Subset calibration report: marginal odds ratio

2024-09-27

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(Base case) MAR: 12% outcome proportion, 40% missingness proportion

Table 1: **Synthetic data MAR simulation: oracle marginal odds ratio (mOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome and simple MAR** scenario. The value of the estimand is 0.382. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Nominal coverage	Oracle coverage	Power	Prop. completed
Benchmark model	0	-0.001	0.069	0.066	0.071	0.066	0.071	0.940	0.949	1.000	100
Complete-case	-0.176	-0.175	0.115	0.114	0.113	0.21	0.208	0.659	0.667	0.440	100
Confounded model	0.216	0.218	0.068	0.065	0.069	0.226	0.228	0.095	0.105	1.000	100
IPW	-0.002	0.001	0.122	0.123	0.121	0.123	0.121	0.953	0.951	0.884	100
Raking (vanilla)	0	-0.001	0.078	0.074	0.078	0.074	0.078	0.937	0.949	0.998	100
MICE	0	-0.001	0.075	0.072	0.075	0.072	0.075	0.940	0.947	1.000	100
MI-XGB	-0.007	-0.008	0.077	0.073	0.077	0.073	0.078	0.934	0.946	0.999	100
MI-RF	0.006	0.005	0.078	0.071	0.078	0.071	0.078	0.922	0.947	0.999	100
IPCW-TMLE-M	-0.02	-0.020	0.14	0.139	0.142	0.141	0.143	0.940	0.946	0.747	100
IPCW-TMLE-MTO	-0.03	-0.027	0.133	0.128	0.134	0.132	0.136	0.930	0.941	0.782	100

Table 2: **Synthetic data MAR simulation: census marginal odds ratio (mOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome and simple MAR** scenario. The value of the estimand is 0.381. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Oracle coverage	Nominal coverage	Power	Prop. completed
Benchmark model	0.001	-0.001	0.069	0.066	0.071	0.066	0.071	0.949	0.939	1.000	100
Complete-case	-0.175	-0.174	0.115	0.114	0.113	0.209	0.208	0.671	0.660	0.440	100
Confounded model	0.217	0.218	0.068	0.065	0.069	0.227	0.229	0.103	0.092	1.000	100
IPW	-0.001	0.002	0.122	0.123	0.121	0.123	0.121	0.952	0.952	0.884	100
Raking (vanilla)	0	0.000	0.078	0.074	0.078	0.074	0.078	0.949	0.936	0.998	100
MICE	0	-0.001	0.075	0.072	0.075	0.072	0.075	0.947	0.940	1.000	100
MI-XGB	-0.006	-0.008	0.077	0.073	0.077	0.073	0.078	0.946	0.934	0.999	100
MI-RF	0.007	0.006	0.078	0.071	0.078	0.071	0.078	0.946	0.922	0.999	100
IPCW-TMLE-M	-0.02	-0.019	0.14	0.139	0.142	0.141	0.143	0.946	0.942	0.747	100
IPCW-TMLE-MTO	-0.029	-0.027	0.133	0.128	0.134	0.131	0.136	0.942	0.930	0.782	100

Table 3: **Synthetic data MAR simulation: oracle marginal odds ratio (mOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **complex outcome and simple MAR** scenario. The value of the estimand is 0.307. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Nominal coverage	Oracle coverage	Power	Prop. completed
Benchmark model	-0.001	0.000	0.06	0.061	0.061	0.061	0.061	0.954	0.952	0.999	100
Complete-case*	-0.141	-0.142	0.118	0.118	0.118	0.184	0.185	0.784	0.786	0.298	100
Confounded model*	-0.216	-0.215	0.069	0.069	0.07	0.227	0.226	0.116	0.117	0.265	100
IPW*	0.043	0.042	0.124	0.124	0.127	0.131	0.134	0.935	0.938	0.804	100
Raking (vanilla)*	0.051	0.051	0.076	0.077	0.076	0.092	0.092	0.900	0.898	0.996	100
MICE*	0.113	0.113	0.076	0.076	0.077	0.136	0.137	0.685	0.682	1.000	100
MI-XGB*	0.087	0.087	0.074	0.075	0.075	0.114	0.114	0.788	0.785	1.000	100
MI-RF*	0.057	0.058	0.077	0.074	0.078	0.093	0.097	0.872	0.886	0.998	100
IPCW-TMLE-M	-0.055	-0.066	0.172	0.16	0.174	0.169	0.186	0.911	0.944	0.344	100
IPCW-TMLE-MTO	-0.059	-0.058	0.137	0.129	0.139	0.142	0.15	0.907	0.934	0.499	100
IPCW-a-TMLE-M	-0.057	-0.067	0.172	0.16	0.174	0.17	0.187	0.910	0.945	0.342	100
IPCW-a-TMLE-MTO	-0.073	-0.073	0.131	0.12	0.132	0.14	0.151	0.878	0.916	0.508	100

Table 4: **Synthetic data MAR simulation: census marginal odds ratio (mOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **complex outcome and simple MAR** scenario. The value of the estimand is 0.362. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Oracle coverage	Nominal coverage	Power	Prop. completed
Benchmark model	-0.003	-0.003	0.068	0.068	0.067	0.068	0.067	0.951	0.948	1.000	100
Complete-case	-0.195	-0.197	0.118	0.118	0.118	0.228	0.229	0.621	0.618	0.298	100
Confounded model	-0.27	-0.269	0.069	0.069	0.07	0.279	0.278	0.023	0.022	0.265	100
IPW	-0.012	-0.012	0.124	0.124	0.127	0.124	0.128	0.953	0.952	0.804	100
Raking (vanilla)	-0.004	-0.003	0.076	0.077	0.076	0.077	0.076	0.946	0.950	0.996	100
MICE	0.059	0.059	0.076	0.076	0.077	0.096	0.097	0.884	0.882	1.000	100
MI-XGB	0.032	0.032	0.074	0.075	0.075	0.081	0.081	0.925	0.926	1.000	100
MI-RF	0.002	0.003	0.077	0.074	0.078	0.074	0.078	0.950	0.936	0.998	100
IPCW-TMLE-M*	-0.109	-0.120	0.172	0.16	0.174	0.194	0.212	0.912	0.850	0.344	100
IPCW-TMLE-MTO*	-0.114	-0.113	0.137	0.129	0.139	0.172	0.179	0.872	0.814	0.499	100
IPCW-a-TMLE-M*	-0.112	-0.122	0.172	0.16	0.174	0.195	0.213	0.908	0.844	0.342	100
IPCW-a-TMLE-MTO*	-0.127	-0.128	0.131	0.12	0.132	0.175	0.184	0.839	0.769	0.508	100

Table 5: **Synthetic data MAR simulation: oracle marginal odds ratio (mOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome and complex MAR** scenario. The value of the estimand is 0.382. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Nominal coverage	Oracle coverage	Power	Prop. completed
Benchmark model	-0.002	-0.002	0.068	0.066	0.069	0.066	0.069	0.942	0.947	1.000	100
Complete-case	0.191	0.191	0.085	0.084	0.088	0.209	0.211	0.379	0.395	1.000	100
Confounded model	0.214	0.214	0.067	0.065	0.066	0.224	0.224	0.100	0.108	1.000	100
IPW	0.119	0.119	0.089	0.089	0.09	0.149	0.149	0.741	0.736	1.000	100
Raking (vanilla)	0	-0.001	0.072	0.069	0.072	0.069	0.072	0.938	0.952	1.000	100
MICE	-0.002	-0.002	0.071	0.069	0.071	0.069	0.071	0.946	0.949	1.000	100
MI-RF	-0.009	-0.009	0.072	0.069	0.073	0.07	0.074	0.940	0.949	1.000	100
IPCW-TMLE-M	0.043	0.042	0.097	0.107	0.099	0.116	0.108	0.961	0.928	0.992	100
IPCW-TMLE-MTO	0.049	0.048	0.094	0.1	0.096	0.111	0.107	0.941	0.919	0.995	100
IPCW-a-TMLE-M	0.043	0.041	0.099	0.108	0.099	0.116	0.107	0.960	0.927	0.987	100
IPCW-a-TMLE-MTO	0.049	0.048	0.096	0.1	0.096	0.111	0.108	0.933	0.916	0.996	100

Table 6: **Synthetic data MAR simulation: census marginal odds ratio (mOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome and complex MAR** scenario. The value of the estimand is 0.381. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Oracle coverage	Nominal coverage	Power	Prop. completed
Benchmark model	-0.001	-0.001	0.068	0.066	0.069	0.066	0.069	0.947	0.942	1.000	100
Complete-case	0.192	0.192	0.085	0.084	0.088	0.209	0.211	0.390	0.376	1.000	100
Confounded model	0.215	0.215	0.067	0.065	0.066	0.225	0.225	0.106	0.097	1.000	100
IPW	0.119	0.120	0.089	0.089	0.09	0.149	0.15	0.732	0.739	1.000	100
Raking (vanilla)	0	0.000	0.072	0.069	0.072	0.069	0.072	0.950	0.939	1.000	100
MICE	-0.002	-0.001	0.071	0.069	0.071	0.069	0.071	0.949	0.946	1.000	100
MI-RF	-0.008	-0.009	0.072	0.069	0.073	0.07	0.074	0.950	0.940	1.000	100
IPCW-TMLE-M	0.044	0.043	0.097	0.107	0.099	0.116	0.108	0.926	0.962	0.992	100
IPCW-TMLE-MTO	0.049	0.048	0.094	0.1	0.096	0.111	0.108	0.917	0.940	0.995	100
IPCW-a-TMLE-M	0.043	0.042	0.099	0.108	0.099	0.116	0.108	0.926	0.960	0.987	100
IPCW-a-TMLE-MTO	0.05	0.048	0.096	0.1	0.096	0.112	0.108	0.914	0.932	0.996	100

Table 7: **Synthetic data MAR simulation: oracle marginal odds ratio (mOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **complex outcome and complex MAR** scenario. The value of the estimand is 0.307. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Nominal coverage	Oracle coverage	Power	Prop. completed
Benchmark model	-0.002	-0.001	0.06	0.061	0.061	0.061	0.061	0.956	0.954	0.999	100
Complete-case*	0.204	0.204	0.084	0.084	0.086	0.221	0.221	0.322	0.317	1.000	100
Confounded model*	-0.218	-0.217	0.067	0.069	0.067	0.228	0.227	0.109	0.099	0.249	100
IPW*	0.123	0.123	0.089	0.089	0.09	0.152	0.153	0.714	0.712	0.998	100
Raking (vanilla)*	0.055	0.055	0.071	0.069	0.076	0.088	0.094	0.873	0.885	0.999	100
MICE*	0.095	0.096	0.071	0.071	0.075	0.118	0.122	0.728	0.726	1.000	100
MI-RF*	0.052	0.052	0.071	0.071	0.075	0.088	0.091	0.892	0.891	0.999	100
IPCW-TMLE-M	0.022	0.020	0.111	0.116	0.113	0.118	0.115	0.955	0.946	0.832	100
IPCW-TMLE-MTO	0.009	0.007	0.095	0.094	0.094	0.094	0.094	0.950	0.949	0.923	100
IPCW-a-TMLE-M	0.03	0.029	0.114	0.116	0.112	0.12	0.116	0.949	0.940	0.849	100
IPCW-a-TMLE-MTO	0.015	0.012	0.095	0.093	0.093	0.094	0.094	0.940	0.944	0.930	100

