Pain score at postoperative early (up to 6 hours) period

Boohwi Hong

Package install

Data Preparation

Model Fitting

Results of Model

```
##    Length    Class       Mode
##        24 character character
```

```
## Number of studies: k = 18
## Number of treatments: n = 5
## Number of pairwise comparisons: m = 24
## Number of designs: d = 9
##
## Random effects model
##
## Treatment estimate (sm = 'MD', comparison: other treatments vs 'Control'):
##           MD              95%-CI     z  p-value
## Control      .                .      .        .
## ESPB    -1.5861 [-2.2924; -0.8798] -4.40 < 0.0001
## INB     -1.3642 [-2.2273; -0.5011] -3.10   0.0019
## SPB     -1.0528 [-1.9352; -0.1705] -2.34   0.0194
## TPVB    -1.4692 [-2.1747; -0.7637] -4.08 < 0.0001
##
## Quantifying heterogeneity / inconsistency:
## tau^2 = 0.7635; tau = 0.8738; I^2 = 92.1% [89.1%; 94.4%]
##
## Tests of heterogeneity (within designs) and inconsistency (between designs):
##                      Q d.f.  p-value
## Total           216.46   17 < 0.0001
## Within designs  128.78   10 < 0.0001
## Between designs  87.68    7 < 0.0001
```

```
## Original data (with adjusted standard errors for multi-arm studies):
##
##                    treat1 treat2     TE   seTE seTE.adj narms multiarm
## Liu,2021          Control   ESPB 0.7000 0.1107   0.1107     2
## Hu,2021           Control   TPVB 1.0000 0.1390   0.1390     2
```

```
## Yao,2020               Control   ESPB   1.4000 0.1848   0.1848   2
## Turhan,2020              ESPB    TPVB   0.3000 0.7410   1.0366   3        *
## Turhan,2020               INB    TPVB   0.6000 0.6466   0.7493   3        *
## Turhan,2020              ESPB     INB  -0.3000 0.6466   0.7493   3        *
## Lee, 2020                 INB     SPB  -0.7000 0.4718   0.4718   2
## Kim, 2020                 INB     SPB  -0.1000 0.4952   0.4952   2
## Finnerty,2020            ESPB     SPB  -0.4000 0.8524   0.8524   2
## Ciftci,2020              ESPB    TPVB  -0.5000 0.3873   0.5646   3        *
## Ciftci,2020             Control   TPVB  3.0000 0.3291   0.3764   3        *
## Ciftci,2020             Control   ESPB  3.5000 0.3291   0.3764   3        *
## Ciftci, 2019            Control   ESPB  3.6000 0.2456   0.2456   2
## Haichen Chu,2020,BMC Control   TPVB   0.2000 0.2858   0.2858   2
## Gaballah,2019            ESPB     SPB  -0.1000 0.0913   0.0913   2
## Wu, 2018                  INB    TPVB   0.2000 0.1478   0.1478   2
## Okmen,2018              Control   SPB   1.1000 0.3192   0.3192   2
## Kim, 2018               Control   SPB   0.6000 0.3254   0.3254   2
## Ahmed,2017              Control   INB   1.1000 0.1291   0.1291   2
## Kaya,2006               Control   TPVB  0.8000 0.4173   0.4173   2
## Vogt,2005               Control   TPVB  1.3000 0.7616   0.7616   2
## Chen,2020                 INB    TPVB   0.4000 0.3291   0.3674   3        *
## Chen,2020                ESPB     INB   1.0000 0.4041   0.6430   3        *
## Chen,2020                ESPB    TPVB   1.4000 0.3291   0.3674   3        *
##
## Number of treatment arms (by study):
##                    narms
## Liu,2021                2
## Hu,2021                 2
## Yao,2020                2
## Turhan,2020             3
## Lee, 2020               2
## Kim, 2020               2
## Finnerty,2020           2
## Ciftci,2020             3
## Ciftci, 2019            2
## Haichen Chu,2020,BMC    2
## Gaballah,2019           2
## Wu, 2018                2
## Okmen,2018              2
## Kim, 2018               2
## Ahmed,2017              2
## Kaya,2006               2
## Vogt,2005               2
## Chen,2020               3
##
## Results (random effects model):
##
##                       treat1 treat2    MD          95%-CI
## Liu,2021              Control   ESPB  1.5861 [ 0.8798; 2.2924]
## Hu,2021               Control   TPVB  1.4692 [ 0.7637; 2.1747]
## Yao,2020              Control   ESPB  1.5861 [ 0.8798; 2.2924]
## Turhan,2020             ESPB   TPVB -0.1169 [-0.9417; 0.7078]
## Turhan,2020              INB   TPVB  0.1050 [-0.7612; 0.9712]
## Turhan,2020             ESPB    INB -0.2219 [-1.1314; 0.6875]
## Lee, 2020                INB    SPB -0.3114 [-1.2690; 0.6462]
```

