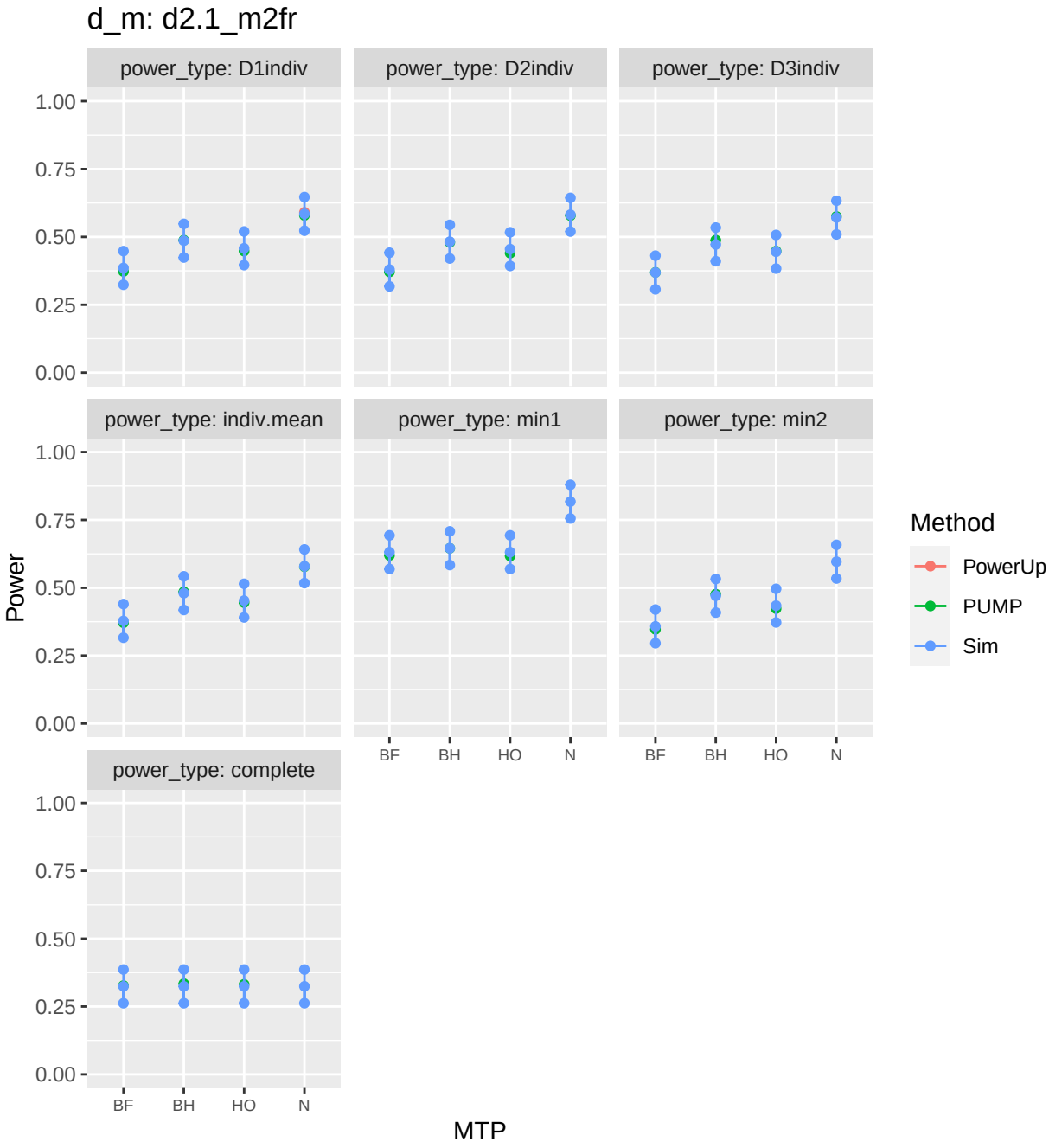

d_m: d2.1_m2ff
power_type: D1indiv
power_type: D2indiv
power_type: D3indiv
power_type: indiv.mean
power_type: min1
power_type: min2
power_type: complete
Power
1.00
0.75
0.50
0.25
0.00
BF
BH
HO
N
MTP
Method
PowerUp
PUMP
Sim


d_m: d2.1_m2fr
power_type: D1indiv
power_type: D2indiv
power_type: D3indiv
power_type: indiv.mean
power_type: min1
power_type: min2
power_type: complete
1.00
0.75
0.50
0.25
0.00
Power
BF
BH
HO
N
MTP
Method
PowerUp
PUMP
Sim

$\bar{n} = 75$

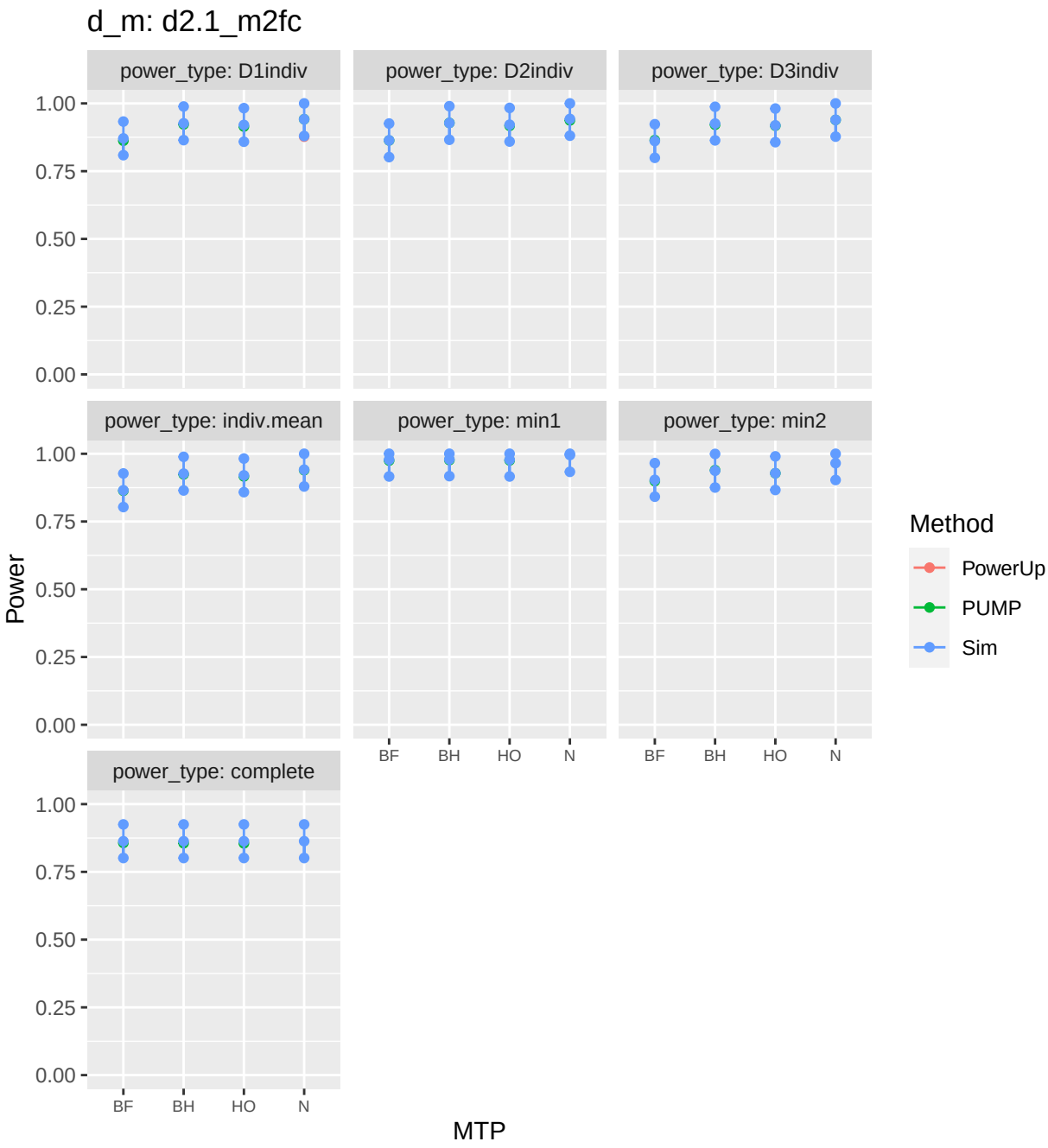

d_m: d2.1_m2fc
power_type: D1indiv
power_type: D2indiv
power_type: D3indiv
power_type: indiv.mean
power_type: min1
power_type: min2
power_type: complete
1.00
0.75
0.50
0.25
0.00
Power
BF
BH
HO
N
MTP
Method
PowerUp
PUMP
Sim


d_m: d2.1_m2ff
power_type: D1indiv
power_type: D2indiv
power_type: D3indiv
power_type: indiv.mean
power_type: min1
power_type: min2
power_type: complete
Power
1.00
0.75
0.50
0.25
0.00
BF
BH
HO
N
MTP
Method
PowerUp
PUMP
Sim