Table 8: **Synthetic data MAR simulation: census marginal odds ratio (mOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **complex outcome and complex MAR** scenario. The value of the estimand is 0.362. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Oracle coverage	Nominal coverage	Power	Prop. completed
Benchmark model	-0.005	-0.004	0.066	0.068	0.067	0.068	0.067	0.954	0.961	1.000	100
Complete-case	0.15	0.150	0.084	0.084	0.086	0.172	0.173	0.568	0.571	1.000	100
Confounded model	-0.272	-0.271	0.067	0.069	0.067	0.281	0.279	0.020	0.021	0.249	100
IPW	0.069	0.069	0.089	0.089	0.09	0.112	0.113	0.879	0.880	0.998	100
Raking (vanilla)	0	0.001	0.071	0.069	0.076	0.069	0.076	0.954	0.946	0.999	100
MICE	0.04	0.042	0.071	0.071	0.075	0.082	0.085	0.918	0.916	1.000	100
MI-RF	-0.003	-0.003	0.071	0.071	0.075	0.071	0.075	0.950	0.951	0.999	100
IPCW-TMLE-M*	-0.033	-0.035	0.111	0.116	0.113	0.12	0.119	0.942	0.946	0.832	100
IPCW-TMLE-MTO*	-0.045	-0.048	0.095	0.094	0.094	0.104	0.105	0.922	0.920	0.923	100
IPCW-a-TMLE-M*	-0.024	-0.025	0.114	0.116	0.112	0.118	0.115	0.945	0.948	0.849	100
IPCW-a-TMLE-MTO*	-0.04	-0.043	0.095	0.093	0.093	0.101	0.103	0.927	0.917	0.930	100

MAR: 12% outcome proportion, 80% missingness proportion

Table 9: **Synthetic data MAR simulation: oracle marginal odds ratio (mOR), 12% outcome proportion, 80% missing proportion**. Comparing estimators under the **simple outcome and simple MAR** scenario. The value of the estimand is 0.382. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Nominal coverage	Oracle coverage	Power	Prop. completed
Benchmark model	0.003	0.002	0.065	0.066	0.065	0.066	0.065	0.950	0.948	1.000	100
Complete-case	-0.095	-0.090	0.222	0.224	0.224	0.243	0.241	0.935	0.926	0.260	100
Confounded model	0.219	0.219	0.064	0.065	0.064	0.229	0.228	0.073	0.068	1.000	100
IPW	-0.004	-0.002	0.254	0.251	0.253	0.251	0.253	0.945	0.949	0.324	100
Raking (vanilla)	0.001	0.002	0.105	0.102	0.102	0.102	0.102	0.938	0.945	0.945	100
MICE	0.003	0.003	0.091	0.091	0.088	0.091	0.088	0.948	0.949	0.982	100
MI-RF	0.066	0.068	0.093	0.077	0.089	0.101	0.111	0.807	0.895	0.998	100
IPCW-TMLE-M	-0.044	-0.052	0.284	0.273	0.276	0.276	0.281	0.934	0.949	0.233	100
IPCW-TMLE-MTO	-0.055	-0.060	0.265	0.244	0.268	0.25	0.274	0.919	0.942	0.286	100

Table 10: **Synthetic data MAR simulation: census marginal odds ratio (mOR), 12% outcome proportion, 80% missing proportion**. Comparing estimators under the **simple outcome and simple MAR** scenario. The value of the estimand is 0.381. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Oracle coverage	Nominal coverage	Power	Prop. completed
Benchmark model	0.003	0.003	0.065	0.066	0.065	0.066	0.065	0.948	0.950	1.000	100
Complete-case	-0.095	-0.089	0.222	0.224	0.224	0.243	0.241	0.926	0.934	0.260	100
Confounded model	0.22	0.219	0.064	0.065	0.064	0.23	0.229	0.066	0.072	1.000	100
IPW	-0.004	-0.002	0.254	0.251	0.253	0.251	0.253	0.949	0.945	0.324	100
Raking (vanilla)	0.001	0.003	0.105	0.102	0.102	0.102	0.102	0.945	0.938	0.945	100
MICE	0.003	0.004	0.091	0.091	0.088	0.091	0.088	0.949	0.948	0.982	100
MI-RF	0.066	0.068	0.093	0.077	0.089	0.102	0.112	0.894	0.804	0.998	100
IPCW-TMLE-M	-0.044	-0.052	0.284	0.273	0.276	0.276	0.281	0.949	0.934	0.233	100
IPCW-TMLE-MTO	-0.054	-0.059	0.265	0.244	0.268	0.25	0.274	0.942	0.919	0.286	100

Table 11: **Synthetic data MAR simulation: oracle marginal odds ratio (mOR), 12% outcome proportion, 80% missing proportion**. Comparing estimators under the **complex outcome and simple MAR** scenario. The value of the estimand is 0.307. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Nominal coverage	Oracle coverage	Power	Prop. completed
Benchmark model	-0.003	-0.002	0.062	0.061	0.06	0.061	0.06	0.940	0.944	0.998	100
Complete-case*	-0.106	-0.101	0.234	0.23	0.231	0.253	0.252	0.927	0.920	0.153	100
Confounded model*	-0.219	-0.218	0.069	0.069	0.069	0.23	0.229	0.110	0.111	0.255	100
IPW*	0.022	0.025	0.277	0.251	0.264	0.252	0.265	0.935	0.958	0.285	100
Raking (vanilla)*	0.044	0.045	0.112	0.109	0.114	0.118	0.122	0.920	0.936	0.884	100
MICE*	0.13	0.132	0.108	0.103	0.11	0.166	0.172	0.745	0.772	0.985	100
MI-RF*	0.056	0.057	0.104	0.081	0.105	0.098	0.119	0.814	0.913	0.974	100
IPCW-TMLE-M	-0.108	-0.112	0.348	0.302	0.344	0.321	0.362	0.890	0.943	0.127	100
IPCW-TMLE-MTO	-0.116	-0.117	0.275	0.243	0.279	0.269	0.302	0.884	0.932	0.164	100

Table 12: **Synthetic data MAR simulation: census marginal odds ratio (mOR), 12% outcome proportion, 80% missing proportion**. Comparing estimators under the **complex outcome and simple MAR** scenario. The value of the estimand is 0.362. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Oracle coverage	Nominal coverage	Power	Prop. completed
Benchmark model	-0.007	-0.007	0.069	0.068	0.069	0.068	0.07	0.948	0.946	0.999	100
Complete-case	-0.16	-0.155	0.234	0.23	0.231	0.281	0.278	0.895	0.898	0.153	100
Confounded model	-0.274	-0.273	0.069	0.069	0.069	0.282	0.281	0.019	0.018	0.255	100
IPW	-0.033	-0.030	0.277	0.251	0.264	0.253	0.266	0.958	0.933	0.285	100
Raking (vanilla)	-0.011	-0.009	0.112	0.109	0.114	0.11	0.114	0.949	0.944	0.884	100
MICE	0.075	0.078	0.108	0.103	0.11	0.127	0.135	0.895	0.882	0.985	100
MI-RF	0.002	0.002	0.104	0.081	0.105	0.081	0.105	0.949	0.871	0.974	100
IPCW-TMLE-M*	-0.162	-0.166	0.348	0.302	0.344	0.343	0.382	0.927	0.862	0.127	100
IPCW-TMLE-MTO*	-0.17	-0.171	0.275	0.243	0.279	0.297	0.327	0.908	0.846	0.164	100

Table 13: **Synthetic data MAR simulation: oracle marginal odds ratio (mOR), 12% outcome proportion, 80% missing proportion**. Comparing estimators under the **simple outcome and complex MAR** scenario. The value of the estimand is 0.382. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Nominal coverage	Oracle coverage	Power	Prop. completed
Benchmark model	-0.001	-0.001	0.067	0.066	0.067	0.066	0.067	0.946	0.950	1.000	100
Complete-case	0.525	0.526	0.129	0.132	0.129	0.541	0.541	0.021	0.018	1.000	100
Confounded model	0.215	0.215	0.067	0.065	0.066	0.225	0.225	0.103	0.110	1.000	100
IPW	0.282	0.286	0.157	0.157	0.162	0.323	0.328	0.553	0.561	0.987	100
Raking (vanilla)	0.004	0.005	0.094	0.095	0.094	0.096	0.094	0.954	0.949	0.978	100
MICE	0.002	0.003	0.081	0.08	0.083	0.08	0.084	0.953	0.957	0.998	100
MI-RF	-0.003	-0.002	0.084	0.075	0.086	0.075	0.086	0.929	0.957	0.999	100
IPCW-TMLE-M	0.066	0.064	0.167	0.185	0.168	0.197	0.18	0.967	0.930	0.701	100
IPCW-TMLE-MTO	0.104	0.101	0.157	0.166	0.16	0.195	0.189	0.918	0.894	0.850	100

Table 14: **Synthetic data MAR simulation: census marginal odds ratio (mOR), 12% outcome proportion, 80% missing proportion**. Comparing estimators under the **simple outcome and complex MAR** scenario. The value of the estimand is 0.381. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Oracle coverage	Nominal coverage	Power	Prop. completed
Benchmark model	0	0.000	0.067	0.066	0.067	0.066	0.067	0.949	0.946	1.000	100
Complete-case	0.526	0.526	0.129	0.132	0.129	0.542	0.542	0.018	0.020	1.000	100
Confounded model	0.216	0.216	0.067	0.065	0.066	0.226	0.226	0.109	0.101	1.000	100
IPW	0.283	0.287	0.157	0.157	0.162	0.323	0.329	0.560	0.551	0.987	100
Raking (vanilla)	0.005	0.006	0.094	0.095	0.094	0.096	0.094	0.948	0.954	0.978	100
MICE	0.003	0.004	0.081	0.08	0.083	0.08	0.084	0.958	0.953	0.998	100
MI-RF	-0.003	-0.001	0.084	0.075	0.086	0.075	0.086	0.956	0.928	0.999	100
IPCW-TMLE-M	0.066	0.065	0.167	0.185	0.168	0.197	0.18	0.930	0.967	0.701	100
IPCW-TMLE-MTO	0.104	0.101	0.157	0.166	0.16	0.196	0.189	0.894	0.917	0.850	100

Table 15: **Synthetic data MAR simulation: oracle marginal odds ratio (mOR), 12% outcome proportion, 80% missing proportion**. Comparing estimators under the **complex outcome and complex MAR** scenario. The value of the estimand is 0.307. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Nominal coverage	Oracle coverage	Power	Prop. completed
Benchmark model	-0.003	-0.003	0.061	0.061	0.061	0.061	0.061	0.948	0.950	1.000	100
Complete-case*	0.424	0.422	0.124	0.127	0.122	0.443	0.439	0.081	0.068	1.000	100
Confounded model*	-0.217	-0.216	0.069	0.069	0.068	0.227	0.226	0.122	0.120	0.260	100
IPW*	0.166	0.166	0.151	0.15	0.151	0.224	0.224	0.801	0.804	0.892	100
Raking (vanilla)*	0.071	0.070	0.098	0.099	0.097	0.122	0.12	0.897	0.893	0.974	100
MICE*	0.191	0.190	0.089	0.083	0.089	0.208	0.209	0.377	0.429	1.000	100
MI-RF*	0.12	0.119	0.088	0.077	0.089	0.143	0.148	0.641	0.727	0.999	100
IPCW-TMLE-M	0.028	0.023	0.179	0.195	0.175	0.197	0.176	0.966	0.944	0.399	100
IPCW-TMLE-MTO	0.022	0.021	0.154	0.155	0.149	0.157	0.151	0.952	0.945	0.570	100

