

Supplementary Tables

Table S1. Summary of Results from Simulations under Different Scenarios[†]

(a) Scenario 1, MNAR Missing 25% in Drug and 15% in Placebo Under Null

Method	Mean	SD	Mean SE	1-tailed Type I Error	95% CI Coverage	MSE
Data Generated from Normal						
Likelihood-Normal	-0.007	0.426	0.444	2.0	95.9	0.182
Likelihood-Mixture	-0.024	0.401	0.372	3.5	92.8	0.162
Model Averaging	-0.012	0.413	0.415	2.5	94.9	0.170
Median Regression	-0.035	0.522	0.586	1.5	96.3	0.273
MMRM	0.340	0.440	0.362	19.9	79.1	0.309
Best-60%	-0.025	0.468	0.473	1.9	95.7	0.219
Best-50%	-0.019	0.491	0.488	2.2	94.8	0.242
Wilcoxon Rank	NA	NA	NA	<0.1	NA	NA
Data Generated from Mixture Normal						
Likelihood-Normal	0.011	0.622	0.640	2.5	95.5	0.387
Likelihood-Mixture	-0.028	0.419	0.399	2.1	95.1	0.176
Model Averaging	-0.018	0.459	0.461	2.0	95.6	0.211
Median Regression	-0.066	0.837	0.948	1.3	96.4	0.706
MMRM	0.324	0.608	0.505	13.1	85.4	0.475
Best-60%	-0.048	0.626	0.653	1.8	96.4	0.395
Best-50%	-0.040	0.630	0.648	1.9	95.8	0.398
Wilcoxon Rank	NA	NA	NA	0.1	NA	NA

(b) Scenario 2, MNAR Missing 15% in Drug and 25% in Placebo Under Null

Method	Mean	SD	Mean SE	1-tailed Type I Error	95% CI Coverage	MSE
Data Generated from Normal						
Likelihood-Normal	-0.004	0.427	0.444	2.0	95.7	0.183
Likelihood-Mixture	0.025	0.404	0.393	3.4	93.6	0.164
Model Averaging	0.009	0.414	0.419	2.5	95.1	0.171
Median Regression	0.029	0.525	0.582	2.0	96.0	0.276
MMRM	-0.386	0.439	0.363	0.4	77.0	0.341
Best-60%	0.021	0.469	0.489	2.2	96.0	0.220
Best-50%	0.019	0.493	0.504	2.2	95.7	0.244
Wilcoxon Rank	NA	NA	NA	2.8	NA	NA
Data Generated from Mixture Normal						
Likelihood-Normal	-0.036	0.624	0.640	1.8	95.6	0.391
Likelihood-Mixture	0.003	0.424	0.400	3.0	94.8	0.180
Model Averaging	-0.006	0.465	0.461	2.6	95.4	0.216
Median Regression	0.041	0.839	0.943	1.9	96.2	0.705
MMRM	-0.386	0.607	0.508	1.2	83.2	0.517
Best-60%	0.018	0.628	0.673	2.3	96.3	0.395
Best-50%	0.011	0.633	0.667	2.2	96.0	0.400
Wilcoxon Rank	NA	NA	NA	3.1	NA	NA

(c) Scenario 3, MNAR Missing 25% in Drug and 15% in Placebo Under Alternative

Method	Mean	SD	Mean SE	Power	95% CI Coverage	MSE
Data Generated from Normal						
Likelihood-Normal	0.993	0.426	0.444	60.8	95.9	0.182
Likelihood-Mixture	0.855	0.429	0.415	53.8	88.8	0.205
Model Averaging	0.938	0.427	0.435	57.5	93.7	0.186
Median Regression	0.954	0.530	0.586	36.0	96.4	0.282
MMRM	1.340	0.440	0.362	92.0	79.1	0.309
Best-60%	0.974	0.468	0.476	52.5	95.8	0.219
Best-50%	0.981	0.491	0.489	51.4	94.9	0.242
Wilcoxon Rank	NA	NA	NA	14.6	NA	NA
Data Generated from Mixture Normal						
Likelihood-Normal	1.037	0.688	0.691	32.0	94.9	0.475
Likelihood-Mixture	0.954	0.410	0.407	67.1	94.4	0.170
Model Averaging	0.974	0.431	0.429	64.9	95.0	0.186
Median Regression	1.061	0.985	1.118	14.2	96.5	0.974
MMRM	1.454	0.657	0.539	72.3	81.1	0.637
Best-60%	1.406	0.672	0.701	50.2	93.0	0.616
Best-50%	1.514	0.658	0.679	58.8	89.8	0.698
Wilcoxon Rank	NA	NA	NA	8.6	NA	NA