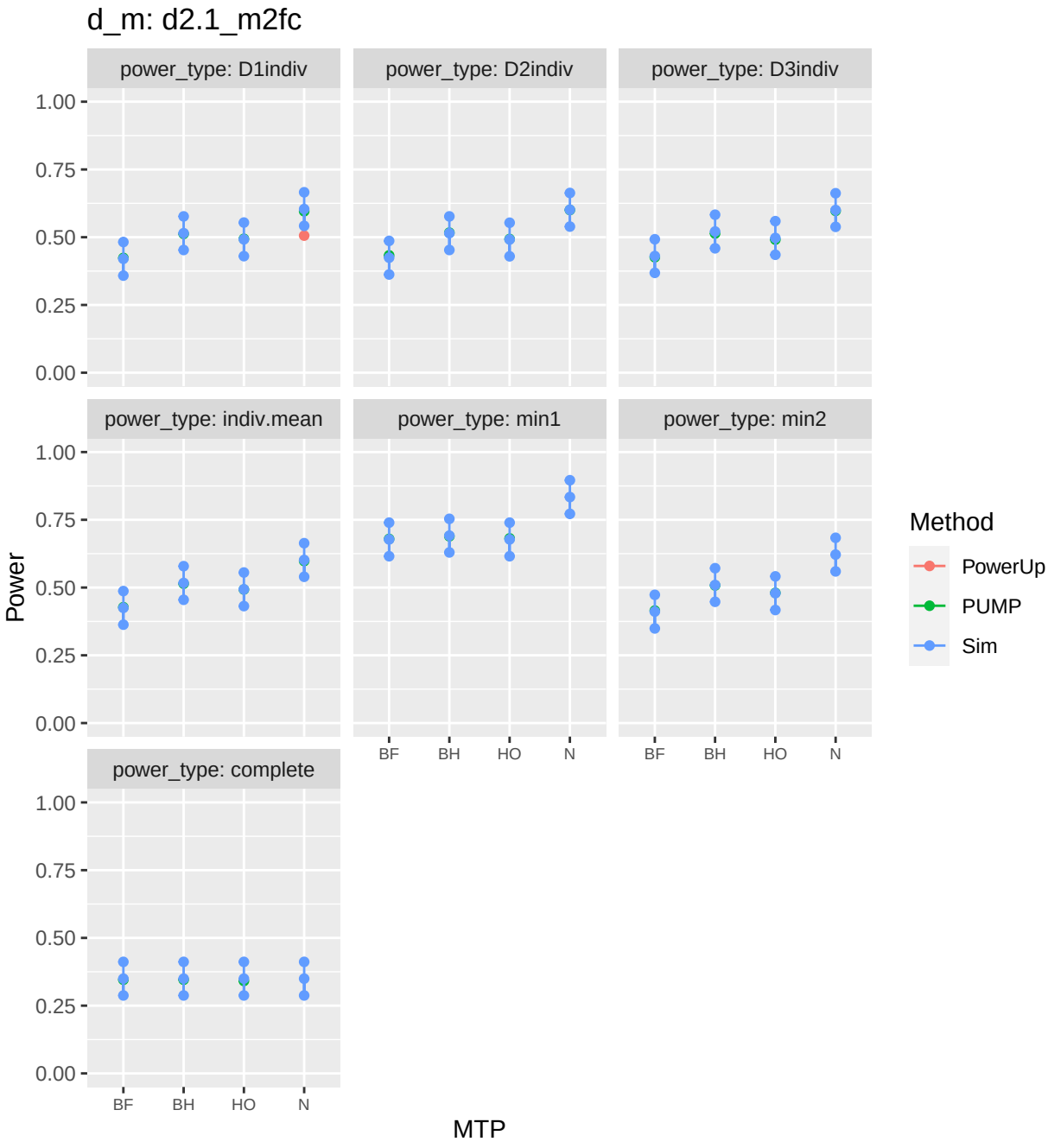

d_m: d2.1_m2fr
power_type: D1indiv
power_type: D2indiv
power_type: D3indiv
power_type: indiv.mean
power_type: min1
power_type: min2
power_type: complete
Power
1.00
0.75
0.50
0.25
0.00
BF
BH
HO
N
MTP
Method
PowerUp
PUMP
Sim