Table 16: **Synthetic data MAR simulation: census marginal odds ratio (mOR), 12% outcome proportion, 80% missing proportion**. Comparing estimators under the **complex outcome and complex MAR** scenario. The value of the estimand is 0.362. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Oracle coverage	Nominal coverage	Power	Prop. completed
Benchmark model	-0.004	-0.005	0.068	0.068	0.067	0.068	0.068	0.948	0.948	1.000	100
Complete-case	0.37	0.367	0.124	0.127	0.122	0.391	0.387	0.146	0.164	1.000	100
Confounded model	-0.271	-0.271	0.069	0.069	0.068	0.28	0.279	0.022	0.023	0.260	100
IPW	0.112	0.111	0.151	0.15	0.151	0.187	0.188	0.884	0.886	0.892	100
Raking (vanilla)	0.016	0.015	0.098	0.099	0.097	0.1	0.098	0.948	0.949	0.974	100
MICE	0.136	0.135	0.089	0.083	0.089	0.16	0.162	0.670	0.629	1.000	100
MI-RF	0.066	0.064	0.088	0.077	0.089	0.102	0.109	0.889	0.832	0.999	100
IPCW-TMLE-M*	-0.026	-0.031	0.179	0.195	0.175	0.197	0.177	0.943	0.965	0.399	100
IPCW-TMLE-MTO*	-0.033	-0.034	0.154	0.155	0.149	0.159	0.153	0.949	0.948	0.570	100

MAR: 5% outcome proportion, 40% missingness proportion

Table 17: **Synthetic data MAR simulation: oracle marginal odds ratio (mOR), 5% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome and simple MAR** scenario. The value of the estimand is 0.396. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Nominal coverage	Oracle coverage	Power	Prop. completed
Benchmark model	0	0.001	0.101	0.1	0.103	0.1	0.103	0.947	0.946	0.974	100
Complete-case	-0.177	-0.172	0.179	0.175	0.179	0.249	0.248	0.826	0.840	0.250	100
Confounded model	0.222	0.223	0.099	0.098	0.103	0.243	0.245	0.382	0.392	1.000	100
IPW	-0.001	0.000	0.195	0.189	0.19	0.189	0.19	0.941	0.947	0.557	100
Raking (vanilla)	0.001	-0.001	0.113	0.111	0.112	0.111	0.112	0.950	0.956	0.941	100
MICE	0.001	0.003	0.109	0.108	0.11	0.108	0.11	0.951	0.952	0.952	100
MI-RF	0.039	0.040	0.111	0.107	0.111	0.114	0.118	0.927	0.940	0.978	100
IPCW-TMLE-M	-0.026	-0.029	0.213	0.206	0.208	0.208	0.21	0.940	0.946	0.439	100
IPCW-TMLE-MTO	-0.033	-0.032	0.203	0.193	0.202	0.196	0.204	0.929	0.942	0.476	100
r-IPCW-TMLE-MTO	-0.034	-0.035	0.204	0.193	0.201	0.196	0.204	0.930	0.942	0.470	100

Table 18: **Synthetic data MAR simulation: census marginal odds ratio (mOR), 5% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome and simple MAR** scenario. The value of the estimand is 0.39. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Oracle coverage	Nominal coverage	Power	Prop. completed
Benchmark model	0.006	0.007	0.101	0.1	0.103	0.101	0.103	0.949	0.948	0.974	100
Complete-case	-0.171	-0.166	0.179	0.175	0.179	0.244	0.244	0.846	0.834	0.250	100
Confounded model	0.228	0.229	0.099	0.098	0.103	0.248	0.251	0.369	0.360	1.000	100
IPW	0.005	0.006	0.195	0.189	0.19	0.189	0.191	0.947	0.943	0.557	100
Raking (vanilla)	0.007	0.005	0.113	0.111	0.112	0.111	0.112	0.953	0.948	0.941	100
MICE	0.007	0.009	0.109	0.108	0.11	0.108	0.11	0.951	0.949	0.952	100
MI-RF	0.046	0.046	0.111	0.107	0.111	0.116	0.12	0.934	0.922	0.978	100
IPCW-TMLE-M	-0.02	-0.023	0.213	0.206	0.208	0.207	0.21	0.948	0.942	0.439	100
IPCW-TMLE-MTO	-0.027	-0.026	0.203	0.193	0.202	0.195	0.203	0.942	0.930	0.476	100
r-IPCW-TMLE-MTO	-0.028	-0.029	0.204	0.193	0.201	0.195	0.203	0.944	0.932	0.470	100

Table 19: **Synthetic data MAR simulation: oracle marginal odds ratio (mOR), 5% outcome proportion, 40% missing proportion**. Comparing estimators under the **complex outcome and simple MAR** scenario. The value of the estimand is 0.297. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Nominal coverage	Oracle coverage	Power	Prop. completed
Benchmark model	0.003	0.002	0.083	0.086	0.081	0.086	0.082	0.950	0.946	0.941	100
Complete-case*	-0.123	-0.123	0.166	0.166	0.168	0.207	0.208	0.898	0.891	0.190	100
Confounded model*	-0.27	-0.270	0.095	0.097	0.093	0.287	0.286	0.196	0.187	0.060	100
IPW*	0.061	0.055	0.175	0.173	0.172	0.184	0.181	0.935	0.931	0.540	100
Raking (vanilla)*	0.064	0.064	0.107	0.109	0.109	0.126	0.126	0.915	0.910	0.906	100
MICE*	0.152	0.150	0.105	0.107	0.102	0.186	0.181	0.704	0.696	0.987	100
MI-RF*	0.08	0.080	0.106	0.102	0.106	0.13	0.133	0.870	0.885	0.953	100
IPCW-TMLE-M	-0.065	-0.076	0.251	0.224	0.244	0.233	0.255	0.900	0.946	0.180	100
IPCW-TMLE-MTO	-0.064	-0.069	0.201	0.183	0.202	0.194	0.213	0.907	0.938	0.260	100
r-IPCW-TMLE-MTO	-0.031	-0.035	0.206	0.183	0.207	0.186	0.21	0.908	0.944	0.328	100

Table 20: **Synthetic data MAR simulation: census marginal odds ratio (mOR), 5% outcome proportion, 40% missing proportion**. Comparing estimators under the **complex outcome and simple MAR** scenario. The value of the estimand is 0.369. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Oracle coverage	Nominal coverage	Power	Prop. completed
Benchmark model	-0.006	-0.005	0.092	0.095	0.092	0.095	0.092	0.954	0.958	0.974	100
Complete-case	-0.195	-0.194	0.166	0.166	0.168	0.256	0.257	0.779	0.792	0.190	100
Confounded model	-0.342	-0.342	0.095	0.097	0.093	0.355	0.355	0.056	0.060	0.060	100
IPW	-0.011	-0.016	0.175	0.173	0.172	0.174	0.173	0.948	0.947	0.540	100
Raking (vanilla)	-0.008	-0.008	0.107	0.109	0.109	0.109	0.109	0.950	0.954	0.906	100
MICE	0.08	0.078	0.105	0.107	0.102	0.134	0.129	0.880	0.880	0.987	100
MI-RF	0.008	0.008	0.106	0.102	0.106	0.103	0.106	0.951	0.943	0.953	100
IPCW-TMLE-M*	-0.137	-0.148	0.251	0.224	0.244	0.262	0.285	0.914	0.846	0.180	100
IPCW-TMLE-MTO*	-0.136	-0.141	0.201	0.183	0.202	0.228	0.246	0.901	0.839	0.260	100
r-IPCW-TMLE-MTO*	-0.103	-0.106	0.206	0.183	0.207	0.21	0.233	0.921	0.872	0.328	100

Table 21: **Synthetic data MAR simulation: oracle marginal odds ratio (mOR), 5% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome and complex MAR** scenario. The value of the estimand is 0.396. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Nominal cover-age	Oracle cover-age	Power	Prop. com-pleted
Benchmark model	-0.007	-0.005	0.098	0.1	0.097	0.101	0.097	0.953	0.946	0.968	100
Complete-case	0.214	0.216	0.125	0.127	0.122	0.248	0.248	0.609	0.598	0.998	100
Confounded model	0.216	0.217	0.095	0.098	0.095	0.237	0.237	0.398	0.381	1.000	100
IPW	0.136	0.135	0.133	0.134	0.132	0.191	0.189	0.839	0.826	0.978	100
Raking (vanilla)	-0.007	-0.005	0.104	0.105	0.103	0.105	0.103	0.949	0.948	0.958	100
MICE	-0.007	-0.005	0.101	0.104	0.099	0.104	0.099	0.956	0.945	0.964	100
MI-RF	-0.003	0.000	0.103	0.104	0.102	0.104	0.102	0.948	0.947	0.964	100
IPCW-TMLE-M	0.074	0.075	0.146	0.158	0.147	0.174	0.165	0.952	0.918	0.876	100
IPCW-TMLE-MTO	0.083	0.085	0.14	0.146	0.141	0.168	0.165	0.928	0.906	0.912	100
IPCW-a-TMLE-M	0.08	0.083	0.149	0.158	0.15	0.177	0.172	0.942	0.914	0.874	100
IPCW-a-TMLE-MTO	0.089	0.092	0.144	0.146	0.142	0.171	0.169	0.917	0.910	0.923	100
r-IPCW-TMLE-MTO	0.077	0.079	0.14	0.147	0.141	0.166	0.162	0.932	0.908	0.910	100

Table 22: **Synthetic data MAR simulation: census marginal odds ratio (mOR), 5% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome and complex MAR** scenario. The value of the estimand is 0.39. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Oracle cover-age	Nominal cover-age	Power	Prop. com-pleted
Benchmark model	-0.001	0.002	0.098	0.1	0.097	0.1	0.097	0.947	0.955	0.968	100
Complete-case	0.22	0.222	0.125	0.127	0.122	0.254	0.253	0.578	0.587	0.998	100
Confounded model	0.222	0.223	0.095	0.098	0.095	0.243	0.242	0.351	0.372	1.000	100
IPW	0.143	0.141	0.133	0.134	0.132	0.196	0.193	0.818	0.826	0.978	100
Raking (vanilla)	0	0.001	0.104	0.105	0.103	0.105	0.103	0.951	0.948	0.958	100
MICE	-0.001	0.001	0.101	0.104	0.099	0.104	0.099	0.949	0.957	0.964	100
MI-RF	0.003	0.006	0.103	0.104	0.102	0.104	0.102	0.947	0.952	0.964	100
IPCW-TMLE-M	0.08	0.081	0.146	0.158	0.147	0.177	0.168	0.912	0.948	0.876	100
IPCW-TMLE-MTO	0.089	0.091	0.14	0.146	0.141	0.171	0.168	0.900	0.920	0.912	100
IPCW-a-TMLE-M	0.086	0.089	0.149	0.158	0.15	0.18	0.175	0.909	0.939	0.874	100
IPCW-a-TMLE-MTO	0.096	0.098	0.144	0.146	0.142	0.175	0.172	0.902	0.911	0.923	100
r-IPCW-TMLE-MTO	0.084	0.085	0.14	0.147	0.141	0.169	0.165	0.904	0.926	0.910	100