(d) Scenario 4, MNAR Missing 15% in Drug and 25% in Placebo Under Alternative

Method	Mean	SD	Mean SE	Power	95% CI Coverage	MSE
Data Generated from Normal						
Likelihood-Normal	0.996	0.427	0.444	61.6	95.7	0.183
Likelihood-Mixture	0.912	0.431	0.451	58.7	90.1	0.193
Model Averaging	0.961	0.428	0.457	60.4	94.0	0.185
Median Regression	1.020	0.531	0.582	41.0	96.1	0.282
MMRM	0.614	0.439	0.363	41.9	77.0	0.341
Best-60%	1.020	0.469	0.487	55.9	96.0	0.220
Best-50%	1.019	0.493	0.503	52.9	95.7	0.244
Wilcoxon Rank	NA	NA	NA	64.3	NA	NA
Data Generated from Mixture Normal						
Likelihood-Normal	0.998	0.668	0.703	28.4	96.0	0.446
Likelihood-Mixture	0.986	0.418	0.409	68.7	94.4	0.175
Model Averaging	0.994	0.429	0.427	66.6	95.1	0.184
Median Regression	1.183	0.992	1.112	17.8	95.9	1.017
MMRM	0.745	0.651	0.555	30.0	88.1	0.489
Best-60%	1.477	0.673	0.719	53.6	91.6	0.681
Best-50%	1.568	0.661	0.697	60.1	89.2	0.759
Wilcoxon Rank	NA	NA	NA	45.4	NA	NA

[†] All scenarios have 5% additional dropouts under MCAR. Results are based on 5000 simulations.

SD = Standard deviation of the 5000 estimated treatment differences.

Mean SE = Average of the 5000 standard errors for the treatment difference.

MSE = Mean squared error.

Table S2. Mean Estimates of Parameters from Simulations

(a) Data Generated From Normal

Fit with Normal Model

	α	β	δ	σ
True Value	3	.12	0 (<i>null</i>) or 1	2.89
1. MNAR 25%/15%, Null [†]	2.71	.11	-.01	3.03
2. MNAR 15%/25%, Null [†]	2.71	.11	-.00	3.03
3. MNAR 25%/15%, Alternative [†]	2.71	.11	.99	3.03
4. MNAR 15%/25%, Alternative [†]	2.71	.11	1.00	3.03
5. MNAR 15%/25%, Alternative	3.01	.12	.99	2.85

Fit with Mixture Normal Model

	p	α_1	α_2	β	δ	σ
True Value	NA	NA	NA	NA	NA	NA
1. MNAR 25%/15%, Null [†]	.26	-1.80	3.66	.11	-.04	2.54
2. MNAR 15%/25%, Null [†]	.26	-1.73	3.61	.11	.03	2.54
3. MNAR 25%/15%, Alternative [†]	.22	-2.14	3.31	.12	.98	2.63
4. MNAR 15%/25%, Alternative [†]	.22	-1.68	3.20	.12	1.17	2.65
5. MNAR 15%/25%, Alternative	.24	.65	3.08	.12	1.19	2.54