```
## Kim, 2020              INB    SPB -0.3114 [-1.2690; 0.6462]
## Finnerty,2020          ESPB   SPB -0.5333 [-1.4453; 0.3787]
## Ciftci,2020            ESPB  TPVB -0.1169 [-0.9417; 0.7078]
## Ciftci,2020         Control  TPVB  1.4692 [ 0.7637; 2.1747]
## Ciftci,2020         Control  ESPB  1.5861 [ 0.8798; 2.2924]
## Ciftci, 2019        Control  ESPB  1.5861 [ 0.8798; 2.2924]
## Haichen Chu,2020,BMC Control  TPVB  1.4692 [ 0.7637; 2.1747]
## Gaballah,2019          ESPB   SPB -0.5333 [-1.4453; 0.3787]
## Wu, 2018               INB   TPVB  0.1050 [-0.7612; 0.9712]
## Okmen,2018          Control   SPB  1.0528 [ 0.1705; 1.9352]
## Kim, 2018           Control   SPB  1.0528 [ 0.1705; 1.9352]
## Ahmed,2017          Control   INB  1.3642 [ 0.5011; 2.2273]
## Kaya,2006           Control  TPVB  1.4692 [ 0.7637; 2.1747]
## Vogt,2005           Control  TPVB  1.4692 [ 0.7637; 2.1747]
## Chen,2020              INB   TPVB  0.1050 [-0.7612; 0.9712]
## Chen,2020             ESPB    INB -0.2219 [-1.1314; 0.6875]
## Chen,2020             ESPB   TPVB -0.1169 [-0.9417; 0.7078]
##
## Number of studies: k = 18
## Number of treatments: n = 5
## Number of pairwise comparisons: m = 24
## Number of designs: d = 9
##
## Random effects model
##
## Treatment estimate (sm = 'MD', comparison: other treatments vs 'Control'):
##           MD            95%-CI     z  p-value
## Control    .                .     .        .
## ESPB   -1.5861 [-2.2924; -0.8798] -4.40 < 0.0001
## INB    -1.3642 [-2.2273; -0.5011] -3.10   0.0019
## SPB    -1.0528 [-1.9352; -0.1705] -2.34   0.0194
## TPVB   -1.4692 [-2.1747; -0.7637] -4.08 < 0.0001
##
## Quantifying heterogeneity / inconsistency:
## tau^2 = 0.7635; tau = 0.8738; I^2 = 92.1% [89.1%; 94.4%]
##
## Tests of heterogeneity (within designs) and inconsistency (between designs):
##                    Q d.f.  p-value
## Total         216.46   17 < 0.0001
## Within designs 128.78  10 < 0.0001
## Between designs 87.68   7 < 0.0001


## Q statistics to assess homogeneity / consistency
##
##                    Q df  p-value
## Total         216.46 17 < 0.0001
## Within designs 128.78 10 < 0.0001
## Between designs 87.68  7 < 0.0001
##
## Design-specific decomposition of within-designs Q statistic
##
##            Design     Q df  p-value
##     Control vs ESPB 116.87  2 < 0.0001
##      Control vs SPB   1.20  1   0.2727
```

```
##        Control vs TPVB   6.70  3   0.0821
##           ESPB vs SPB    0.12  1   0.7264
##            INB vs SPB    0.77  1   0.3804
##   ESPB vs INB vs TPVB    3.12  2   0.2105
##
## Between-designs Q statistic after detaching of single designs
##
##           Detached design    Q df   p-value
##           Control vs ESPB 87.51  6 < 0.0001
##            Control vs INB 87.68  6 < 0.0001
##            Control vs SPB 86.69  6 < 0.0001
##           Control vs TPVB 62.14  6 < 0.0001
##               ESPB vs SPB 85.08  6 < 0.0001
##                INB vs SPB 86.27  6 < 0.0001
##               INB vs TPVB 87.32  6 < 0.0001
##   Control vs ESPB vs TPVB 24.81  5   0.0002
##      ESPB vs INB vs TPVB 69.97  5 < 0.0001
##
## Q statistic to assess consistency under the assumption of
## a full design-by-treatment interaction random effects model
##
##                   Q df p-value tau.within tau2.within
## Between designs 7.77  7  0.3531     0.9897      0.9795
```