Table 23: **Synthetic data MAR simulation: oracle marginal odds ratio (mOR), 5% outcome proportion, 40% missing proportion**. Comparing estimators under the **complex outcome and complex MAR** scenario. The value of the estimand is 0.297. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Nominal coverage	Oracle coverage	Power	Prop. completed
Benchmark model	0	0.002	0.086	0.086	0.083	0.086	0.083	0.946	0.942	0.932	100
Complete-case*	0.258	0.258	0.115	0.115	0.115	0.282	0.282	0.384	0.386	0.996	100
Confounded model*	-0.275	-0.274	0.097	0.097	0.091	0.291	0.289	0.182	0.181	0.052	100
IPW*	0.15	0.152	0.118	0.12	0.116	0.192	0.191	0.764	0.756	0.960	100
Raking (vanilla)*	0.076	0.076	0.099	0.096	0.095	0.123	0.122	0.863	0.875	0.963	100
MICE*	0.132	0.133	0.097	0.099	0.093	0.165	0.162	0.737	0.730	0.990	100
MI-RF*	0.084	0.084	0.099	0.099	0.094	0.13	0.126	0.861	0.862	0.962	100
IPCW-TMLE-M	0.059	0.052	0.161	0.16	0.16	0.171	0.168	0.950	0.934	0.621	100
IPCW-TMLE-MTO	0.04	0.037	0.133	0.128	0.135	0.134	0.14	0.931	0.938	0.750	100
IPCW-a-TMLE-M	0.072	0.067	0.162	0.16	0.161	0.176	0.174	0.942	0.929	0.644	100
IPCW-a-TMLE-MTO	0.05	0.051	0.134	0.127	0.132	0.137	0.142	0.921	0.933	0.772	100
r-IPCW-TMLE-MTO	0.088	0.089	0.137	0.13	0.139	0.157	0.165	0.881	0.904	0.820	100

Table 24: **Synthetic data MAR simulation: census marginal odds ratio (mOR), 5% outcome proportion, 40% missing proportion**. Comparing estimators under the **complex outcome and complex MAR** scenario. The value of the estimand is 0.369. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Oracle coverage	Nominal coverage	Power	Prop. completed
Benchmark model	-0.009	-0.009	0.093	0.095	0.093	0.095	0.093	0.949	0.952	0.966	100
Complete-case	0.186	0.186	0.115	0.115	0.115	0.219	0.218	0.623	0.618	0.996	100
Confounded model	-0.347	-0.346	0.097	0.097	0.091	0.36	0.357	0.052	0.051	0.052	100
IPW	0.078	0.080	0.118	0.12	0.116	0.144	0.141	0.900	0.902	0.960	100
Raking (vanilla)	0.004	0.004	0.099	0.096	0.095	0.097	0.095	0.954	0.950	0.963	100
MICE	0.06	0.061	0.097	0.099	0.093	0.116	0.111	0.906	0.906	0.990	100
MI-RF	0.012	0.012	0.099	0.099	0.094	0.1	0.095	0.948	0.949	0.962	100
IPCW-TMLE-M*	-0.013	-0.020	0.161	0.16	0.16	0.161	0.161	0.948	0.948	0.621	100
IPCW-TMLE-MTO*	-0.032	-0.035	0.133	0.128	0.135	0.132	0.14	0.947	0.925	0.750	100
IPCW-a-TMLE-M*	0	-0.005	0.162	0.16	0.161	0.16	0.161	0.948	0.953	0.644	100
IPCW-a-TMLE-MTO*	-0.022	-0.021	0.134	0.127	0.132	0.129	0.134	0.951	0.934	0.772	100
r-IPCW-TMLE-MTO*	0.016	0.017	0.137	0.13	0.139	0.131	0.14	0.948	0.937	0.820	100

MAR: 5% outcome proportion, 80% missingness proportion

Table 25: **Synthetic data MAR simulation: oracle marginal odds ratio (mOR), 5% outcome proportion, 80% missing proportion**. Comparing estimators under the **simple outcome and simple MAR** scenario. The value of the estimand is 0.396. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Nominal coverage	Oracle coverage	Power	Prop. completed
Benchmark model	-0.001	-0.001	0.1	0.1	0.101	0.1	0.101	0.947	0.946	0.969	100
Complete-case	-0.108	-0.105	0.35	0.346	0.342	0.363	0.358	0.942	0.937	0.136	100
Confounded model	0.222	0.222	0.098	0.098	0.094	0.243	0.241	0.379	0.384	1.000	100
IPW	-0.099	-0.101	0.417	0.392	0.397	0.404	0.41	0.920	0.941	0.120	100
Raking (vanilla)	-0.008	-0.005	0.161	0.185	0.158	0.185	0.158	0.971	0.945	0.571	100
MICE	-0.002	-0.005	0.139	0.135	0.138	0.135	0.138	0.937	0.949	0.815	100
MI-RF	0.123	0.124	0.12	0.112	0.117	0.166	0.171	0.781	0.827	0.988	100
IPCW-TMLE-M	-0.116	-0.123	0.462	0.405	0.444	0.422	0.46	0.904	0.944	0.133	100
IPCW-TMLE-MTO	-0.1	-0.103	0.432	0.369	0.421	0.382	0.434	0.898	0.942	0.164	100
r-IPCW-TMLE-MTO	-0.104	-0.105	0.437	0.372	0.421	0.386	0.434	0.898	0.945	0.171	100

Table 26: **Synthetic data MAR simulation: census marginal odds ratio (mOR), 5% outcome proportion, 80% missing proportion**. Comparing estimators under the **simple outcome and simple MAR** scenario. The value of the estimand is 0.39. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Oracle coverage	Nominal coverage	Power	Prop. completed
Benchmark model	0.005	0.006	0.1	0.1	0.101	0.101	0.101	0.946	0.946	0.969	100
Complete-case	-0.102	-0.099	0.35	0.346	0.342	0.361	0.356	0.939	0.944	0.136	100
Confounded model	0.229	0.228	0.098	0.098	0.094	0.249	0.247	0.364	0.351	1.000	100
IPW	-0.093	-0.095	0.417	0.392	0.397	0.403	0.408	0.941	0.923	0.120	100
Raking (vanilla)	-0.002	0.001	0.161	0.185	0.158	0.185	0.158	0.946	0.972	0.571	100
MICE	0.004	0.002	0.139	0.135	0.138	0.135	0.138	0.946	0.936	0.815	100
MI-RF	0.129	0.130	0.12	0.112	0.117	0.171	0.175	0.816	0.772	0.988	100
IPCW-TMLE-M	-0.11	-0.117	0.462	0.405	0.444	0.42	0.459	0.945	0.905	0.133	100
IPCW-TMLE-MTO	-0.094	-0.097	0.432	0.369	0.421	0.381	0.432	0.941	0.898	0.164	100
r-IPCW-TMLE-MTO	-0.097	-0.099	0.437	0.372	0.421	0.384	0.432	0.946	0.900	0.171	100

Table 27: **Synthetic data MAR simulation: oracle marginal odds ratio (mOR), 5% outcome proportion, 80% missing proportion**. Comparing estimators under the **complex outcome and simple MAR** scenario. The value of the estimand is 0.297. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Nominal coverage	Oracle coverage	Power	Prop. completed
Benchmark model	0.004	0.005	0.086	0.086	0.085	0.086	0.086	0.952	0.954	0.941	100
Complete-case*	-0.083	-0.076	0.33	0.325	0.32	0.335	0.329	0.949	0.942	0.119	100
Confounded model*	-0.27	-0.269	0.097	0.097	0.094	0.287	0.285	0.201	0.202	0.057	100
IPW*	-0.052	-0.047	0.367	0.346	0.37	0.35	0.373	0.938	0.945	0.120	100
Raking (vanilla)*	0.06	0.066	0.17	0.184	0.172	0.194	0.184	0.951	0.940	0.512	100
MICE*	0.182	0.184	0.154	0.14	0.153	0.23	0.24	0.722	0.778	0.901	100
MI-RF*	0.03	0.031	0.136	0.113	0.139	0.117	0.142	0.889	0.946	0.785	100
IPCW-TMLE-M	-0.186	-0.210	0.494	0.406	0.46	0.446	0.505	0.865	0.939	0.096	100
IPCW-TMLE-MTO	-0.138	-0.140	0.417	0.351	0.401	0.377	0.424	0.876	0.938	0.116	100
r-IPCW-TMLE-MTO	-0.108	-0.114	0.444	0.355	0.426	0.371	0.441	0.866	0.942	0.154	100

Table 28: **Synthetic data MAR simulation: census marginal odds ratio (mOR), 5% outcome proportion, 80% missing proportion**. Comparing estimators under the **complex outcome and simple MAR** scenario. The value of the estimand is 0.369. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Oracle coverage	Nominal coverage	Power	Prop. completed
Benchmark model	-0.006	-0.005	0.095	0.095	0.093	0.095	0.094	0.948	0.950	0.968	100
Complete-case	-0.155	-0.148	0.33	0.325	0.32	0.36	0.352	0.926	0.940	0.119	100
Confounded model	-0.342	-0.341	0.097	0.097	0.094	0.355	0.354	0.058	0.057	0.057	100
IPW	-0.124	-0.119	0.367	0.346	0.37	0.368	0.388	0.940	0.922	0.120	100
Raking (vanilla)	-0.012	-0.006	0.17	0.184	0.172	0.185	0.172	0.949	0.965	0.512	100
MICE	0.11	0.112	0.154	0.14	0.153	0.178	0.19	0.895	0.840	0.901	100
MI-RF	-0.041	-0.041	0.136	0.113	0.139	0.12	0.145	0.938	0.873	0.785	100
IPCW-TMLE-M*	-0.258	-0.281	0.494	0.406	0.46	0.481	0.539	0.926	0.837	0.096	100
IPCW-TMLE-MTO*	-0.21	-0.212	0.417	0.351	0.401	0.409	0.453	0.925	0.849	0.116	100
r-IPCW-TMLE-MTO*	-0.18	-0.186	0.444	0.355	0.426	0.398	0.465	0.933	0.848	0.154	100

Table 29: **Synthetic data MAR simulation: oracle marginal odds ratio (mOR), 5% outcome proportion, 80% missing proportion**. Comparing estimators under the **simple outcome and complex MAR** scenario. The value of the estimand is 0.396. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Nominal coverage	Oracle coverage	Power	Prop. completed
Benchmark model	-0.004	-0.006	0.1	0.1	0.104	0.1	0.104	0.956	0.954	0.980	100
Complete-case	0.615	0.616	0.203	0.199	0.201	0.646	0.647	0.136	0.141	0.998	100
Confounded model	0.22	0.220	0.096	0.098	0.098	0.241	0.241	0.396	0.382	1.000	100
IPW	0.376	0.376	0.242	0.232	0.236	0.442	0.444	0.634	0.667	0.913	100
Raking (vanilla)	0.002	0.001	0.139	0.146	0.139	0.146	0.139	0.962	0.949	0.792	100
MICE	-0.001	-0.003	0.117	0.117	0.119	0.118	0.12	0.948	0.948	0.920	100
MI-RF	0.032	0.031	0.12	0.11	0.119	0.115	0.123	0.916	0.939	0.966	100
IPCW-TMLE-M	0.101	0.102	0.27	0.268	0.261	0.286	0.28	0.946	0.927	0.471	100
IPCW-TMLE-MTO	0.153	0.156	0.258	0.238	0.258	0.283	0.301	0.883	0.906	0.636	100
IPCW-a-TMLE-M	0.101	0.095	0.281	0.271	0.272	0.29	0.289	0.939	0.929	0.460	100
IPCW-a-TMLE-MTO	0.161	0.156	0.266	0.239	0.268	0.288	0.309	0.875	0.906	0.639	100
r-IPCW-TMLE-MTO	0.119	0.120	0.256	0.241	0.256	0.268	0.283	0.909	0.924	0.580	100