(b) Data Generated From Mixture Normal

Fit with Mixture Normal Model

	p	α_1	α_2	β	δ	σ
True Value	0.4	-3	3	.12	0 or 1	2.89
1. MNAR 25%/15%, Null [†]	.40	-4.54	2.83	.12	-.04	2.88
2. MNAR 15%/25%, Null [†]	.39	-4.51	2.79	.12	.01	2.89
3. MNAR 25%/15%, Alternative [†]	.41	-3.91	2.90	.12	.96	2.87
4. MNAR 15%/25%, Alternative [†]	.41	-3.90	2.84	.11	.98	2.89
5. MNAR 15%/25%, Alternative	.40	-3.15	3.00	.12	1.00	2.82

Fit with Normal Model

	α	β	δ	σ
True Value	NA	NA	NA	NA
1. MNAR 25%/15%, Null [†]	.14	.12	.01	4.37
2. MNAR 15%/25%, Null [†]	.16	.11	-.04	4.38
3. MNAR 25%/15%, Alternative [†]	.09	.11	1.04	4.73
4. MNAR 15%/25%, Alternative [†]	.06	.11	1.00	4.80
5. MNAR 15%/25%, Alternative	.54	.12	1.03	4.49

[†] All scenarios have 5% additional dropouts under MCAR. Results are based on 5000 simulations.

NA = not applicable because there are no true parameters for the mis-specified models.

Table S3. Summary of Results from Simulations under Data Generated from Normal with MAR[†]

(a) Scenario 1, MAR Missing 30% in Drug and 20% in Placebo Under Null

Method	Mean	SD	Mean SE	1-tailed Type I Error	95% CI Coverage	MSE
Likelihood-Normal	-0.923	0.850	0.723	0.2	73.2	1.575
Likelihood-Mixture	-0.028	0.391	0.370	2.8	94.5	0.153
Model Averaging	-0.028	0.392	0.371	2.8	94.5	0.154
Median Regression	-0.698	0.795	0.912	0.2	92.4	1.118
MMRM	-0.007	0.467	0.465	2.4	94.8	0.218
Best-60%	-0.445	0.591	0.602	0.4	88.2	0.547
Best-50%	-0.343	0.573	0.574	0.6	90.0	0.446
Wilcoxon Rank	NA	NA	NA	0.1	NA	NA

(b) Scenario 2, MAR Missing 20% in Drug and 30% in Placebo Under Null

Method	Mean	SD	Mean SE	1-tailed Type I Error	95% CI Coverage	MSE
Likelihood-Normal	0.933	0.847	0.724	27.5	72.3	1.589
Likelihood-Mixture	0.018	0.388	0.370	2.6	94.6	0.151
Model Averaging	0.020	0.390	0.371	2.6	94.7	0.152
Median Regression	0.716	1.604	0.847	10.8	89.0	3.087
MMRM	-0.001	0.470	0.466	2.3	94.8	0.220
Best-60%	0.446	0.591	0.608	11.7	87.9	0.548
Best-50%	0.343	0.573	0.579	9.6	89.9	0.446
Wilcoxon Rank	NA	NA	NA	20.7	NA	NA

(c) Scenario 3, MAR Missing 30% in Drug and 20% in Placebo Under Alternative

Method	Mean	SD	Mean SE	Power	95% CI Coverage	MSE
Likelihood-Normal	0.056	0.867	0.723	5.5	72.6	1.641
Likelihood-Mixture	0.676	0.384	0.367	46.8	85.3	0.252
Model Averaging	0.675	0.384	0.368	46.7	85.3	0.253
Median Regression	0.273	0.815	0.919	4.8	92.6	1.192
MMRM	0.994	0.466	0.466	56.4	95.1	0.217
Best-60%	0.541	0.604	0.608	13.9	87.8	0.575
Best-50%	0.651	0.580	0.576	20.5	89.7	0.458
Wilcoxon Rank	NA	NA	NA	3.6	NA	NA

(d) Scenario 4, MAR Missing 20% in Drug and 30% in Placebo Under Alternative

Method	Mean	SD	Mean SE	Power	95% CI Coverage	MSE
Likelihood-Normal	1.932	0.873	0.725	72.5	71.9	1.630
Likelihood-Mixture	0.731	0.398	0.380	48.5	86.5	0.230
Model Averaging	0.733	0.401	0.381	48.6	86.6	0.232
Median Regression	1.691	0.819	0.854	52.6	89.0	1.148
MMRM	0.999	0.469	0.466	56.1	94.7	0.220
Best-60%	1.439	0.602	0.606	70.4	87.6	0.555
Best-50%	1.336	0.581	0.578	66.7	89.5	0.451
Wilcoxon Rank	NA	NA	NA	70.5	NA	NA

[†] No dropouts under MCAR. Results are based on 5000 simulations.