Network Graph
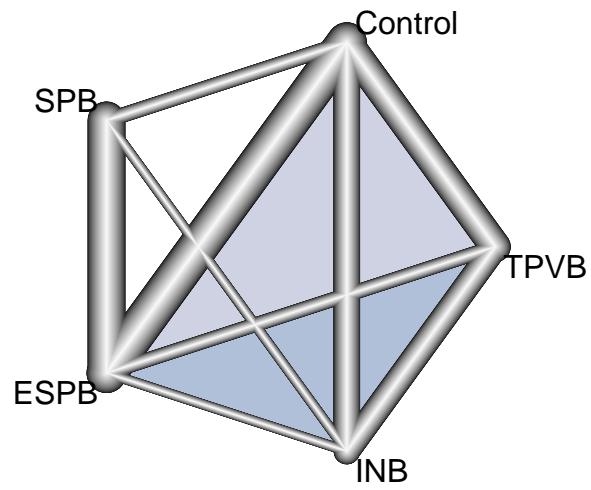
Visualizing Direct and Indirect Evidence

```
## Extensive documentation for the dmetar package can be found at:
##   www.bookdown.org/MathiasHarrer/Doing_Meta_Analysis_in_R/


## Direct Evidence Proportion for each Network Estimate
## -------------------------------------------------
##                 Direct Indirect meanpath   minpar
## ESPB vs SPB      0.8400   0.1600 1.202586 1.190541
## Control vs ESPB 0.8057   0.1943 1.238686 1.330961
## Control vs TPVB 0.6742   0.3258 1.370289 1.674923
## INB vs TPVB      0.6040   0.3960 1.452625 2.075780
## Control vs INB  0.5714   0.4286 1.478300 1.750038
## ESPB vs TPVB     0.2244   0.7756 2.089752 1.537805
## Control vs SPB  0.2063   0.7937 1.866376 1.403406
## INB vs SPB       0.1521   0.8479 2.613691 1.502369
## ESPB vs INB      0.1166   0.8834 2.164955 1.558320
## SPB vs TPVB      0.0000   1.0000 2.662481 1.418772
```