Table 30: **Synthetic data MAR simulation: census marginal odds ratio (mOR), 5% outcome proportion, 80% missing proportion**. Comparing estimators under the **simple outcome and complex MAR** scenario. The value of the estimand is 0.39. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Oracle coverage	Nominal coverage	Power	Prop. completed
Benchmark model	0.003	0.001	0.1	0.1	0.104	0.1	0.104	0.953	0.953	0.980	100
Complete-case	0.621	0.622	0.203	0.199	0.201	0.652	0.653	0.132	0.131	0.998	100
Confounded model	0.226	0.227	0.096	0.098	0.098	0.246	0.247	0.362	0.373	1.000	100
IPW	0.382	0.382	0.242	0.232	0.236	0.447	0.449	0.657	0.626	0.913	100
Raking (vanilla)	0.008	0.007	0.139	0.146	0.139	0.146	0.139	0.950	0.964	0.792	100
MICE	0.005	0.003	0.117	0.117	0.119	0.118	0.12	0.948	0.947	0.920	100
MI-RF	0.038	0.037	0.12	0.11	0.119	0.117	0.125	0.936	0.912	0.966	100
IPCW-TMLE-M	0.107	0.108	0.27	0.268	0.261	0.288	0.283	0.928	0.944	0.471	100
IPCW-TMLE-MTO	0.159	0.162	0.258	0.238	0.258	0.286	0.305	0.903	0.882	0.636	100
IPCW-a-TMLE-M	0.107	0.101	0.281	0.271	0.272	0.292	0.291	0.927	0.935	0.460	100
IPCW-a-TMLE-MTO	0.167	0.162	0.266	0.239	0.268	0.292	0.313	0.902	0.868	0.639	100
r-IPCW-TMLE-MTO	0.125	0.126	0.256	0.241	0.256	0.271	0.286	0.922	0.906	0.580	100

Table 31: **Synthetic data MAR simulation: oracle marginal odds ratio (mOR), 5% outcome proportion, 80% missing proportion**. Comparing estimators under the **complex outcome and complex MAR** scenario. The value of the estimand is 0.297. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Nominal coverage	Oracle coverage	Power	Prop. completed
Benchmark model	0.001	0.000	0.087	0.086	0.088	0.086	0.088	0.950	0.953	0.934	100
Complete-case*	0.492	0.493	0.167	0.162	0.159	0.518	0.518	0.156	0.154	0.994	100
Confounded model*	-0.273	-0.276	0.098	0.097	0.1	0.29	0.293	0.199	0.202	0.063	100
IPW*	0.217	0.218	0.194	0.189	0.187	0.288	0.287	0.785	0.806	0.775	100
Raking (vanilla)*	0.1	0.097	0.14	0.142	0.142	0.174	0.172	0.893	0.890	0.803	100
MICE*	0.265	0.265	0.12	0.112	0.116	0.287	0.289	0.356	0.406	0.998	100
MI-RF*	0.173	0.170	0.12	0.106	0.12	0.203	0.208	0.614	0.693	0.986	100
IPCW-TMLE-M	0.085	0.083	0.265	0.257	0.256	0.271	0.269	0.942	0.941	0.325	100
IPCW-TMLE-MTO	0.091	0.090	0.217	0.202	0.216	0.221	0.234	0.913	0.930	0.501	100
IPCW-a-TMLE-M	0.096	0.095	0.271	0.257	0.26	0.275	0.276	0.938	0.940	0.348	100
IPCW-a-TMLE-MTO	0.115	0.115	0.217	0.2	0.213	0.231	0.242	0.890	0.918	0.557	100
r-IPCW-TMLE-MTO	0.18	0.181	0.227	0.207	0.221	0.275	0.286	0.822	0.879	0.643	100

Table 32: **Synthetic data MAR simulation: census marginal odds ratio (mOR), 5% outcome proportion, 80% missing proportion**. Comparing estimators under the **complex outcome and complex MAR** scenario. The value of the estimand is 0.369. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Oracle coverage	Nominal coverage	Power	Prop. completed
Benchmark model	-0.009	-0.007	0.096	0.095	0.094	0.095	0.094	0.946	0.944	0.959	100
Complete-case	0.42	0.421	0.167	0.162	0.159	0.45	0.45	0.284	0.277	0.994	100
Confounded model	-0.345	-0.348	0.098	0.097	0.1	0.359	0.362	0.063	0.059	0.063	100
IPW	0.145	0.146	0.194	0.189	0.187	0.238	0.238	0.878	0.864	0.775	100
Raking (vanilla)	0.028	0.026	0.14	0.142	0.142	0.145	0.144	0.948	0.945	0.803	100
MICE	0.193	0.193	0.12	0.112	0.116	0.223	0.225	0.645	0.594	0.998	100
MI-RF	0.102	0.098	0.12	0.106	0.12	0.147	0.155	0.869	0.804	0.986	100
IPCW-TMLE-M*	0.014	0.011	0.265	0.257	0.256	0.257	0.256	0.953	0.954	0.325	100
IPCW-TMLE-MTO*	0.019	0.018	0.217	0.202	0.216	0.202	0.217	0.949	0.932	0.501	100
IPCW-a-TMLE-M*	0.024	0.023	0.271	0.257	0.26	0.259	0.261	0.947	0.952	0.348	100
IPCW-a-TMLE-MTO*	0.043	0.043	0.217	0.2	0.213	0.205	0.217	0.945	0.924	0.557	100
r-IPCW-TMLE-MTO*	0.108	0.110	0.227	0.207	0.221	0.234	0.247	0.926	0.885	0.643	100

MNAR: 12% outcome proportion, 40% missingness proportion

Table 33: **Synthetic data MNAR simulation: oracle marginal odds ratio (mOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome and MNAR-value** scenario. The value of the estimand is 0.382. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Nominal coverage	Oracle coverage	Power	Prop. completed
Benchmark model	-0.002	-0.001	0.068	0.066	0.068	0.066	0.068	0.942	0.948	1.000	100
Complete-case	-0.131	-0.131	0.103	0.104	0.102	0.167	0.166	0.761	0.762	0.676	100
Confounded model	0.214	0.216	0.068	0.065	0.067	0.223	0.226	0.110	0.129	1.000	100
IPW	-0.137	-0.138	0.109	0.111	0.11	0.176	0.177	0.756	0.759	0.599	100
Raking (vanilla)	-0.112	-0.110	0.076	0.081	0.075	0.138	0.133	0.738	0.691	0.923	100
MICE	-0.111	-0.108	0.076	0.073	0.076	0.133	0.132	0.666	0.692	0.954	100
MI-XGB	-0.112	-0.111	0.076	0.092	0.078	0.145	0.135	0.809	0.694	0.864	100
MI-RF	-0.109	-0.106	0.074	0.07	0.075	0.129	0.13	0.664	0.697	0.966	100
IPCW-TMLE-M	-0.133	-0.134	0.13	0.128	0.126	0.184	0.184	0.789	0.825	0.502	100
IPCW-TMLE-MTO	-0.134	-0.132	0.123	0.118	0.118	0.178	0.177	0.772	0.806	0.563	100

Table 34: **Synthetic data MNAR simulation: census marginal odds ratio (mOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome and MNAR-value** scenario. The value of the estimand is 0.381. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Oracle coverage	Nominal coverage	Power	Prop. completed
Benchmark model	-0.002	0.000	0.068	0.066	0.068	0.066	0.068	0.948	0.942	1.000	100
Complete-case	-0.13	-0.130	0.103	0.104	0.102	0.167	0.165	0.764	0.763	0.676	100
Confounded model	0.214	0.216	0.068	0.065	0.067	0.224	0.226	0.126	0.109	1.000	100
IPW	-0.137	-0.138	0.109	0.111	0.11	0.176	0.176	0.760	0.758	0.599	100
Raking (vanilla)	-0.111	-0.109	0.076	0.081	0.075	0.138	0.132	0.695	0.741	0.923	100
MICE	-0.11	-0.107	0.076	0.073	0.076	0.132	0.132	0.695	0.671	0.954	100
MI-XGB	-0.111	-0.110	0.076	0.092	0.078	0.144	0.135	0.697	0.811	0.864	100
MI-RF	-0.108	-0.106	0.074	0.07	0.075	0.129	0.13	0.700	0.666	0.966	100
IPCW-TMLE-M	-0.132	-0.134	0.13	0.128	0.126	0.184	0.184	0.827	0.792	0.502	100
IPCW-TMLE-MTO	-0.133	-0.131	0.123	0.118	0.118	0.178	0.176	0.807	0.772	0.563	100

Table 35: **Synthetic data MNAR simulation: oracle marginal odds ratio (mOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **complex outcome and MNAR-value** scenario. The value of the estimand is 0.307. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Nominal coverage	Oracle coverage	Power	Prop. completed
Benchmark model	-0.002	-0.003	0.061	0.061	0.061	0.061	0.061	0.947	0.949	0.998	100
Complete-case*	-0.093	-0.094	0.109	0.109	0.107	0.143	0.142	0.863	0.862	0.498	100
Confounded model*	-0.218	-0.219	0.069	0.069	0.069	0.228	0.229	0.114	0.117	0.261	100
IPW*	-0.086	-0.088	0.114	0.113	0.111	0.142	0.142	0.872	0.882	0.494	100
Raking (vanilla)*	-0.399	-0.399	0.08	0.089	0.078	0.409	0.407	0.004	0.002	0.150	100
MICE*	-0.399	-0.400	0.074	0.074	0.075	0.406	0.407	0.000	0.000	0.239	100
MI-XGB*	-0.292	-0.292	0.08	0.084	0.077	0.304	0.302	0.060	0.048	0.046	100
MI-RF*	-0.419	-0.421	0.076	0.073	0.073	0.425	0.427	0.000	0.000	0.336	100
IPCW-TMLE-M	-0.124	-0.129	0.141	0.135	0.136	0.184	0.188	0.807	0.858	0.257	100
IPCW-TMLE-MTO	-0.104	-0.106	0.122	0.117	0.119	0.156	0.159	0.833	0.863	0.403	100
IPCW-a-TMLE-M	-0.124	-0.131	0.14	0.135	0.136	0.184	0.188	0.810	0.856	0.255	100
IPCW-a-TMLE-MTO	-0.102	-0.102	0.116	0.11	0.115	0.15	0.154	0.816	0.859	0.471	100

Table 36: **Synthetic data MNAR simulation: census marginal odds ratio (mOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **complex outcome and MNAR-value** scenario. The value of the estimand is 0.362. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Oracle coverage	Nominal coverage	Power	Prop. completed
Benchmark model	-0.004	-0.005	0.068	0.068	0.067	0.068	0.067	0.943	0.944	0.999	100
Complete-case	-0.147	-0.149	0.109	0.109	0.107	0.183	0.183	0.740	0.734	0.498	100
Confounded model	-0.272	-0.273	0.069	0.069	0.069	0.281	0.282	0.022	0.023	0.261	100
IPW	-0.14	-0.142	0.114	0.113	0.111	0.18	0.181	0.767	0.760	0.494	100
Raking (vanilla)	-0.454	-0.454	0.08	0.089	0.078	0.462	0.461	0.000	0.000	0.150	100
MICE	-0.453	-0.454	0.074	0.074	0.075	0.459	0.461	0.000	0.000	0.239	100
MI-XGB	-0.346	-0.346	0.08	0.084	0.077	0.356	0.355	0.011	0.013	0.046	100
MI-RF	-0.473	-0.475	0.076	0.073	0.073	0.479	0.481	0.000	0.000	0.336	100
IPCW-TMLE-M*	-0.179	-0.183	0.141	0.135	0.136	0.224	0.228	0.748	0.688	0.257	100
IPCW-TMLE-MTO*	-0.158	-0.160	0.122	0.117	0.119	0.197	0.2	0.753	0.703	0.403	100
IPCW-a-TMLE-M*	-0.179	-0.185	0.14	0.135	0.136	0.224	0.23	0.746	0.690	0.255	100
IPCW-a-TMLE-MTO*	-0.156	-0.156	0.116	0.11	0.115	0.191	0.194	0.735	0.688	0.471	100