SD = Standard deviation of the 5000 estimated treatment differences.

Mean SE = Average of the 5000 standard errors for the treatment difference.

MSE = Mean squared error.

Table S4. Summary of Results from Simulations under Data Generated from Mixture Normal with Different Variances[†]

(a) Scenario 1, MNAR Missing 25% in Drug and 15% in Placebo Under Null

Method	Mean	SD	Mean SE	1-tailed Type I Error	95% CI Coverage	MSE
Likelihood-Normal	0.064	0.646	0.645	3.2	94.8	0.421
Likelihood-Mixture	-0.028	0.424	0.413	2.1	95.0	0.180
Model Averaging	-0.016	0.453	0.452	2.0	95.5	0.206
Median Regression	-0.058	0.815	0.933	1.3	96.4	0.668
MMRM	0.364	0.618	0.504	15.3	83.3	0.515
Best-60%	-0.046	0.612	0.640	1.7	96.4	0.376
Best-50%	-0.039	0.612	0.630	2.0	95.7	0.376
Wilcoxon Rank	NA	NA	NA	0.1	NA	NA

(b) Scenario 2, MNAR Missing 15% in Drug and 25% in Placebo Under Null

Method	Mean	SD	Mean SE	1-tailed Type I Error	95% CI Coverage	MSE
Likelihood-Normal	-0.094	0.648	0.646	1.7	94.8	0.428
Likelihood-Mixture	0.006	0.428	0.414	2.7	95.1	0.183
Model Averaging	-0.006	0.458	0.451	2.5	95.3	0.209
Median Regression	0.035	0.828	0.927	1.9	96.2	0.687
MMRM	-0.429	0.619	0.507	1.1	80.9	0.567
Best-60%	0.017	0.614	0.659	2.3	96.3	0.377
Best-50%	0.010	0.615	0.649	2.2	96.0	0.378
Wilcoxon Rank	NA	NA	NA	3.0	NA	NA

(c) Scenario 3, MNAR Missing 25% in Drug and 15% in Placebo Under Alternative

Method	Mean	SD	Mean SE	Power	95% CI Coverage	MSE
Likelihood-Normal	1.106	0.715	0.691	36.4	93.9	0.522
Likelihood-Mixture	0.984	0.420	0.420	67.1	95.0	0.177
Model Averaging	1.003	0.440	0.437	65.5	95.3	0.194
Median Regression	1.085	0.933	1.072	15.6	97.1	0.877
MMRM	1.506	0.665	0.535	75.0	78.9	0.698
Best-60%	1.389	0.651	0.682	51.8	93.0	0.575
Best-50%	1.481	0.639	0.659	60.4	90.3	0.639
Wilcoxon Rank	NA	NA	NA	9.4	NA	NA

(d) Scenario 4, MNAR Missing 15% in Drug and 25% in Placebo Under Alternative

Method	Mean	SD	Mean SE	Power	95% CI Coverage	MSE
Likelihood-Normal	0.941	0.691	0.707	26.1	95.7	0.481
Likelihood-Mixture	1.022	0.425	0.422	69.1	94.8	0.181
Model Averaging	1.026	0.434	0.433	67.7	95.3	0.189
Median Regression	1.199	0.941	1.065	19.5	96.3	0.925
MMRM	0.708	0.664	0.552	28.9	86.5	0.525
Best-60%	1.457	0.650	0.699	55.7	91.9	0.631
Best-50%	1.535	0.640	0.677	61.3	89.8	0.696
Wilcoxon Rank	NA	NA	NA	47.6	NA	NA

[†] In the mixture-normal distribution, the variance for the 2nd normal is 1.44 times the variance of the 1st normal. All scenarios have 5% additional dropouts under MCAR. Results are based on 5000 simulations.