Direct evidence proportion for each network estimate (fixed−effect model)
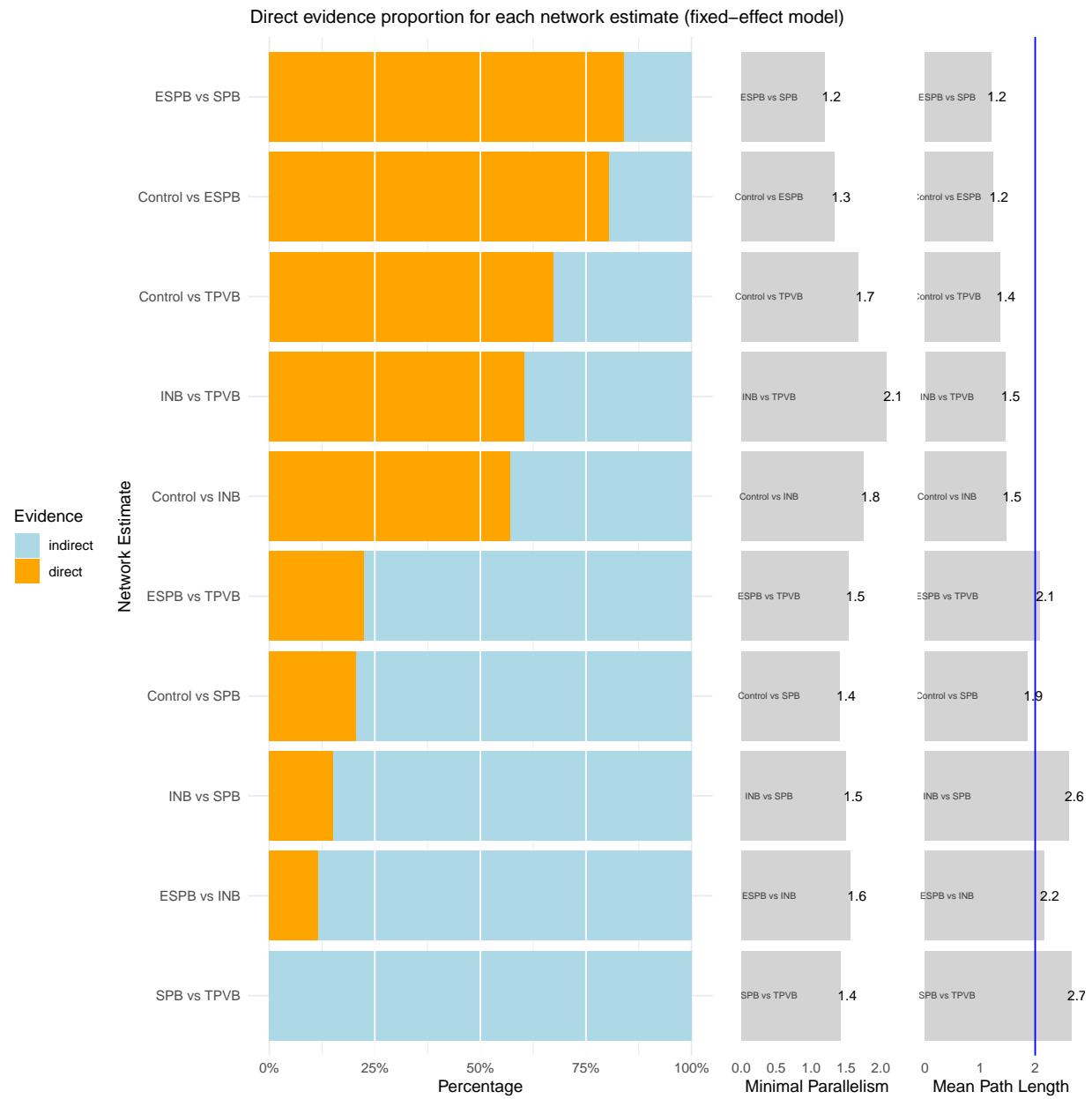
Effect Estimate Table

```
##         Control  ESPB    INB     SPB    TPVB
## Control      NA 1.586  1.364  1.053  1.469
## ESPB         NA    NA -0.222 -0.533 -0.117
## INB          NA    NA     NA -0.311  0.105
## SPB          NA    NA     NA     NA  0.416
## TPVB         NA    NA     NA     NA     NA
```

```
## League table (random effects model):
##
##             Control  2.25 ( 1.37;  3.14)  1.10 (-0.63;  2.83)
##   1.59 ( 0.88;  2.29)                      ESPB  0.43 (-0.98;  1.84)
##   1.36 ( 0.50;  2.23) -0.22 (-1.13;  0.69)                      INB
##   1.05 ( 0.17;  1.94) -0.53 (-1.45;  0.38) -0.31 (-1.27;  0.65)
##   1.47 ( 0.76;  2.17) -0.12 (-0.94;  0.71)  0.11 (-0.76;  0.97)
##
##   0.85 (-0.44;  2.14) 1.25 ( 0.41;  2.09)
##  -0.20 (-1.60;  1.20) 0.43 (-0.70;  1.56)
##  -0.40 (-1.79;  0.98) 0.37 (-0.71;  1.46)
##               SPB                       .
##   0.42 (-0.59;  1.43)               TPVB
```