Varying R2

$R_1^2 = 0.6, 0.6, 0.6$

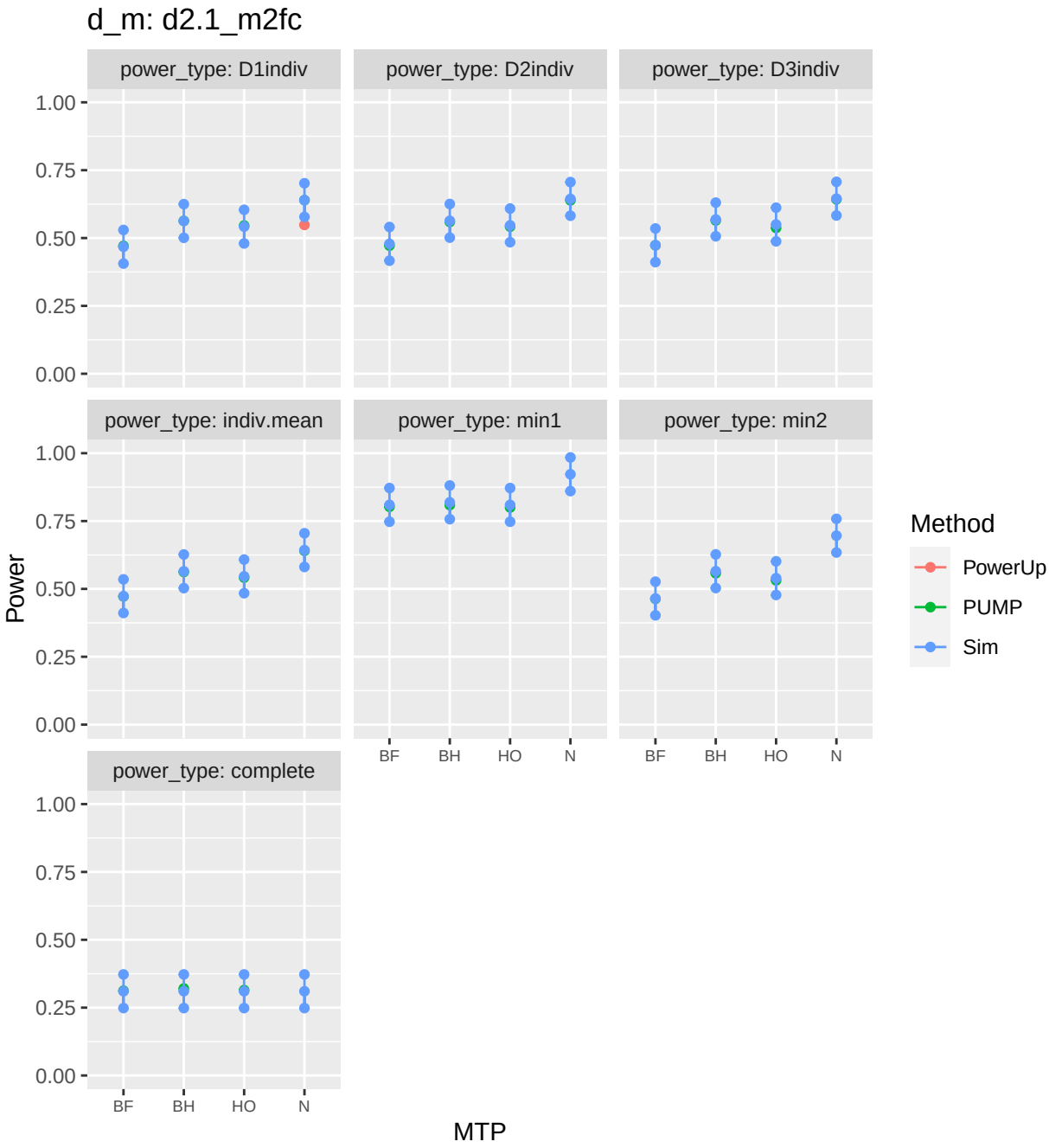


$R_1^2 = 0,\ 0,\ 0$

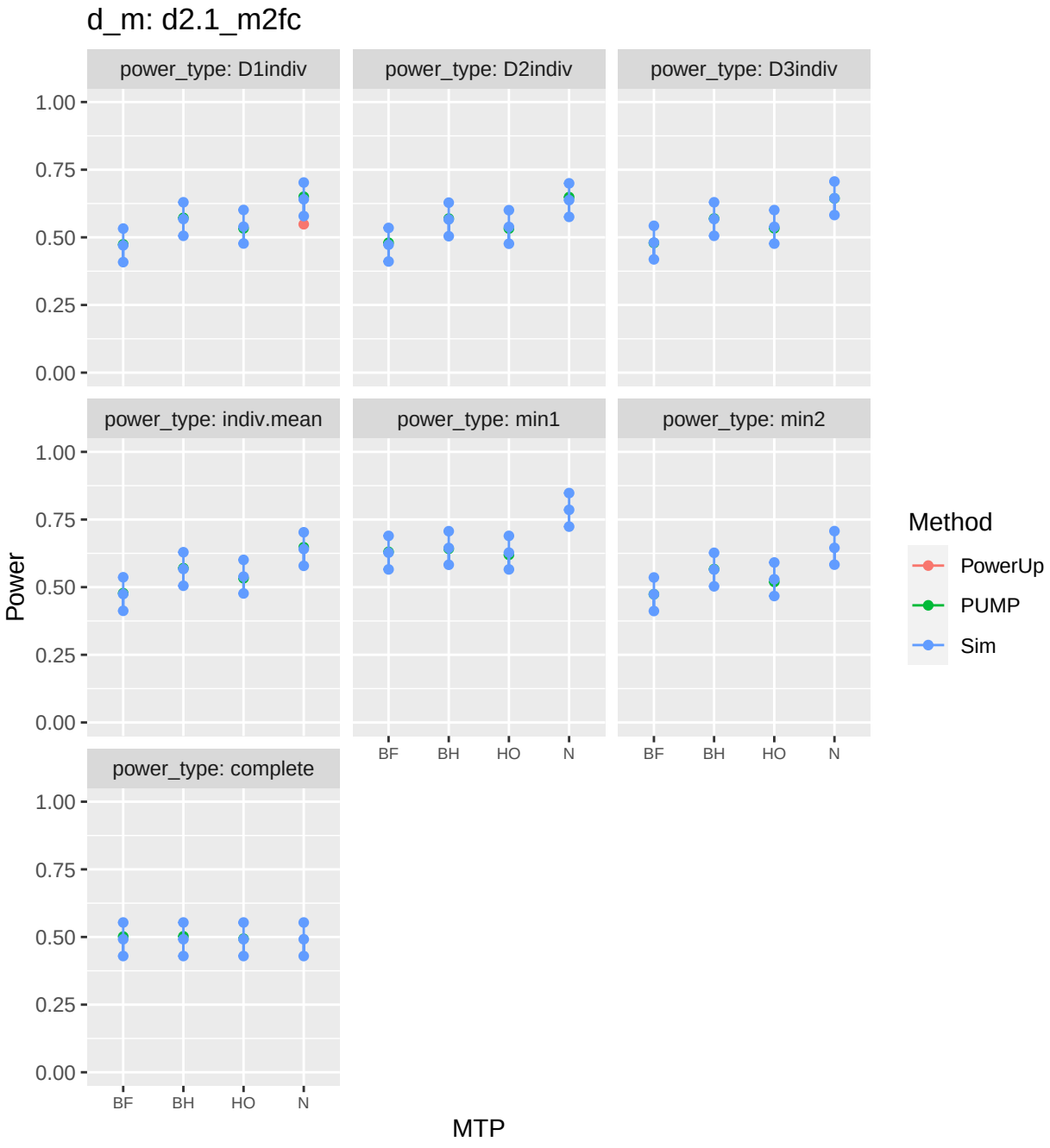

d_m: d2.1_m2fc
power_type: D1indiv
power_type: D2indiv
power_type: D3indiv
power_type: indiv.mean
power_type: min1
power_type: min2
power_type: complete
1.00
0.75
0.50
0.25
0.00
Power
BF
BH
HO
N
MTP
Method
PowerUp
PUMP
Sim

Varying rho

$\rho = 0.2$

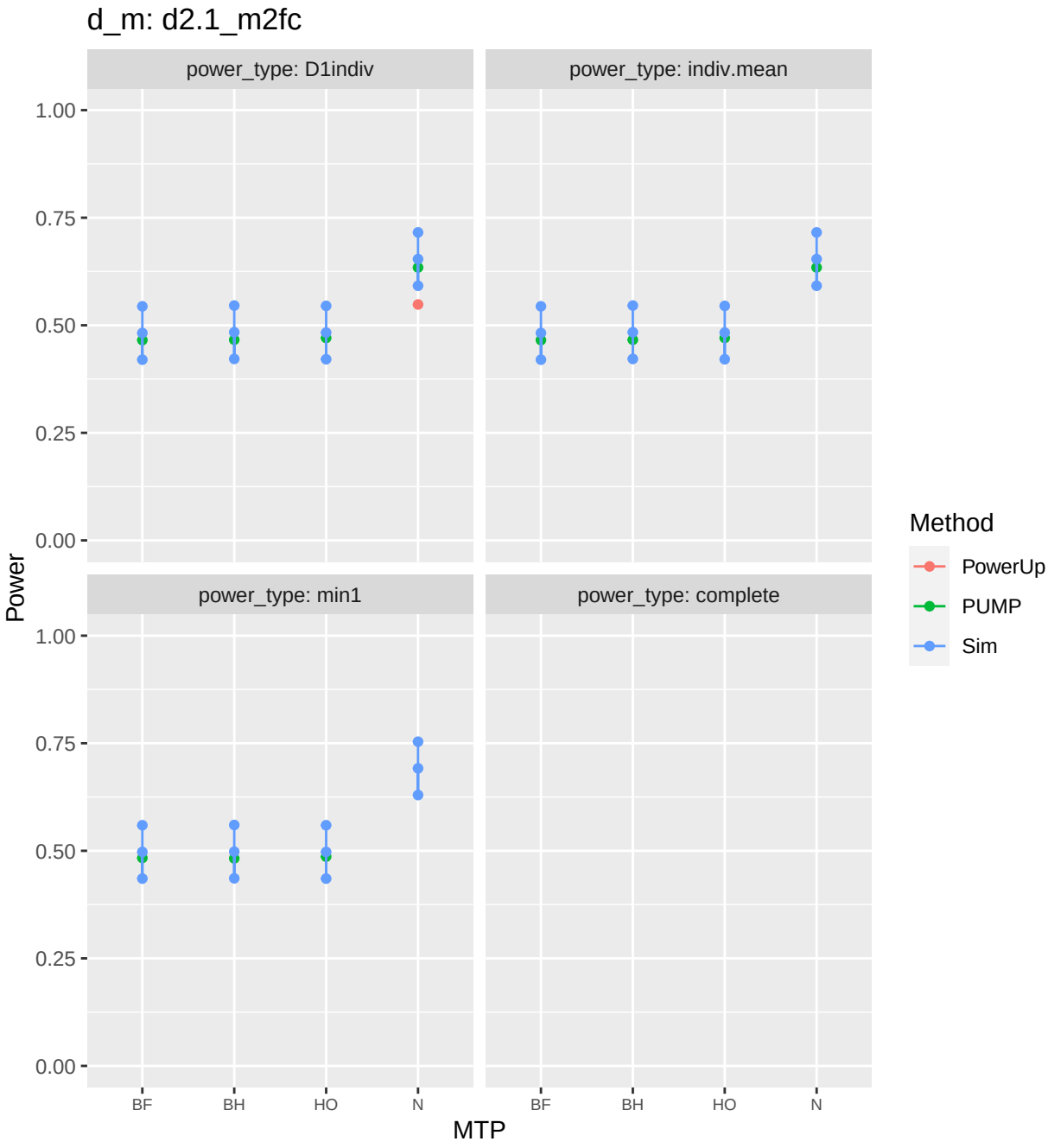


$\rho = 0.8$


d_m: d2.1_m2fc
power_type: D1indiv
power_type: D2indiv
power_type: D3indiv
power_type: indiv.mean
power_type: min1
power_type: min2
power_type: complete
Power
1.00
0.75
0.50
0.25
0.00
BF
BH
HO
N
MTP
Method
PowerUp
PUMP
Sim