SD = Standard deviation of the 5000 estimated treatment differences.

Mean SE = Average of the 5000 standard errors for the treatment difference.

MSE = Mean squared error.

Table S5. Summary of Results from Simulations under Data Generated from t-Distribution with Degrees-of-freedom 10[†]

(a) Scenario 1, MNAR Missing 25% in Drug and 15% in Placebo Under Null

Method	Mean	SD	Mean SE	1-tailed Type I Error	95% CI Coverage	MSE
Likelihood-Normal	-0.009	0.464	0.485	1.9	95.8	0.215
Likelihood-Mixture	-0.022	0.465	0.431	3.3	92.7	0.217
Model Averaging	-0.013	0.466	0.463	2.6	94.3	0.217
Median Regression	-0.039	0.538	0.603	1.3	96.8	0.291
MMRM	0.370	0.482	0.402	19.1	80.1	0.369
Best-60%	-0.024	0.520	0.524	1.9	95.7	0.271
Best-50%	-0.018	0.555	0.550	2.3	94.9	0.309
Wilcoxon Rank	NA	NA	NA	<0.1	NA	NA

(b) Scenario 2, MNAR Missing 15% in Drug and 25% in Placebo Under Null

Method	Mean	SD	Mean SE	1-tailed Type I Error	95% CI Coverage	MSE
Likelihood-Normal	0.001	0.459	0.484	1.7	96.5	0.211
Likelihood-Mixture	0.020	0.468	0.446	3.7	92.8	0.219
Model Averaging	0.006	0.467	0.473	2.6	94.8	0.218
Median Regression	0.036	0.530	0.599	2.0	96.4	0.283
MMRM	-0.416	0.471	0.403	0.5	78.8	0.395
Best-60%	0.025	0.520	0.544	2.3	95.6	0.271
Best-50%	0.023	0.555	0.569	2.6	95.1	0.309
Wilcoxon Rank	NA	NA	NA	2.5	NA	NA

(c) Scenario 3, MNAR Missing 25% in Drug and 15% in Placebo Under Alternative

Method	Mean	SD	Mean SE	Power	95% CI Coverage	MSE
Likelihood-Normal	0.991	0.464	0.485	53.8	95.8	0.215
Likelihood-Mixture	0.922	0.462	0.459	52.0	92.3	0.220
Model Averaging	0.970	0.462	0.474	53.7	94.8	0.214
Median Regression	0.950	0.544	0.603	34.2	96.7	0.299
MMRM	1.370	0.482	0.402	88.0	80.1	0.369
Best-60%	0.975	0.520	0.527	45.0	95.7	0.271
Best-50%	0.982	0.555	0.550	43.3	94.9	0.309
Wilcoxon Rank	NA	NA	NA	12.1	NA	NA

(d) Scenario 4, MNAR Missing 15% in Drug and 25% in Placebo Under Alternative

Method	Mean	SD	Mean SE	Power	95% CI Coverage	MSE
Likelihood-Normal	1.000	0.466	0.485	54.3	95.5	0.217
Likelihood-Mixture	0.966	0.470	0.637	56.1	93.0	0.222
Model Averaging	0.989	0.469	0.600	55.2	94.9	0.220
Median Regression	1.018	0.544	0.599	38.8	96.6	0.296
MMRM	0.586	0.479	0.403	33.8	78.1	0.401
Best-60%	1.024	0.520	0.542	48.5	95.5	0.271
Best-50%	1.023	0.555	0.569	44.6	95.1	0.309
Wilcoxon Rank	NA	NA	NA	60.2	NA	NA

[†] All scenarios have 5% additional dropouts under MCAR. Results are based on 5000 simulations.

SD = Standard deviation of the 5000 estimated treatment differences.

Mean SE = Average of the 5000 standard errors for the treatment difference.

MSE = Mean squared error.