Ranking and Forest plot

```
##         P-score
## ESPB     0.7918
## TPVB     0.6937
## INB      0.6148
## SPB      0.3969
## Control  0.0027
```

Treatment	Block vs. Control (Early period, NRS pain)	MD	95%–CI
ESPB		−1.59	[−2.29; −0.88]
TPVB		−1.47	[−2.17; −0.76]
INB		−1.36	[−2.23; −0.50]
SPB		−1.05	[−1.94; −0.17]
Control		0.00	

−3   −2   −1   0   1
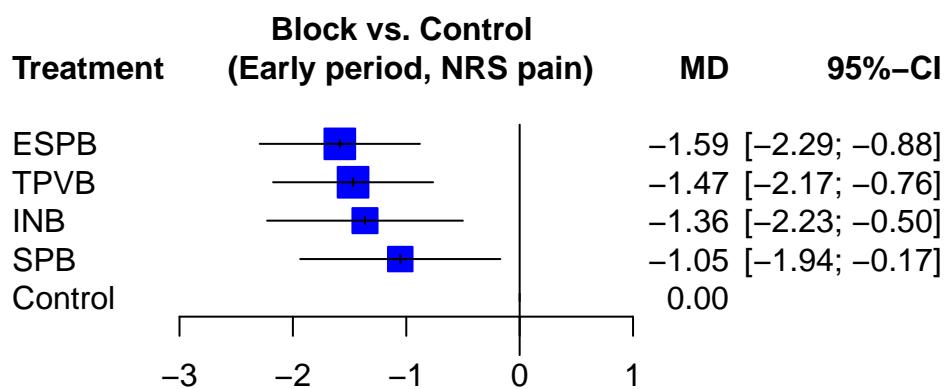
Net Heat Plot for evaluating the validity of the results

The gray boxes signify how important a treatment comparison is for the estimation of another treatment comparison. The bigger the box, the more important the comparison.

The colored backgrounds signify the amount of inconsistency of the design in a row that can be attributed to the design in a column. Field colors can range from a deep red (which indicates strong inconsistency) to blue (which indicates that evidence from this design supports evidence in the row).