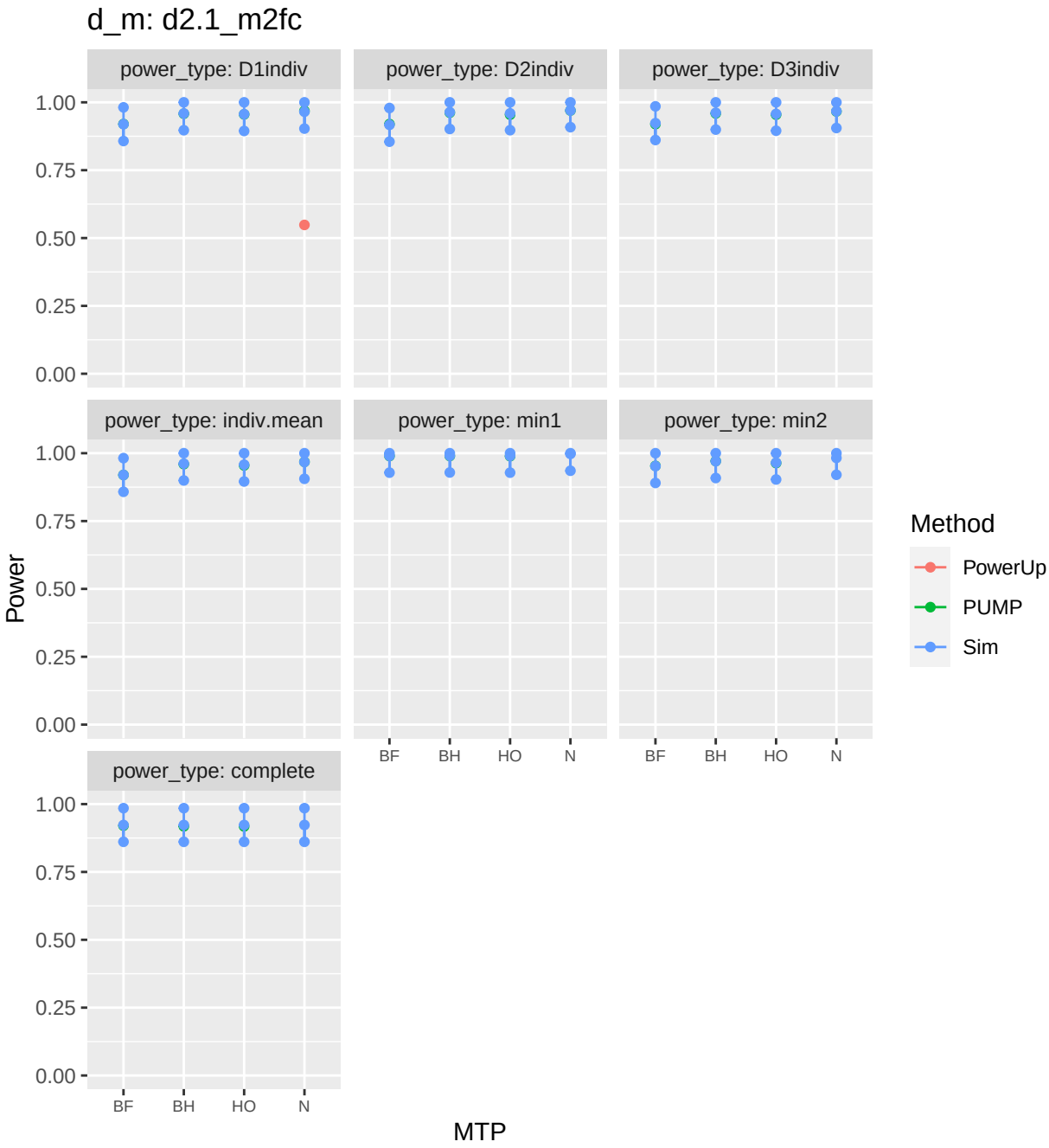
Varying true positives

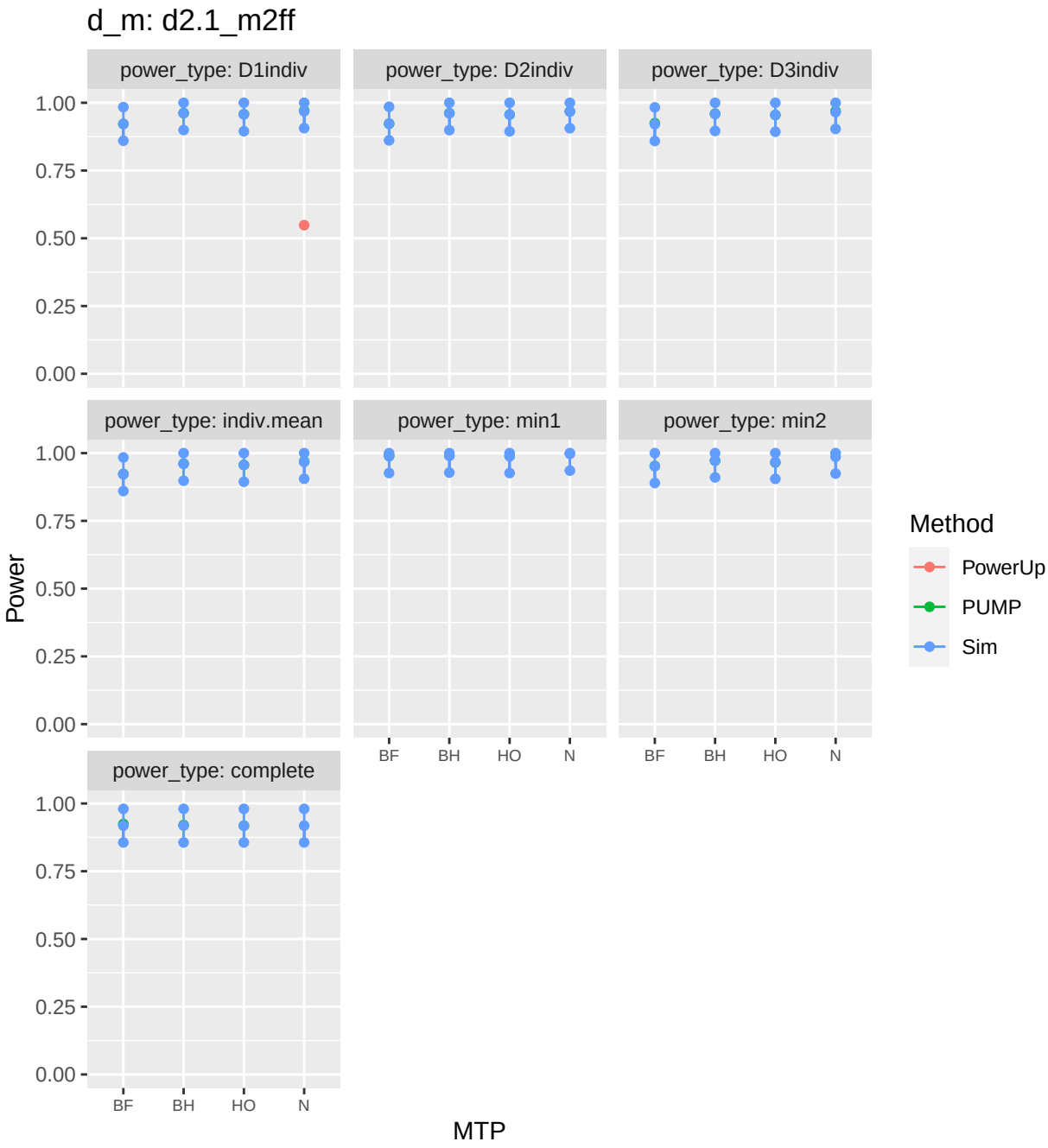
MDES = 0.125, 0, 0

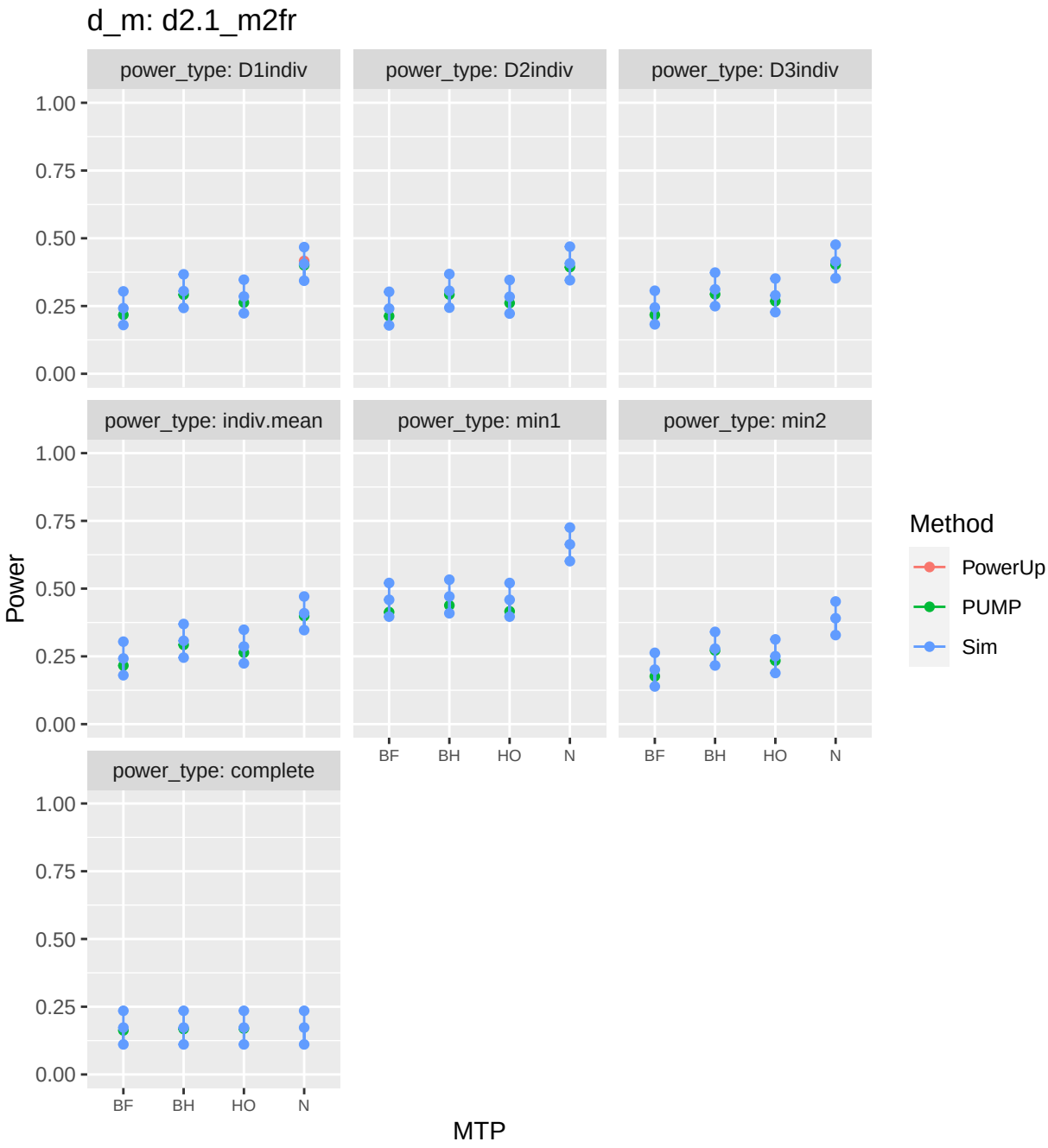


Varying ICC

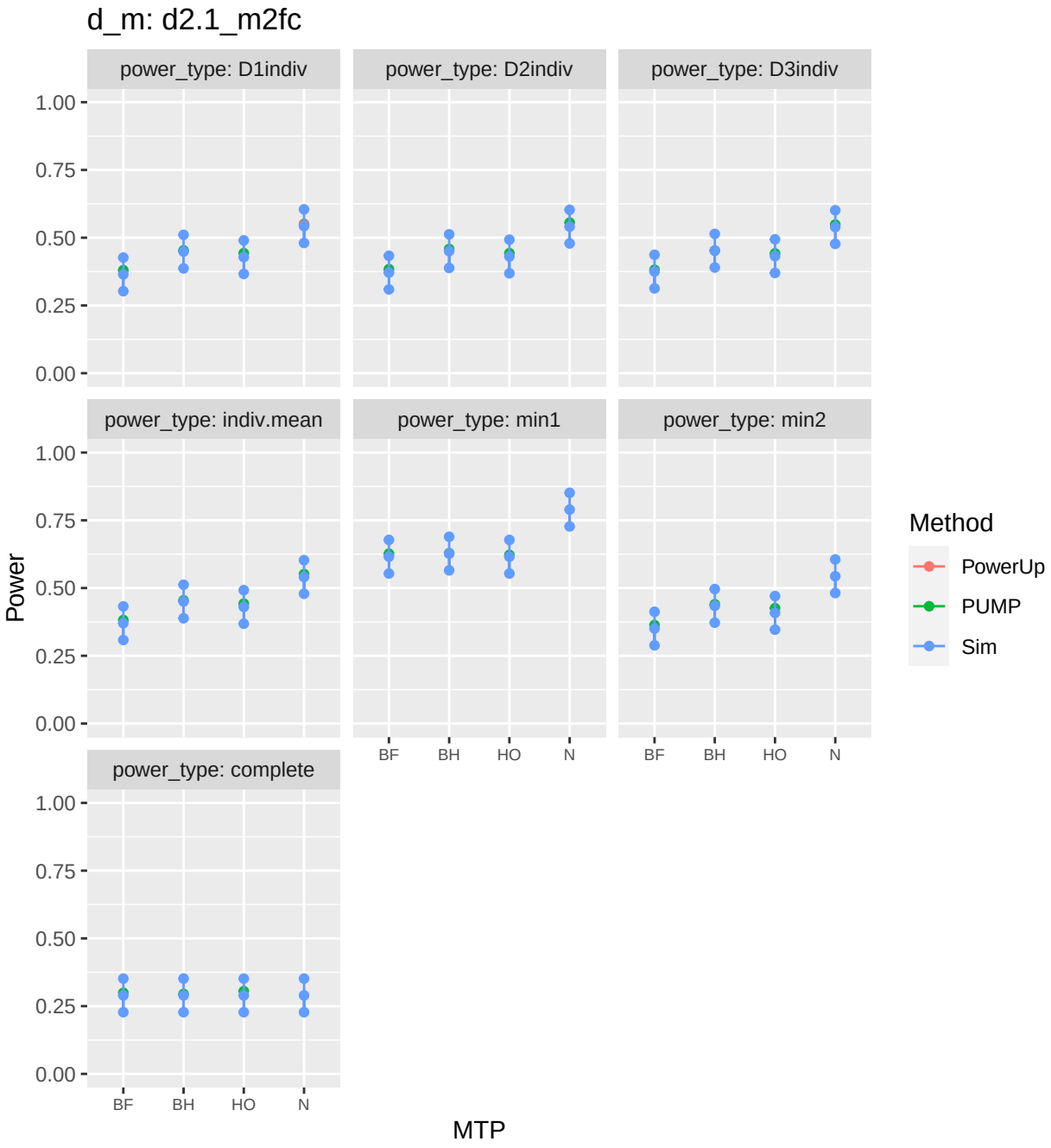
$\text{ICC}_2 = 0.7, 0.7, 0.7$

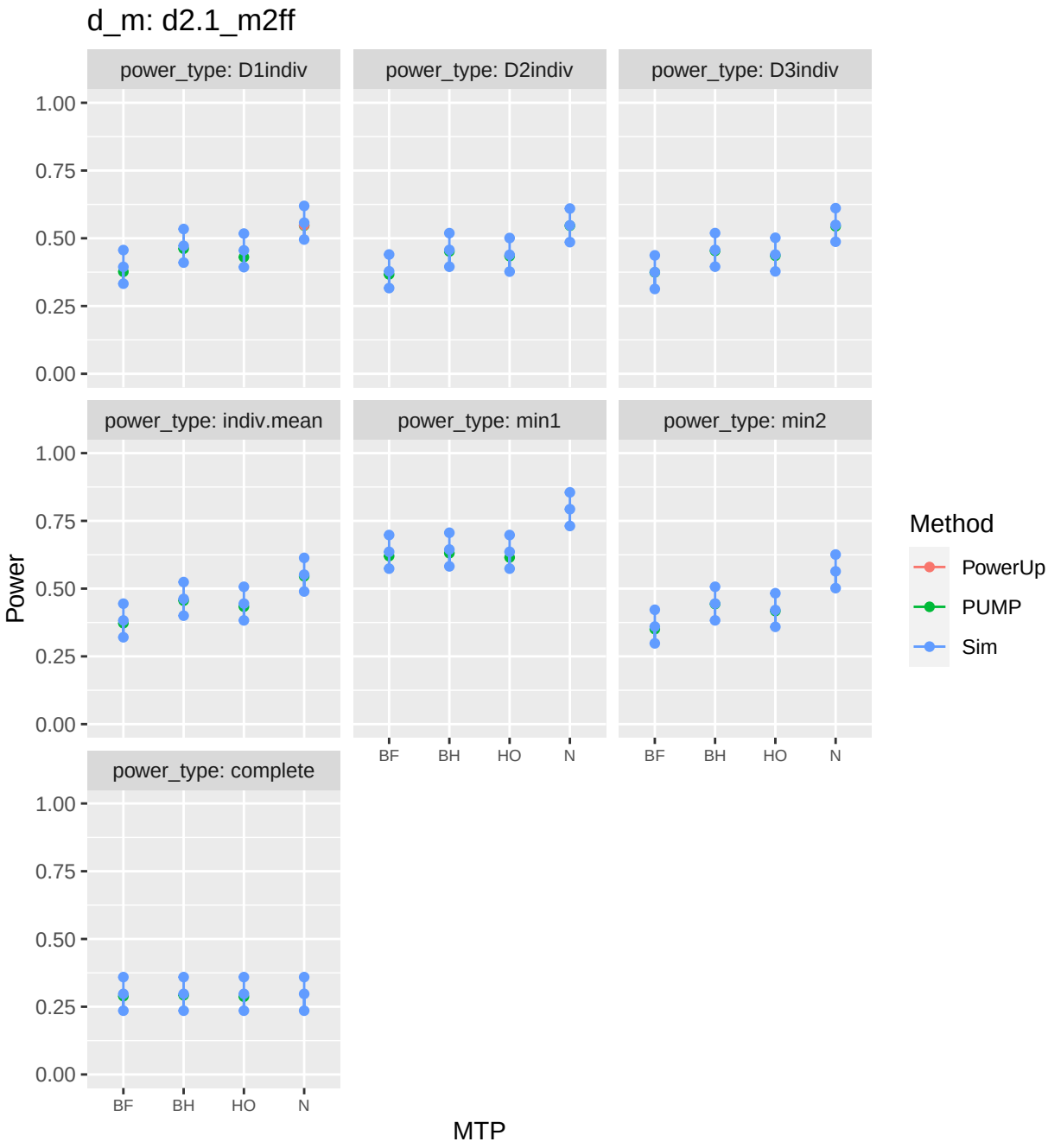


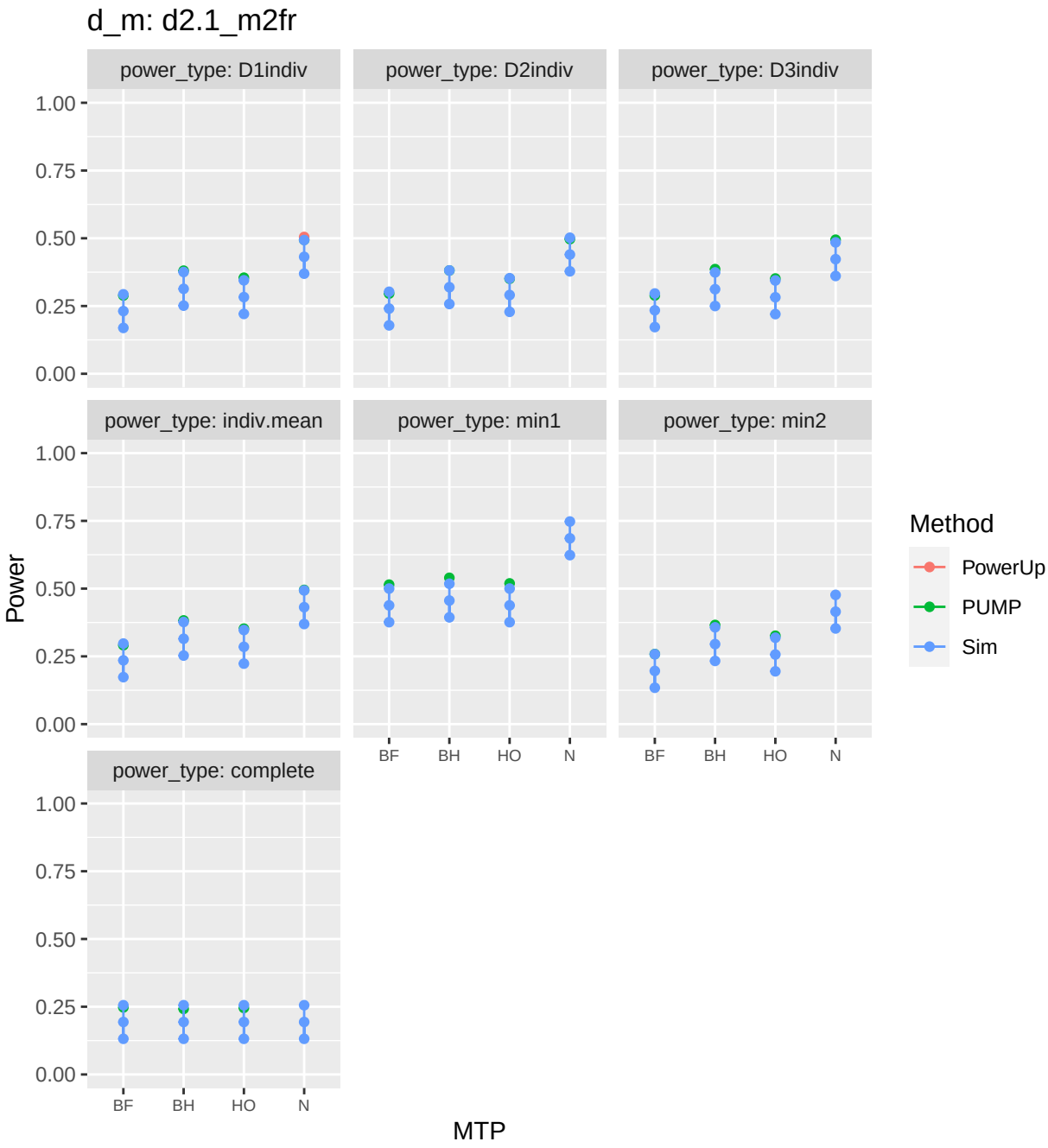

d_m: d2.1_m2ff