Table 37: **Synthetic data MNAR simulation: oracle marginal odds ratio (mOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome and MNAR-unobserved** scenario. The value of the estimand is 0.382. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Nominal coverage	Oracle coverage	Power	Prop. completed
Benchmark model	-0.002	-0.002	0.066	0.066	0.064	0.066	0.064	0.952	0.950	1.000	100
Complete-case	-0.068	-0.070	0.099	0.101	0.098	0.122	0.121	0.905	0.900	0.884	100
Confounded model	0.215	0.216	0.065	0.065	0.064	0.225	0.225	0.090	0.087	1.000	100
IPW	-0.07	-0.071	0.104	0.105	0.103	0.126	0.125	0.900	0.900	0.855	100
Raking (vanilla)	-0.008	-0.007	0.071	0.08	0.07	0.081	0.071	0.971	0.946	1.000	100
MICE	-0.008	-0.008	0.069	0.07	0.069	0.071	0.07	0.952	0.946	1.000	100
MI-XGB	-0.014	-0.014	0.072	0.073	0.072	0.075	0.073	0.948	0.946	1.000	100
MI-RF	-0.007	-0.007	0.071	0.07	0.071	0.07	0.072	0.941	0.947	1.000	100
IPCW-TMLE-M	-0.074	-0.075	0.12	0.119	0.118	0.14	0.14	0.899	0.916	0.746	100
IPCW-TMLE-MTO	-0.073	-0.074	0.117	0.112	0.113	0.133	0.135	0.892	0.911	0.792	100
IPCW-a-TMLE-M	-0.074	-0.075	0.12	0.119	0.118	0.14	0.139	0.898	0.916	0.748	100
IPCW-a-TMLE-MTO	-0.073	-0.073	0.116	0.112	0.114	0.133	0.135	0.891	0.912	0.790	100

Table 38: **Synthetic data MNAR simulation: census marginal odds ratio (mOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome and MNAR-unobserved** scenario. The value of the estimand is 0.381. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Oracle coverage	Nominal coverage	Power	Prop. completed
Benchmark model	-0.002	-0.001	0.066	0.066	0.064	0.066	0.064	0.951	0.952	1.000	100
Complete-case	-0.068	-0.070	0.099	0.101	0.098	0.121	0.121	0.901	0.905	0.884	100
Confounded model	0.215	0.216	0.065	0.065	0.064	0.225	0.226	0.085	0.089	1.000	100
IPW	-0.069	-0.070	0.104	0.105	0.103	0.126	0.124	0.900	0.900	0.855	100
Raking (vanilla)	-0.007	-0.007	0.071	0.08	0.07	0.081	0.07	0.946	0.971	1.000	100
MICE	-0.007	-0.007	0.069	0.07	0.069	0.071	0.07	0.946	0.953	1.000	100
MI-XGB	-0.014	-0.013	0.072	0.073	0.072	0.075	0.073	0.945	0.948	1.000	100
MI-RF	-0.006	-0.006	0.071	0.07	0.071	0.07	0.072	0.947	0.942	1.000	100
IPCW-TMLE-M	-0.073	-0.075	0.12	0.119	0.118	0.139	0.14	0.919	0.899	0.746	100
IPCW-TMLE-MTO	-0.072	-0.074	0.117	0.112	0.113	0.133	0.135	0.912	0.892	0.792	100
IPCW-a-TMLE-M	-0.073	-0.074	0.12	0.119	0.118	0.139	0.139	0.918	0.900	0.748	100
IPCW-a-TMLE-MTO	-0.072	-0.073	0.116	0.112	0.114	0.133	0.135	0.913	0.892	0.790	100

Table 39: **Synthetic data MNAR simulation: oracle marginal odds ratio (mOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome (unobserved covariate) and MNAR-unobserved** scenario. The value of the estimand is 0.382. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Nominal coverage	Oracle coverage	Power	Prop. completed
Benchmark model	-0.001	0.001	0.073	0.071	0.074	0.071	0.074	0.945	0.955	0.999	100
Complete-case*	-0.066	-0.063	0.105	0.105	0.105	0.124	0.122	0.902	0.902	0.856	100
Confounded model*	0.216	0.219	0.071	0.068	0.07	0.226	0.23	0.128	0.142	1.000	100
IPW*	-0.068	-0.066	0.109	0.109	0.106	0.129	0.125	0.900	0.902	0.827	100
Raking (vanilla)*	-0.006	-0.006	0.077	0.084	0.077	0.084	0.078	0.967	0.946	0.996	100
MICE*	-0.006	-0.006	0.075	0.073	0.076	0.073	0.076	0.943	0.948	0.998	100
MI-RF*	-0.004	-0.003	0.077	0.072	0.077	0.072	0.077	0.934	0.949	0.998	100
IPCW-TMLE-M	-0.073	-0.074	0.124	0.123	0.119	0.143	0.14	0.893	0.906	0.729	100
IPCW-TMLE-MTO	-0.073	-0.072	0.119	0.116	0.115	0.137	0.136	0.886	0.906	0.772	100
IPCW-a-TMLE-M	-0.073	-0.074	0.124	0.123	0.119	0.143	0.14	0.892	0.907	0.731	100
IPCW-a-TMLE-MTO	-0.073	-0.073	0.119	0.115	0.115	0.137	0.136	0.890	0.908	0.777	100

Table 40: **Synthetic data MNAR simulation: census marginal odds ratio (mOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome (unobserved covariate) and MNAR-unobserved** scenario. The value of the estimand is 0.381. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Oracle coverage	Nominal coverage	Power	Prop. completed
Benchmark model	0	0.000	0.071	0.069	0.07	0.069	0.07	0.947	0.942	0.999	100
Complete-case	-0.065	-0.063	0.105	0.105	0.105	0.124	0.122	0.902	0.902	0.856	100
Confounded model	0.216	0.219	0.071	0.068	0.07	0.227	0.23	0.142	0.128	1.000	100
IPW	-0.068	-0.066	0.109	0.109	0.106	0.129	0.125	0.902	0.900	0.827	100
Raking (vanilla)	-0.006	-0.006	0.077	0.084	0.077	0.084	0.078	0.946	0.967	0.996	100
MICE	-0.006	-0.005	0.075	0.073	0.076	0.073	0.076	0.948	0.942	0.998	100
MI-RF	-0.004	-0.003	0.077	0.072	0.077	0.072	0.077	0.950	0.934	0.998	100
IPCW-TMLE-M*	-0.073	-0.074	0.124	0.123	0.119	0.143	0.14	0.906	0.893	0.729	100
IPCW-TMLE-MTO*	-0.073	-0.072	0.119	0.116	0.115	0.136	0.136	0.906	0.886	0.772	100
IPCW-a-TMLE-M*	-0.073	-0.074	0.124	0.123	0.119	0.143	0.14	0.907	0.892	0.731	100
IPCW-a-TMLE-MTO*	-0.073	-0.073	0.119	0.115	0.115	0.137	0.136	0.908	0.890	0.777	100

MNAR: 12% outcome proportion, 80% missingness proportion

Table 41: **Synthetic data MNAR simulation: oracle marginal odds ratio (mOR), 12% outcome proportion, 80% missing proportion**. Comparing estimators under the **simple outcome and MNAR-value** scenario. The value of the estimand is 0.382. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Nominal coverage	Oracle coverage	Power	Prop. completed
Benchmark model	0.001	0.001	0.068	0.066	0.07	0.066	0.07	0.952	0.956	1.000	100
Complete-case	-0.131	-0.138	0.202	0.198	0.206	0.238	0.248	0.889	0.904	0.245	100
Confounded model	0.217	0.216	0.067	0.065	0.07	0.227	0.227	0.093	0.100	1.000	100
IPW	-0.123	-0.125	0.245	0.235	0.246	0.265	0.276	0.895	0.925	0.191	100
Raking (vanilla)	-0.102	-0.099	0.112	0.117	0.107	0.155	0.145	0.870	0.850	0.680	100
MICE	-0.109	-0.108	0.107	0.107	0.106	0.152	0.151	0.796	0.829	0.729	100
MI-XGB	-0.116	-0.114	0.107	0.115	0.103	0.163	0.154	0.844	0.811	0.644	100
MI-RF	-0.09	-0.090	0.098	0.076	0.095	0.118	0.131	0.732	0.852	0.923	100
IPCW-TMLE-M	-0.127	-0.139	0.29	0.262	0.284	0.291	0.316	0.874	0.934	0.158	100
IPCW-TMLE-MTO	-0.122	-0.129	0.265	0.234	0.265	0.264	0.294	0.868	0.926	0.212	100

Table 42: **Synthetic data MNAR simulation: census marginal odds ratio (mOR), 12% outcome proportion, 80% missing proportion**. Comparing estimators under the **simple outcome and MNAR-value** scenario. The value of the estimand is 0.381. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Oracle coverage	Nominal coverage	Power	Prop. completed
Benchmark model	0.001	0.001	0.068	0.066	0.07	0.066	0.07	0.956	0.952	1.000	100
Complete-case	-0.131	-0.137	0.202	0.198	0.206	0.237	0.248	0.906	0.890	0.245	100
Confounded model	0.218	0.216	0.067	0.065	0.07	0.227	0.228	0.098	0.092	1.000	100
IPW	-0.122	-0.124	0.245	0.235	0.246	0.265	0.276	0.925	0.896	0.191	100
Raking (vanilla)	-0.101	-0.098	0.112	0.117	0.107	0.155	0.145	0.851	0.871	0.680	100
MICE	-0.108	-0.107	0.107	0.107	0.106	0.152	0.151	0.832	0.798	0.729	100
MI-XGB	-0.116	-0.113	0.107	0.115	0.103	0.163	0.153	0.812	0.846	0.644	100
MI-RF	-0.089	-0.090	0.098	0.076	0.095	0.117	0.131	0.852	0.735	0.923	100
IPCW-TMLE-M	-0.127	-0.139	0.29	0.262	0.284	0.291	0.316	0.934	0.874	0.158	100
IPCW-TMLE-MTO	-0.121	-0.128	0.265	0.234	0.265	0.263	0.294	0.926	0.868	0.212	100

Table 43: **Synthetic data MNAR simulation: oracle marginal odds ratio (mOR), 12% outcome proportion, 80% missing proportion**. Comparing estimators under the **complex outcome and MNAR-value** scenario. The value of the estimand is 0.307. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Nominal coverage	Oracle coverage	Power	Prop. completed
Benchmark model	-0.001	0.000	0.061	0.06	0.061	0.06	0.061	0.952	0.953	0.999	100
Complete-case*	-0.103	-0.106	0.181	0.181	0.179	0.209	0.208	0.910	0.911	0.198	100
Confounded model*	-0.216	-0.215	0.068	0.069	0.071	0.227	0.227	0.121	0.117	0.265	100
IPW*	-0.087	-0.090	0.213	0.207	0.214	0.224	0.232	0.913	0.928	0.178	100
Raking (vanilla)*	-0.531	-0.532	0.111	0.118	0.112	0.544	0.543	0.006	0.002	0.480	100
MICE*	-0.527	-0.528	0.103	0.097	0.103	0.536	0.538	0.012	0.002	0.627	100
MI-RF*	-0.547	-0.548	0.092	0.08	0.092	0.553	0.556	0.000	0.000	0.815	100
IPCW-TMLE-M	-0.124	-0.140	0.267	0.231	0.251	0.263	0.287	0.867	0.935	0.120	100
IPCW-TMLE-MTO	-0.123	-0.135	0.227	0.201	0.224	0.236	0.261	0.854	0.920	0.165	100
IPCW-a-TMLE-M	-0.125	-0.141	0.266	0.231	0.248	0.262	0.285	0.867	0.935	0.122	100
IPCW-a-TMLE-MTO	-0.124	-0.131	0.218	0.193	0.216	0.229	0.253	0.852	0.916	0.180	100