Fixed effect model
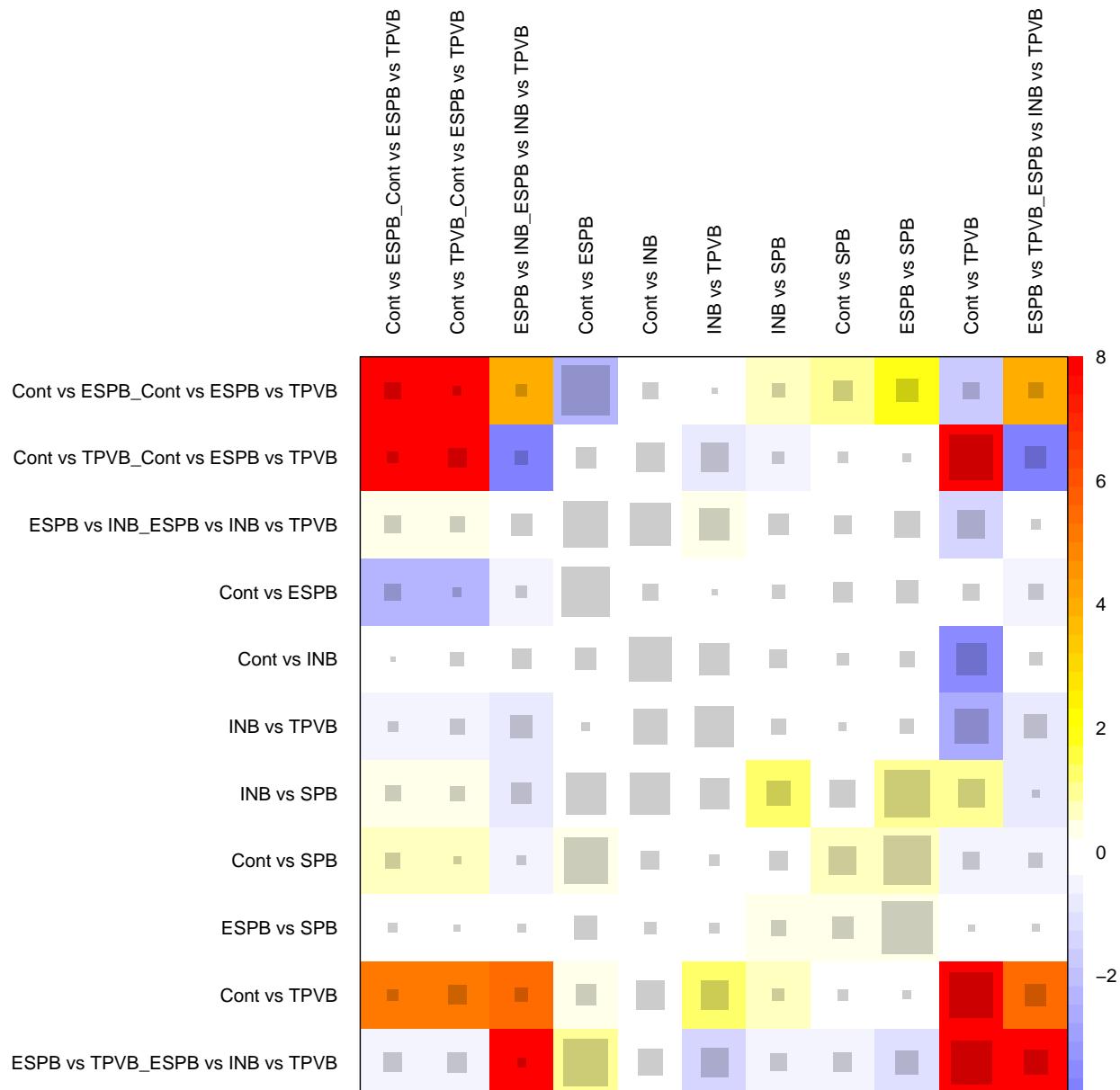
Random effect model
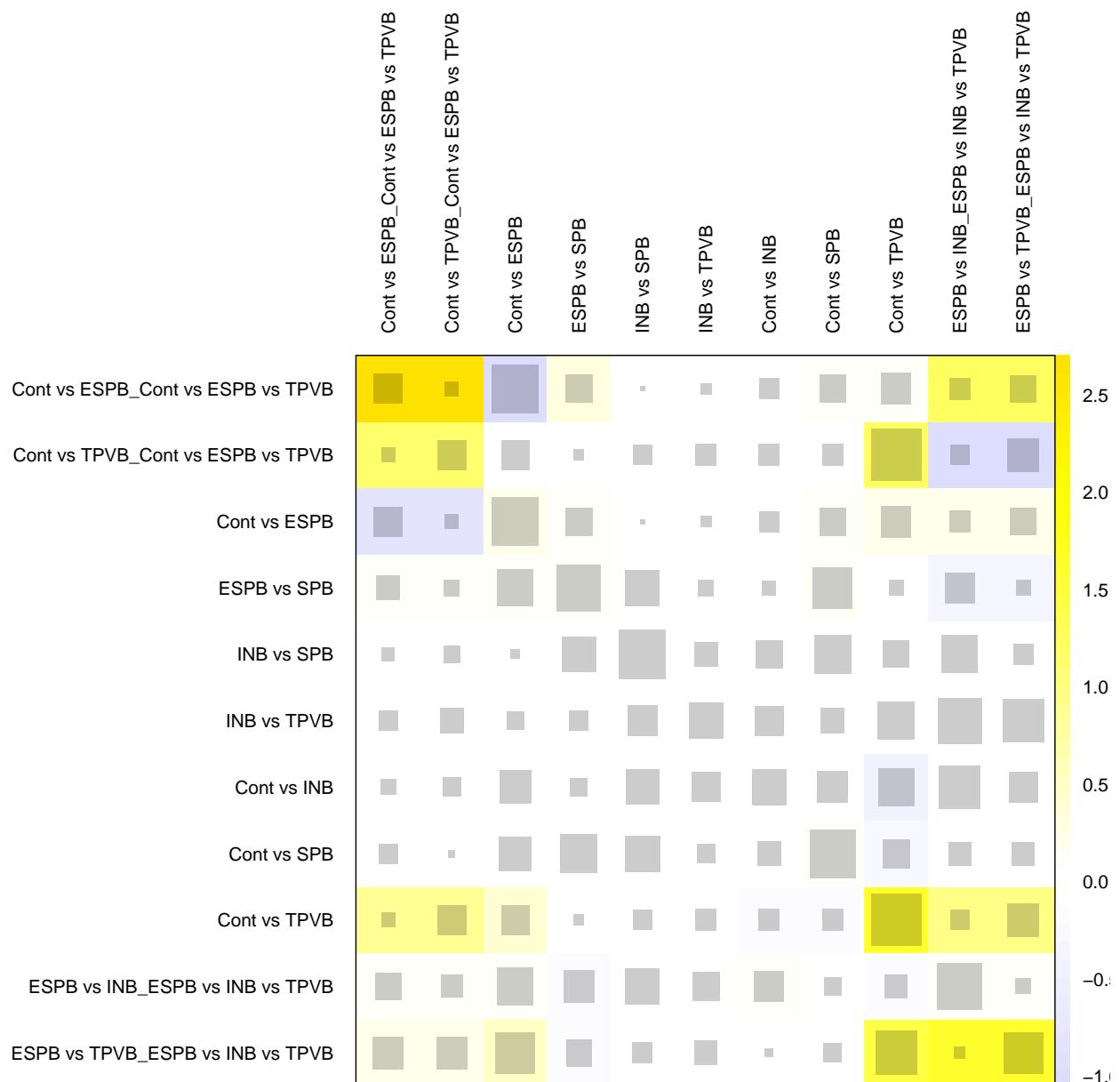
Net Splitting to check for consistency

```
## Separate indirect from direct evidence (SIDE) using back-calculation method
##
## Random effects model:
##
##         comparison k prop     nma  direct  indir.    Diff     z p-value
##  ESPB vs Control 4 0.64 -1.5861 -2.2518 -0.4188 -1.8330 -2.45  0.0144
##    INB vs Control 1 0.25 -1.3642 -1.1000 -1.4516  0.3516  0.35  0.7301
##    SPB vs Control 2 0.47 -1.0528 -0.8506 -1.2302  0.3797  0.42  0.6739
##  TPVB vs Control 5 0.70 -1.4692 -1.2505 -1.9846  0.7341  0.93  0.3510
##      ESPB vs INB 2 0.41 -0.2219  0.4285 -0.6826  1.1111  1.18  0.2381
##      ESPB vs SPB 2 0.43 -0.5333 -0.2024 -0.7788  0.5764  0.61  0.5402
##     ESPB vs TPVB 3 0.53 -0.1169  0.4285 -0.7366  1.1651  1.38  0.1671
##       INB vs SPB 2 0.48 -0.3114 -0.4034 -0.2268 -0.1766 -0.18  0.8567
##      INB vs TPVB 3 0.64  0.1050  0.3739 -0.3690  0.7428  0.81  0.4193
##      SPB vs TPVB 0    0  0.4164       .  0.4164       .     .       .
##
## Legend:
##  comparison - Treatment comparison
##  k          - Number of studies providing direct evidence
##  prop       - Direct evidence proportion
##  nma        - Estimated treatment effect (MD) in network meta-analysis
##  direct     - Estimated treatment effect (MD) derived from direct evidence
##  indir.     - Estimated treatment effect (MD) derived from indirect evidence
##  Diff       - Difference between direct and indirect treatment estimates
##  z          - z-value of test for disagreement (direct versus indirect)
##  p-value    - p-value of test for disagreement (direct versus indirect)
```