power_type: D1indiv
power_type: D2indiv
power_type: D3indiv
power_type: indiv.mean
power_type: min1
power_type: min2
power_type: complete
Power
1.00
0.75
0.50
0.25
0.00
BF
BH
HO
N
MTP
Method
PowerUp
PUMP
Sim


d_m: d2.1_m2fr
power_type: D1indiv
power_type: D2indiv
power_type: D3indiv
power_type: indiv.mean
power_type: min1
power_type: min2
power_type: complete
1.00
0.75
0.50
0.25
0.00
Power
BF
BH
HO
N
MTP
Method
PowerUp
PUMP
Sim

$\text{ICC}_2 = 0, 0, 0$

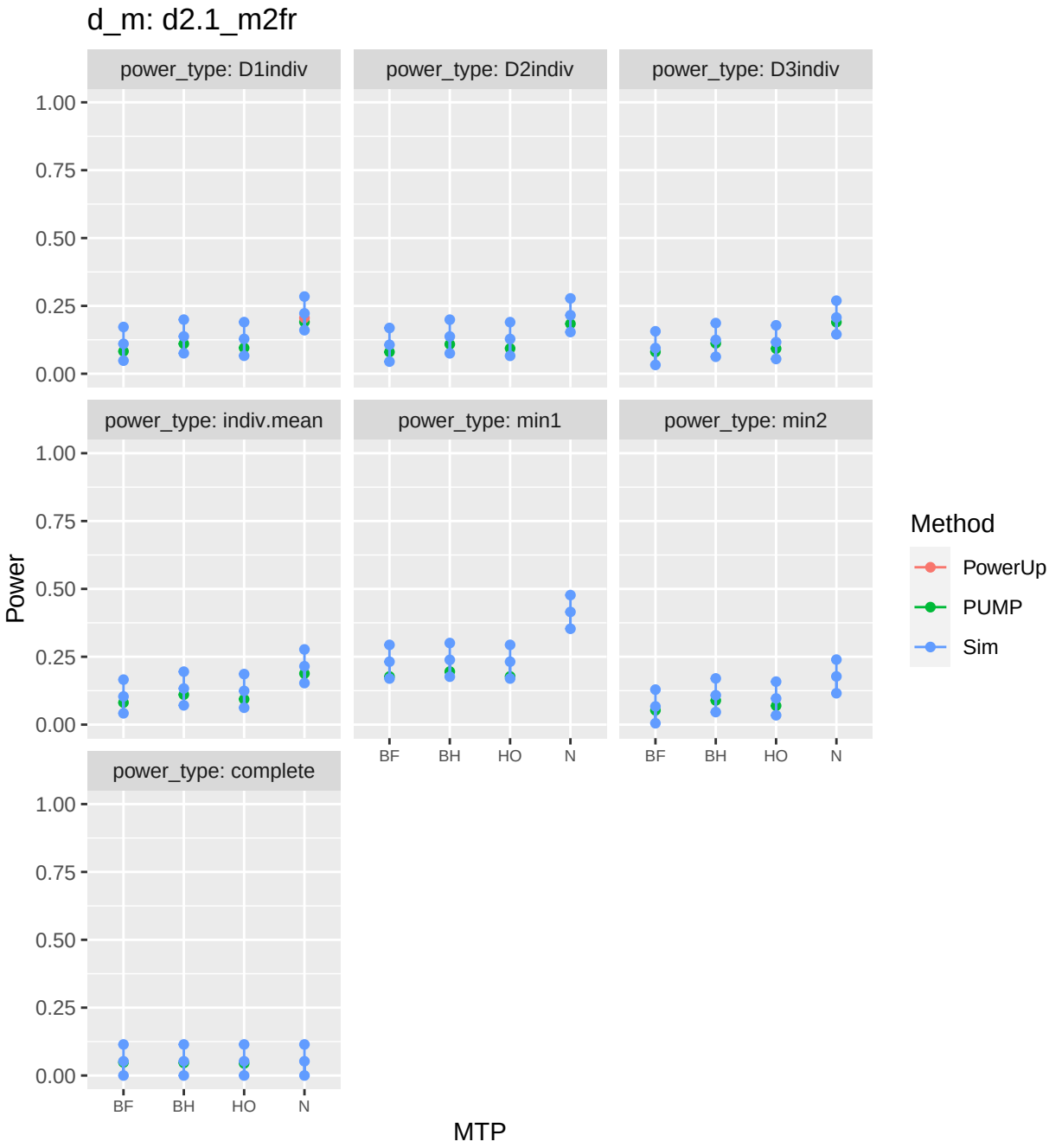



d_m: d2.1_m2ff
power_type: D1indiv
power_type: D2indiv
power_type: D3indiv
power_type: indiv.mean
power_type: min1
power_type: min2
power_type: complete
1.00
0.75
0.50
0.25
0.00
Power
BF
BH
HO
N
MTP
Method
PowerUp
PUMP
Sim