Table 44: **Synthetic data MNAR simulation: census marginal odds ratio (mOR), 12% outcome proportion, 80% missing proportion**. Comparing estimators under the **complex outcome and MNAR-value** scenario. The value of the estimand is 0.362. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Oracle coverage	Nominal coverage	Power	Prop. completed
Benchmark model	-0.003	-0.004	0.067	0.068	0.067	0.068	0.067	0.952	0.955	1.000	100
Complete-case	-0.158	-0.161	0.181	0.181	0.179	0.24	0.24	0.860	0.856	0.198	100
Confounded model	-0.271	-0.270	0.068	0.069	0.071	0.279	0.279	0.017	0.019	0.265	100
IPW	-0.142	-0.144	0.213	0.207	0.214	0.251	0.258	0.899	0.868	0.178	100
Raking (vanilla)	-0.585	-0.586	0.111	0.118	0.112	0.597	0.597	0.000	0.002	0.480	100
MICE	-0.582	-0.582	0.103	0.097	0.103	0.59	0.591	0.000	0.007	0.627	100
MI-RF	-0.602	-0.602	0.092	0.08	0.092	0.607	0.609	0.000	0.000	0.815	100
IPCW-TMLE-M*	-0.179	-0.194	0.267	0.231	0.251	0.292	0.317	0.910	0.816	0.120	100
IPCW-TMLE-MTO*	-0.177	-0.189	0.227	0.201	0.224	0.268	0.293	0.880	0.794	0.165	100
IPCW-a-TMLE-M*	-0.179	-0.195	0.266	0.231	0.248	0.292	0.316	0.909	0.812	0.122	100
IPCW-a-TMLE-MTO*	-0.178	-0.185	0.218	0.193	0.216	0.262	0.285	0.873	0.792	0.180	100

Table 45: **Synthetic data MNAR simulation: oracle marginal odds ratio (mOR), 12% outcome proportion, 80% missing proportion**. Comparing estimators under the **simple outcome and MNAR-unobserved** scenario. The value of the estimand is 0.382. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Nominal coverage	Oracle coverage	Power	Prop. completed
Benchmark model	-0.003	-0.002	0.065	0.066	0.065	0.066	0.065	0.951	0.948	1.000	100
Complete-case	-0.053	-0.051	0.203	0.205	0.208	0.212	0.214	0.951	0.948	0.353	100
Confounded model	0.214	0.214	0.064	0.065	0.065	0.224	0.224	0.090	0.082	1.000	100
IPW	-0.053	-0.053	0.238	0.237	0.231	0.243	0.237	0.941	0.943	0.270	100
Raking (vanilla)	-0.009	-0.008	0.103	0.114	0.099	0.114	0.099	0.966	0.946	0.922	100
MICE	-0.011	-0.011	0.089	0.089	0.09	0.089	0.091	0.947	0.946	0.980	100
MI-XGB	0.005	0.005	0.104	0.096	0.101	0.096	0.101	0.924	0.950	0.949	100
MI-RF	0.04	0.042	0.093	0.077	0.092	0.086	0.101	0.866	0.931	0.998	100
IPCW-TMLE-M	-0.067	-0.072	0.27	0.256	0.262	0.265	0.272	0.920	0.948	0.224	100
IPCW-TMLE-MTO	-0.061	-0.065	0.256	0.234	0.247	0.242	0.256	0.912	0.946	0.280	100
IPCW-a-TMLE-M	-0.068	-0.071	0.27	0.256	0.258	0.265	0.267	0.920	0.946	0.225	100
IPCW-a-TMLE-MTO	-0.06	-0.064	0.255	0.233	0.245	0.241	0.253	0.914	0.942	0.287	100

Table 46: **Synthetic data MNAR simulation: census marginal odds ratio (mOR), 12% outcome proportion, 80% missing proportion**. Comparing estimators under the **simple outcome and MNAR-unobserved** scenario. The value of the estimand is 0.381. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Oracle coverage	Nominal coverage	Power	Prop. completed
Benchmark model	-0.002	-0.002	0.065	0.066	0.065	0.066	0.065	0.948	0.951	1.000	100
Complete-case	-0.052	-0.050	0.203	0.205	0.208	0.212	0.214	0.948	0.952	0.353	100
Confounded model	0.215	0.215	0.064	0.065	0.065	0.224	0.224	0.080	0.088	1.000	100
IPW	-0.052	-0.052	0.238	0.237	0.231	0.242	0.237	0.943	0.942	0.270	100
Raking (vanilla)	-0.008	-0.007	0.103	0.114	0.099	0.114	0.099	0.946	0.966	0.922	100
MICE	-0.011	-0.011	0.089	0.089	0.09	0.089	0.091	0.946	0.947	0.980	100
MI-XGB	0.005	0.006	0.104	0.096	0.101	0.096	0.101	0.950	0.923	0.949	100
MI-RF	0.04	0.042	0.093	0.077	0.092	0.087	0.101	0.930	0.863	0.998	100
IPCW-TMLE-M	-0.066	-0.072	0.27	0.256	0.262	0.265	0.272	0.949	0.919	0.224	100
IPCW-TMLE-MTO	-0.06	-0.064	0.256	0.234	0.247	0.242	0.255	0.946	0.913	0.280	100
IPCW-a-TMLE-M	-0.067	-0.070	0.27	0.256	0.258	0.265	0.267	0.946	0.921	0.225	100
IPCW-a-TMLE-MTO	-0.059	-0.063	0.255	0.233	0.245	0.24	0.253	0.943	0.915	0.287	100

Table 47: **Synthetic data MNAR simulation: oracle marginal odds ratio (mOR), 12% outcome proportion, 80% missing proportion**. Comparing estimators under the **simple outcome (unobserved covariate) and MNAR-unobserved** scenario. The value of the estimand is 0.382. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Nominal coverage	Oracle coverage	Power	Prop. completed
Benchmark model	0.003	0.002	0.073	0.071	0.075	0.071	0.075	0.951	0.955	1.000	100
Complete-case*	-0.055	-0.053	0.213	0.214	0.207	0.221	0.213	0.948	0.943	0.328	100
Confounded model*	0.219	0.219	0.07	0.068	0.071	0.23	0.23	0.110	0.120	1.000	100
IPW*	-0.056	-0.057	0.246	0.246	0.242	0.252	0.248	0.932	0.940	0.248	100
Raking (vanilla)*	-0.006	-0.008	0.105	0.119	0.108	0.119	0.108	0.973	0.951	0.902	100
MICE*	-0.009	-0.012	0.095	0.092	0.095	0.093	0.096	0.944	0.951	0.975	100
MI-XGB*	0.003	0.003	0.1	0.094	0.102	0.094	0.102	0.930	0.952	0.970	100
MI-RF*	0.048	0.049	0.096	0.08	0.097	0.093	0.109	0.853	0.923	0.997	100
IPCW-TMLE-M	-0.07	-0.074	0.285	0.267	0.276	0.276	0.286	0.917	0.945	0.207	100
IPCW-TMLE-MTO	-0.062	-0.063	0.267	0.243	0.258	0.251	0.265	0.905	0.939	0.273	100
IPCW-a-TMLE-M	-0.07	-0.075	0.285	0.267	0.276	0.276	0.286	0.916	0.942	0.210	100
IPCW-a-TMLE-MTO	-0.063	-0.063	0.265	0.241	0.254	0.249	0.262	0.907	0.942	0.272	100

Table 48: **Synthetic data MNAR simulation: census marginal odds ratio (mOR), 12% outcome proportion, 80% missing proportion**. Comparing estimators under the **simple outcome (unobserved covariate) and MNAR-unobserved** scenario. The value of the estimand is 0.381. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Oracle coverage	Nominal coverage	Power	Prop. completed
Benchmark model	0.003	0.002	0.071	0.069	0.073	0.069	0.073	0.957	0.950	0.999	100
Complete-case	-0.054	-0.052	0.213	0.214	0.207	0.221	0.213	0.943	0.948	0.328	100
Confounded model	0.22	0.219	0.07	0.068	0.071	0.23	0.23	0.120	0.110	1.000	100
IPW	-0.056	-0.057	0.246	0.246	0.242	0.252	0.248	0.940	0.932	0.248	100
Raking (vanilla)	-0.006	-0.007	0.105	0.119	0.108	0.119	0.108	0.951	0.973	0.902	100
MICE	-0.009	-0.012	0.095	0.092	0.095	0.093	0.096	0.951	0.944	0.975	100
MI-XGB	0.003	0.003	0.1	0.094	0.102	0.094	0.102	0.952	0.930	0.970	100
MI-RF	0.048	0.049	0.096	0.08	0.097	0.093	0.109	0.923	0.853	0.997	100
IPCW-TMLE-M*	-0.07	-0.074	0.285	0.267	0.276	0.276	0.286	0.945	0.917	0.207	100
IPCW-TMLE-MTO*	-0.062	-0.062	0.267	0.243	0.258	0.251	0.265	0.940	0.905	0.273	100
IPCW-a-TMLE-M*	-0.07	-0.075	0.285	0.267	0.276	0.275	0.286	0.942	0.916	0.210	100
IPCW-a-TMLE-MTO*	-0.063	-0.063	0.265	0.241	0.254	0.249	0.262	0.942	0.907	0.272	100

MNAR: 5% outcome proportion, 40% missingness proportion

Table 49: **Synthetic data MNAR simulation: oracle marginal odds ratio (mOR), 5% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome and MNAR-value** scenario. The value of the estimand is 0.396. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Nominal coverage	Oracle coverage	Power	Prop. completed
Benchmark model	-0.003	-0.004	0.096	0.1	0.093	0.1	0.093	0.958	0.954	0.984	100
Complete-case	-0.137	-0.135	0.156	0.16	0.159	0.21	0.209	0.863	0.856	0.369	100
Confounded model	0.22	0.218	0.093	0.098	0.091	0.241	0.236	0.381	0.339	1.000	100
IPW	-0.142	-0.141	0.168	0.169	0.166	0.22	0.218	0.856	0.860	0.326	100
Raking (vanilla)	-0.114	-0.116	0.108	0.125	0.107	0.169	0.158	0.887	0.816	0.627	100
MICE	-0.116	-0.118	0.107	0.11	0.105	0.16	0.158	0.817	0.804	0.728	100
MI-XGB	-0.114	-0.116	0.108	0.122	0.108	0.167	0.159	0.880	0.813	0.648	100
MI-RF	-0.106	-0.104	0.105	0.106	0.104	0.15	0.148	0.824	0.826	0.776	100
IPCW-TMLE-M	-0.144	-0.148	0.191	0.188	0.188	0.237	0.24	0.859	0.879	0.255	100
IPCW-TMLE-MTO	-0.141	-0.143	0.185	0.175	0.18	0.225	0.229	0.848	0.881	0.301	100

Table 50: **Synthetic data MNAR simulation: census marginal odds ratio (mOR), 5% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome and MNAR-value** scenario. The value of the estimand is 0.39. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Oracle coverage	Nominal coverage	Power	Prop. completed
Benchmark model	0.003	0.003	0.096	0.1	0.093	0.1	0.093	0.952	0.961	0.984	100
Complete-case	-0.13	-0.129	0.156	0.16	0.159	0.206	0.205	0.864	0.869	0.369	100
Confounded model	0.227	0.224	0.093	0.098	0.091	0.247	0.242	0.311	0.355	1.000	100
IPW	-0.136	-0.134	0.168	0.169	0.166	0.216	0.214	0.864	0.863	0.326	100
Raking (vanilla)	-0.107	-0.110	0.108	0.125	0.107	0.165	0.153	0.831	0.901	0.627	100
MICE	-0.109	-0.111	0.107	0.11	0.105	0.155	0.153	0.827	0.837	0.728	100
MI-XGB	-0.108	-0.110	0.108	0.122	0.108	0.163	0.154	0.829	0.891	0.648	100
MI-RF	-0.1	-0.098	0.105	0.106	0.104	0.145	0.143	0.842	0.844	0.776	100
IPCW-TMLE-M	-0.138	-0.142	0.191	0.188	0.188	0.233	0.236	0.886	0.864	0.255	100
IPCW-TMLE-MTO	-0.135	-0.136	0.185	0.175	0.18	0.221	0.226	0.884	0.853	0.301	100