Comparison	Number of Studies	Direct Evidence	Random effects model	MD	95%-CI
ESPB vs Control					
Direct estimate	4	0.64		−2.25	[−3.14; −1.37]
Indirect estimate				−0.42	[−1.59; 0.75]
Network estimate				−1.59	[−2.29; −0.88]
INB vs Control					
Direct estimate	1	0.25		−1.10	[−2.83; 0.63]
Indirect estimate				−1.45	[−2.45; −0.46]
Network estimate				−1.36	[−2.23; −0.50]
SPB vs Control					
Direct estimate	2	0.47		−0.85	[−2.14; 0.44]
Indirect estimate				−1.23	[−2.44; −0.02]
Network estimate				−1.05	[−1.94; −0.17]
TPVB vs Control					
Direct estimate	5	0.70		−1.25	[−2.09; −0.41]
Indirect estimate				−1.98	[−3.28; −0.69]
Network estimate				−1.47	[−2.17; −0.76]
ESPB vs INB					
Direct estimate	2	0.41		0.43	[−0.98; 1.84]
Indirect estimate				−0.68	[−1.87; 0.51]
Network estimate				−0.22	[−1.13; 0.69]
ESPB vs SPB					
Direct estimate	2	0.43		−0.20	[−1.60; 1.20]
Indirect estimate				−0.78	[−1.98; 0.42]
Network estimate				−0.53	[−1.45; 0.38]
ESPB vs TPVB					
Direct estimate	3	0.53		0.43	[−0.70; 1.56]
Indirect estimate				−0.74	[−1.94; 0.47]
Network estimate				−0.12	[−0.94; 0.71]
INB vs SPB					
Direct estimate	2	0.48		−0.40	[−1.79; 0.98]
Indirect estimate				−0.23	[−1.55; 1.10]
Network estimate				−0.31	[−1.27; 0.65]
INB vs TPVB					
Direct estimate	3	0.64		0.37	[−0.71; 1.46]
Indirect estimate				−0.37	[−1.81; 1.07]
Network estimate				0.11	[−0.76; 0.97]

−3 −2 −1 0 1 2 3

Comparison-Adjusted Funnel Plots

p = 0.1416 (Egger)

Legend:
- Control vs SPB
- Control vs ESPB
- Control vs INB
- Control vs TPVB
- SPB vs ESPB
- SPB vs INB
- ESPB vs INB
- ESPB vs TPVB
- INB vs TPVB

Standard Error (y-axis): 0.0, 0.2, 0.4, 0.6, 0.8, 1.0

Mean Difference centered at comparison–specific effect (x-axis): -3, -2, -1, 0, 1, 2, 3

Data points labeled: Liu,2021; Gaballah,2019; Ahmed,2017; Hu,2021; Wu, 2018; Yao,2020; Ciftci, 2019; Haichen Chu,2020,BMC; Kim, 2018; Okmen,2018; Chen,2020; Chen,2020; Ciftci,2020; Ciftci,2020; Ciftci,2020; Kaya,2006; Chen,2020; Lee, 2020; Kim, 2020; Turhan,2020; Turhan,2020; Turhan,2020; Vogt,2005; Finnerty,2020