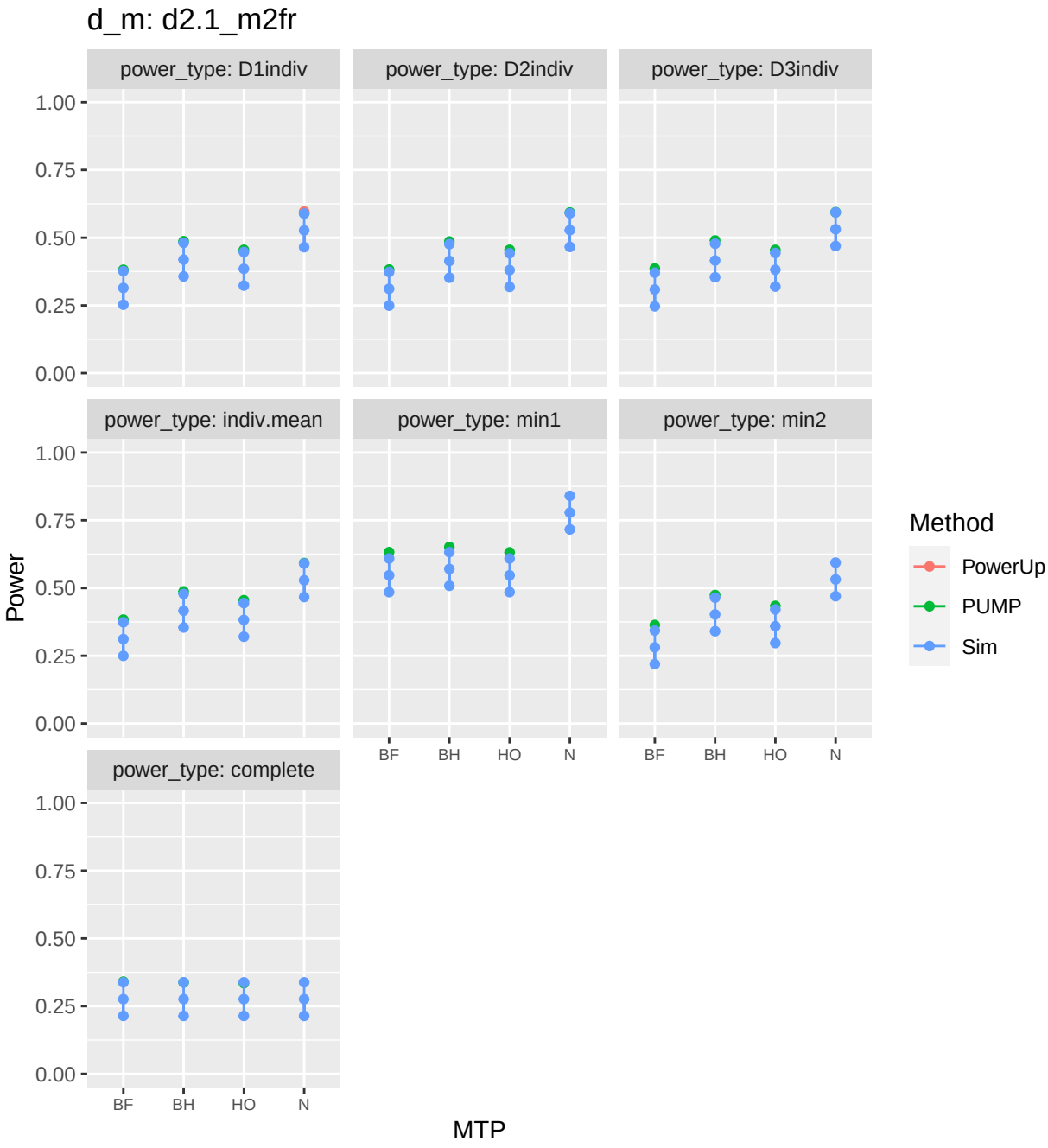

d_m: d2.1_m2fr
power_type: D1indiv
power_type: D2indiv
power_type: D3indiv
power_type: indiv.mean
power_type: min1
power_type: min2
power_type: complete
1.00
0.75
0.50
0.25
0.00
Power
BF
BH
HO
N
MTP
Method
PowerUp
PUMP
Sim

Varying Omega

$\omega_2 = 0.8, 0.8, 0.8$



$\omega_2 = 0, 0, 0$


d_m: d2.1_m2fr
power_type: D1indiv
power_type: D2indiv
power_type: D3indiv
power_type: indiv.mean
power_type: min1
power_type: min2
power_type: complete
1.00
0.75
0.50
0.25
0.00
Power
BF
BH
HO
N
MTP
Method
PowerUp
PUMP
Sim

MDES validation

Target value: 0.125

```
##
##
## +-----+---------------+---------------+-------------+-----------+------+---+-------+
## | MTP | Adjusted MDES | D1indiv Power | Target MDES |    d_m    |  S   | M | MDES  |
## +=====+===============+===============+=============+===========+======+===+=======+
## | BF  |     0.125     |     0.475     |    0.125    | d2.1_m2fc | 5000 | 3 | 0.125 |
## +-----+---------------+---------------+-------------+-----------+------+---+-------+
## | BH  |      NA       |      NA       |    0.125    | d2.1_m2fc | 5000 | 3 | 0.125 |
## +-----+---------------+---------------+-------------+-----------+------+---+-------+
## | HO  |     0.126     |     0.552     |    0.125    | d2.1_m2fc | 5000 | 3 | 0.125 |
## +-----+---------------+---------------+-------------+-----------+------+---+-------+
##
## Table: d2.1_m2fc (continued below)
##
##
##
## +---------+----+---+------+-----+---------+---------+------+------+------+-------+-------+
## | numZero | J  | K | nbar | rho | omega.2 | omega.3 | R2.1 | R2.2 | R2.3 | ICC.2 | ICC.3 |
## +=========+====+===+======+=====+=========+=========+======+======+======+=======+=======+
## |    0    | 20 | 1 |  50  | 0.5 |   NA    |   NA    | 0.1  |  NA  |  NA  |  0.2  |  NA   |
## +---------+----+---+------+-----+---------+---------+------+------+------+-------+-------+
## |    0    | 20 | 1 |  50  | 0.5 |   NA    |   NA    | 0.1  |  NA  |  NA  |  0.2  |  NA   |
## +---------+----+---+------+-----+---------+---------+------+------+------+-------+-------+
## |    0    | 20 | 1 |  50  | 0.5 |   NA    |   NA    | 0.1  |  NA  |  NA  |  0.2  |  NA   |
## +---------+----+---+------+-----+---------+---------+------+------+------+-------+-------+
```

```
##
##
## +-----+---------------+---------------+-------------+-----------+------+---+-------+
## | MTP | Adjusted MDES | D1indiv Power | Target MDES |    d_m    |  S   | M | MDES  |
## +=====+===============+===============+=============+===========+======+===+=======+
## | BF  |     0.125     |     0.473     |    0.125    | d2.1_m2ff | 5000 | 3 | 0.125 |
## +-----+---------------+---------------+-------------+-----------+------+---+-------+
## | BH  |     0.125     |     0.567     |    0.125    | d2.1_m2ff | 5000 | 3 | 0.125 |
## +-----+---------------+---------------+-------------+-----------+------+---+-------+
## | HO  |     0.126     |     0.555     |    0.125    | d2.1_m2ff | 5000 | 3 | 0.125 |
## +-----+---------------+---------------+-------------+-----------+------+---+-------+
##
## Table: d2.1_m2ff (continued below)
##
##
##
## +---------+----+---+------+-----+---------+---------+------+------+------+-------+-------+
## | numZero | J  | K | nbar | rho | omega.2 | omega.3 | R2.1 | R2.2 | R2.3 | ICC.2 | ICC.3 |
## +=========+====+===+======+=====+=========+=========+======+======+======+=======+=======+
## |    0    | 20 | 1 |  50  | 0.5 |   NA    |   NA    | 0.1  |  NA  |  NA  |  0.2  |  NA   |
## +---------+----+---+------+-----+---------+---------+------+------+------+-------+-------+
## |    0    | 20 | 1 |  50  | 0.5 |   NA    |   NA    | 0.1  |  NA  |  NA  |  0.2  |  NA   |
## +---------+----+---+------+-----+---------+---------+------+------+------+-------+-------+
## |    0    | 20 | 1 |  50  | 0.5 |   NA    |   NA    | 0.1  |  NA  |  NA  |  0.2  |  NA   |
## +---------+----+---+------+-----+---------+---------+------+------+------+-------+-------+
```

```
##
##
## +-----+---------------+---------------+-------------+-----------+------+---+-------+
## | MTP | Adjusted MDES | D1indiv Power | Target MDES |    d_m    |  S   | M | MDES  |
## +=====+===============+===============+=============+===========+======+===+=======+
## | BF  |     0.125     |     0.266     |    0.125    | d2.1_m2fr | 5000 | 3 | 0.125 |
## +-----+---------------+---------------+-------------+-----------+------+---+-------+
## | BH  |     0.125     |     0.351     |    0.125    | d2.1_m2fr | 5000 | 3 | 0.125 |
## +-----+---------------+---------------+-------------+-----------+------+---+-------+
## | HO  |     0.124     |     0.318     |    0.125    | d2.1_m2fr | 5000 | 3 | 0.125 |
## +-----+---------------+---------------+-------------+-----------+------+---+-------+
##
## Table: d2.1_m2fr (continued below)
##
##
##
## +---------+----+---+------+-----+---------+---------+------+------+------+-------+-------+
## | numZero | J  | K | nbar | rho | omega.2 | omega.3 | R2.1 | R2.2 | R2.3 | ICC.2 | ICC.3 |
## +=========+====+===+======+=====+=========+=========+======+======+======+=======+=======+
## |    0    | 20 | 1 |  50  | 0.5 |   0.1   |   NA    | 0.1  |  NA  |  NA  |  0.2  |  NA   |
## +---------+----+---+------+-----+---------+---------+------+------+------+-------+-------+
## |    0    | 20 | 1 |  50  | 0.5 |   0.1   |   NA    | 0.1  |  NA  |  NA  |  0.2  |  NA   |
## +---------+----+---+------+-----+---------+---------+------+------+------+-------+-------+
## |    0    | 20 | 1 |  50  | 0.5 |   0.1   |   NA    | 0.1  |  NA  |  NA  |  0.2  |  NA   |
## +---------+----+---+------+-----+---------+---------+------+------+------+-------+-------+
```

Sample size validation

Target value: 20

```
##
##
## +-----+-------------+-------------+---------------+-----------+------+---+-------+---------+
## | MTP | Sample.type | Sample.size | D1indiv.power |    d_m    |  S   | M | MDES  | numZero |
## +=====+=============+=============+===============+===========+======+===+=======+=========+
## | BF  |      J      |     20      |     0.475     | d2.1_m2fc | 5000 | 3 | 0.125 |    0    |
## +-----+-------------+-------------+---------------+-----------+------+---+-------+---------+
## | BH  |      J      |     20      |     0.557     | d2.1_m2fc | 5000 | 3 | 0.125 |    0    |
## +-----+-------------+-------------+---------------+-----------+------+---+-------+---------+
## | HO  |      J      |     20      |     0.537     | d2.1_m2fc | 5000 | 3 | 0.125 |    0    |
## +-----+-------------+-------------+---------------+-----------+------+---+-------+---------+
##
## Table: d2.1_m2fc (continued below)
##
##
##
## +----+---+------+-----+---------+---------+------+------+------+-------+-------+
## | J  | K | nbar | rho | omega.2 | omega.3 | R2.1 | R2.2 | R2.3 | ICC.2 | ICC.3 |
## +====+===+======+=====+=========+=========+======+======+======+=======+=======+
## | NA | 1 |  50  | 0.5 |   NA    |   NA    | 0.1  |  NA  |  NA  |  0.2  |  NA   |
## +----+---+------+-----+---------+---------+------+------+------+-------+-------+
## | NA | 1 |  50  | 0.5 |   NA    |   NA    | 0.1  |  NA  |  NA  |  0.2  |  NA   |
## +----+---+------+-----+---------+---------+------+------+------+-------+-------+
## | NA | 1 |  50  | 0.5 |   NA    |   NA    | 0.1  |  NA  |  NA  |  0.2  |  NA   |
## +----+---+------+-----+---------+---------+------+------+------+-------+-------+
##
##
## +-----+-------------+-------------+---------------+-----------+------+---+-------+---------+
## | MTP | Sample.type | Sample.size | D1indiv.power |    d_m    |  S   | M | MDES  | numZero |
## +=====+=============+=============+===============+===========+======+===+=======+=========+
## | BF  |    nbar     |    51.07    |     0.475     | d2.1_m2fc | 5000 | 3 | 0.125 |    0    |
## +-----+-------------+-------------+---------------+-----------+------+---+-------+---------+
## | BH  |    nbar     |     50      |     0.563     | d2.1_m2fc | 5000 | 3 | 0.125 |    0    |
## +-----+-------------+-------------+---------------+-----------+------+---+-------+---------+
## | HO  |    nbar     |     50      |     0.536     | d2.1_m2fc | 5000 | 3 | 0.125 |    0    |
## +-----+-------------+-------------+---------------+-----------+------+---+-------+---------+
##
## Table: d2.1_m2fc (continued below)
##
##
##
## +----+---+-----+---------+---------+------+------+------+-------+-------+
## | J  | K | rho | omega.2 | omega.3 | R2.1 | R2.2 | R2.3 | ICC.2 | ICC.3 |
## +====+===+=====+=========+=========+======+======+======+=======+=======+
## | 20 | 1 | 0.5 |   NA    |   NA    | 0.1  |  NA  |  NA  |  0.2  |  NA   |
## +----+---+-----+---------+---------+------+------+------+-------+-------+
## | 20 | 1 | 0.5 |   NA    |   NA    | 0.1  |  NA  |  NA  |  0.2  |  NA   |
## +----+---+-----+---------+---------+------+------+------+-------+-------+
## | 20 | 1 | 0.5 |   NA    |   NA    | 0.1  |  NA  |  NA  |  0.2  |  NA   |
## +----+---+-----+---------+---------+------+------+------+-------+-------+
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## +-----+-------------+-------------+---------------+-----------+------+---+-------+---------+
## | MTP | Sample.type | Sample.size | D1indiv.power |    d_m    |  S   | M | MDES  | numZero |
## +=====+=============+=============+===============+===========+======+===+=======+=========+
## | BF  |      J      |     20      |     0.473     | d2.1_m2ff | 5000 | 3 | 0.125 |    0    |
## +-----+-------------+-------------+---------------+-----------+------+---+-------+---------+
## | BH  |      J      |     21      |     0.565     | d2.1_m2ff | 5000 | 3 | 0.125 |    0    |
## +-----+-------------+-------------+---------------+-----------+------+---+-------+---------+
## | HO  |      J      |     21      |     0.552     | d2.1_m2ff | 5000 | 3 | 0.125 |    0    |
## +-----+-------------+-------------+---------------+-----------+------+---+-------+---------+
##
## Table: d2.1_m2ff (continued below)
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## +----+---+------+-----+---------+---------+------+------+------+-------+-------+
## | J  | K | nbar | rho | omega.2 | omega.3 | R2.1 | R2.2 | R2.3 | ICC.2 | ICC.3 |
## +====+===+======+=====+=========+=========+======+======+======+=======+=======+
## | NA | 1 |  50  | 0.5 |   NA    |   NA    | 0.1  |  NA  |  NA  |  0.2  |  NA   |
## +----+---+------+-----+---------+---------+------+------+------+-------+-------+
## | NA | 1 |  50  | 0.5 |   NA    |   NA    | 0.1  |  NA  |  NA  |  0.2  |  NA   |
## +----+---+------+-----+---------+---------+------+------+------+-------+-------+
## | NA | 1 |  50  | 0.5 |   NA    |   NA    | 0.1  |  NA  |  NA  |  0.2  |  NA   |
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Target value: 50

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## +-----+-------------+-------------+---------------+-----------+------+---+-------+---------+
## | MTP | Sample.type | Sample.size | D1indiv.power |    d_m    |  S   | M | MDES  | numZero |
## +=====+=============+=============+===============+===========+======+===+=======+=========+
## | BF  |      J      |     20      |     0.266     | d2.1_m2fr | 5000 | 3 | 0.125 |    0    |
## +-----+-------------+-------------+---------------+-----------+------+---+-------+---------+
## | BH  |      J      |     20      |     0.352     | d2.1_m2fr | 5000 | 3 | 0.125 |    0    |
## +-----+-------------+-------------+---------------+-----------+------+---+-------+---------+
## | HO  |      J      |     20      |     0.316     | d2.1_m2fr | 5000 | 3 | 0.125 |    0    |
## +-----+-------------+-------------+---------------+-----------+------+---+-------+---------+
##
## Table: d2.1_m2fr (continued below)
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##
## +----+---+------+-----+---------+---------+------+------+------+-------+-------+
## | J  | K | nbar | rho | omega.2 | omega.3 | R2.1 | R2.2 | R2.3 | ICC.2 | ICC.3 |
## +====+===+======+=====+=========+=========+======+======+======+=======+=======+
## | NA | 1 |  50  | 0.5 |   0.1   |   NA    | 0.1  |  NA  |  NA  |  0.2  |  NA   |
## +----+---+------+-----+---------+---------+------+------+------+-------+-------+
## | NA | 1 |  50  | 0.5 |   0.1   |   NA    | 0.1  |  NA  |  NA  |  0.2  |  NA   |
## +----+---+------+-----+---------+---------+------+------+------+-------+-------+
## | NA | 1 |  50  | 0.5 |   0.1   |   NA    | 0.1  |  NA  |  NA  |  0.2  |  NA   |
## +----+---+------+-----+---------+---------+------+------+------+-------+-------+

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## +-----+-------------+-------------+---------------+-----------+------+---+-------+---------+
## | MTP | Sample.type | Sample.size | D1indiv.power |    d_m    |  S   | M | MDES  | numZero |
## +=====+=============+=============+===============+===========+======+===+=======+=========+
## | BF  |      J      |     20      |     0.266     | d2.1_m2fr | 5000 | 3 | 0.125 |    0    |
## +-----+-------------+-------------+---------------+-----------+------+---+-------+---------+
## | BH  |      J      |     20      |     0.352     | d2.1_m2fr | 5000 | 3 | 0.125 |    0    |
## +-----+-------------+-------------+---------------+-----------+------+---+-------+---------+
## | HO  |      J      |     20      |     0.316     | d2.1_m2fr | 5000 | 3 | 0.125 |    0    |
## +-----+-------------+-------------+---------------+-----------+------+---+-------+---------+
##
## Table: d2.1_m2fr (continued below)
##
##
##
## +----+---+------+-----+---------+---------+------+------+------+-------+-------+
## | J  | K | nbar | rho | omega.2 | omega.3 | R2.1 | R2.2 | R2.3 | ICC.2 | ICC.3 |
## +====+===+======+=====+=========+=========+======+======+======+=======+=======+
## | NA | 1 |  50  | 0.5 |   0.1   |   NA    | 0.1  |  NA  |  NA  |  0.2  |  NA   |
## +----+---+------+-----+---------+---------+------+------+------+-------+-------+
## | NA | 1 |  50  | 0.5 |   0.1   |   NA    | 0.1  |  NA  |  NA  |  0.2  |  NA   |
## +----+---+------+-----+---------+---------+------+------+------+-------+-------+
## | NA | 1 |  50  | 0.5 |   0.1   |   NA    | 0.1  |  NA  |  NA  |  0.2  |  NA   |
## +----+---+------+-----+---------+---------+------+------+------+-------+-------+
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