Table 51: **Synthetic data MNAR simulation: oracle marginal odds ratio (mOR), 5% outcome proportion, 40% missing proportion**. Comparing estimators under the **complex outcome and MNAR-value** scenario. The value of the estimand is 0.297. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Nominal coverage	Oracle coverage	Power	Prop. completed
Benchmark model	0.002	0.005	0.086	0.086	0.086	0.086	0.086	0.945	0.946	0.932	100
Complete-case*	-0.072	-0.074	0.158	0.159	0.153	0.174	0.17	0.932	0.928	0.284	100
Confounded model*	-0.271	-0.268	0.096	0.097	0.097	0.288	0.284	0.196	0.194	0.058	100
IPW*	-0.066	-0.067	0.163	0.164	0.159	0.177	0.173	0.935	0.933	0.280	100
Raking (vanilla)*	-0.479	-0.480	0.115	0.135	0.117	0.498	0.494	0.036	0.014	0.238	100
MICE*	-0.506	-0.505	0.105	0.105	0.103	0.516	0.516	0.003	0.001	0.508	100
MI-RF*	-0.488	-0.485	0.107	0.103	0.105	0.498	0.497	0.002	0.002	0.452	100
IPCW-TMLE-M	-0.113	-0.119	0.2	0.193	0.19	0.224	0.224	0.880	0.914	0.141	100
IPCW-TMLE-MTO	-0.084	-0.089	0.176	0.172	0.172	0.191	0.194	0.907	0.924	0.224	100
IPCW-a-TMLE-M	-0.113	-0.118	0.2	0.193	0.19	0.223	0.224	0.878	0.913	0.140	100
IPCW-a-TMLE-MTO	-0.081	-0.085	0.165	0.159	0.159	0.179	0.18	0.901	0.923	0.267	100
r-IPCW-TMLE-MTO	-0.008	-0.005	0.19	0.173	0.185	0.173	0.186	0.924	0.951	0.395	100

Table 52: **Synthetic data MNAR simulation: census marginal odds ratio (mOR), 5% outcome proportion, 40% missing proportion**. Comparing estimators under the **complex outcome and MNAR-value** scenario. The value of the estimand is 0.369. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Oracle coverage	Nominal coverage	Power	Prop. completed
Benchmark model	-0.006	-0.007	0.094	0.095	0.093	0.095	0.094	0.948	0.952	0.963	100
Complete-case	-0.144	-0.146	0.158	0.159	0.153	0.214	0.212	0.856	0.853	0.284	100
Confounded model	-0.343	-0.339	0.096	0.097	0.097	0.356	0.353	0.050	0.051	0.058	100
IPW	-0.138	-0.139	0.163	0.164	0.159	0.215	0.211	0.870	0.861	0.280	100
Raking (vanilla)	-0.551	-0.552	0.115	0.135	0.117	0.567	0.564	0.002	0.009	0.238	100
MICE	-0.577	-0.577	0.105	0.105	0.103	0.587	0.586	0.000	0.000	0.508	100
MI-RF	-0.559	-0.557	0.107	0.103	0.105	0.569	0.567	0.000	0.000	0.452	100
IPCW-TMLE-M*	-0.185	-0.191	0.2	0.193	0.19	0.267	0.269	0.852	0.805	0.141	100
IPCW-TMLE-MTO*	-0.156	-0.160	0.176	0.172	0.172	0.232	0.235	0.858	0.824	0.224	100
IPCW-a-TMLE-M*	-0.185	-0.190	0.2	0.193	0.19	0.267	0.269	0.852	0.807	0.140	100
IPCW-a-TMLE-MTO*	-0.153	-0.157	0.165	0.159	0.159	0.221	0.224	0.856	0.819	0.267	100
r-IPCW-TMLE-MTO*	-0.08	-0.077	0.19	0.173	0.185	0.191	0.201	0.927	0.886	0.395	100

Table 53: **Synthetic data MNAR simulation: oracle marginal odds ratio (mOR), 5% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome and MNAR-unobserved** scenario. The value of the estimand is 0.396. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Nominal coverage	Oracle coverage	Power	Prop. completed
Benchmark model	-0.003	-0.003	0.101	0.1	0.101	0.1	0.101	0.945	0.950	0.975	100
Complete-case	-0.073	-0.075	0.157	0.155	0.154	0.171	0.171	0.916	0.926	0.542	100
Confounded model	0.22	0.220	0.099	0.098	0.1	0.241	0.241	0.388	0.400	1.000	100
IPW	-0.076	-0.079	0.162	0.161	0.16	0.178	0.179	0.913	0.920	0.510	100
Raking (vanilla)	-0.01	-0.009	0.109	0.125	0.109	0.125	0.109	0.976	0.948	0.904	100
MICE	-0.01	-0.011	0.107	0.106	0.109	0.107	0.109	0.946	0.949	0.953	100
MI-RF	0.014	0.013	0.108	0.105	0.109	0.106	0.11	0.943	0.950	0.968	100
IPCW-TMLE-M	-0.081	-0.083	0.182	0.178	0.182	0.195	0.2	0.913	0.928	0.419	100
IPCW-TMLE-MTO	-0.08	-0.084	0.177	0.168	0.174	0.186	0.193	0.906	0.925	0.463	100
IPCW-a-TMLE-M	-0.081	-0.084	0.182	0.178	0.183	0.195	0.201	0.915	0.931	0.420	100
IPCW-a-TMLE-MTO	-0.08	-0.085	0.177	0.168	0.175	0.186	0.195	0.905	0.923	0.466	100
r-IPCW-TMLE-MTO	-0.082	-0.086	0.177	0.168	0.174	0.187	0.194	0.902	0.922	0.458	100

Table 54: **Synthetic data MNAR simulation: census marginal odds ratio (mOR), 5% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome and MNAR-unobserved** scenario. The value of the estimand is 0.39. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Oracle coverage	Nominal coverage	Power	Prop. completed
Benchmark model	0.003	0.003	0.101	0.1	0.101	0.1	0.101	0.950	0.949	0.975	100
Complete-case	-0.067	-0.069	0.157	0.155	0.154	0.168	0.169	0.930	0.922	0.542	100
Confounded model	0.226	0.226	0.099	0.098	0.1	0.246	0.247	0.374	0.366	1.000	100
IPW	-0.07	-0.073	0.162	0.161	0.16	0.175	0.176	0.922	0.917	0.510	100
Raking (vanilla)	-0.003	-0.003	0.109	0.125	0.109	0.125	0.109	0.949	0.976	0.904	100
MICE	-0.004	-0.005	0.107	0.106	0.109	0.106	0.109	0.949	0.949	0.953	100
MI-RF	0.02	0.019	0.108	0.105	0.109	0.107	0.111	0.946	0.942	0.968	100
IPCW-TMLE-M	-0.075	-0.077	0.182	0.178	0.182	0.193	0.197	0.930	0.918	0.419	100
IPCW-TMLE-MTO	-0.073	-0.078	0.177	0.168	0.174	0.183	0.19	0.928	0.909	0.463	100
IPCW-a-TMLE-M	-0.075	-0.078	0.182	0.178	0.183	0.193	0.199	0.933	0.919	0.420	100
IPCW-a-TMLE-MTO	-0.073	-0.079	0.177	0.168	0.175	0.183	0.192	0.928	0.908	0.466	100
r-IPCW-TMLE-MTO	-0.076	-0.079	0.177	0.168	0.174	0.185	0.192	0.926	0.907	0.458	100

Table 55: **Synthetic data MNAR simulation: oracle marginal odds ratio (mOR), 5% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome (unobserved covariate) and MNAR-unobserved** scenario. The value of the estimand is 0.395. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Nominal coverage	Oracle coverage	Power	Prop. completed
Benchmark model	0.001	-0.002	0.107	0.111	0.105	0.111	0.105	0.958	0.950	0.957	100
Complete-case*	-0.067	-0.065	0.166	0.166	0.165	0.18	0.177	0.928	0.926	0.510	100
Confounded model*	0.225	0.222	0.101	0.105	0.1	0.248	0.244	0.438	0.404	1.000	100
IPW*	-0.068	-0.067	0.175	0.173	0.171	0.186	0.184	0.920	0.930	0.478	100
Raking (vanilla)*	-0.005	-0.004	0.113	0.135	0.114	0.135	0.114	0.980	0.952	0.870	100
MICE*	-0.006	-0.007	0.11	0.114	0.109	0.114	0.109	0.957	0.949	0.940	100
MI-RF*	0.025	0.024	0.111	0.113	0.11	0.115	0.112	0.945	0.942	0.966	100
IPCW-TMLE-M	-0.076	-0.075	0.196	0.189	0.195	0.204	0.209	0.915	0.934	0.396	100
IPCW-TMLE-MTO	-0.075	-0.072	0.19	0.179	0.187	0.194	0.2	0.908	0.929	0.439	100
IPCW-a-TMLE-M	-0.076	-0.075	0.196	0.189	0.194	0.204	0.208	0.916	0.935	0.396	100
IPCW-a-TMLE-MTO	-0.074	-0.074	0.191	0.179	0.189	0.194	0.203	0.904	0.930	0.438	100
r-IPCW-TMLE-MTO	-0.076	-0.074	0.19	0.18	0.189	0.195	0.203	0.907	0.928	0.429	100

Table 56: **Synthetic data MNAR simulation: census marginal odds ratio (mOR), 5% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome (unobserved covariate) and MNAR-unobserved** scenario. The value of the estimand is 0.394. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Oracle coverage	Nominal coverage	Power	Prop. completed
Benchmark model	0.002	0.000	0.104	0.108	0.102	0.108	0.102	0.952	0.959	0.966	100
Complete-case	-0.066	-0.064	0.166	0.166	0.165	0.179	0.177	0.926	0.930	0.510	100
Confounded model	0.226	0.223	0.101	0.105	0.1	0.249	0.245	0.400	0.433	1.000	100
IPW	-0.067	-0.066	0.175	0.173	0.171	0.185	0.184	0.930	0.921	0.478	100
Raking (vanilla)	-0.004	-0.003	0.113	0.135	0.114	0.135	0.114	0.952	0.981	0.870	100
MICE	-0.004	-0.005	0.11	0.114	0.109	0.114	0.109	0.949	0.955	0.940	100
MI-RF	0.026	0.025	0.111	0.113	0.11	0.116	0.113	0.941	0.945	0.966	100
IPCW-TMLE-M*	-0.075	-0.073	0.196	0.189	0.195	0.204	0.208	0.934	0.916	0.396	100
IPCW-TMLE-MTO*	-0.073	-0.071	0.19	0.179	0.187	0.194	0.2	0.930	0.910	0.439	100
IPCW-a-TMLE-M*	-0.075	-0.074	0.196	0.189	0.194	0.204	0.208	0.936	0.917	0.396	100
IPCW-a-TMLE-MTO*	-0.073	-0.073	0.191	0.179	0.189	0.194	0.202	0.930	0.904	0.438	100
r-IPCW-TMLE-MTO*	-0.075	-0.073	0.19	0.18	0.189	0.195	0.202	0.929	0.909	0.429	100

MNAR: 5% outcome proportion, 80% missingness proportion

Table 57: **Synthetic data MNAR simulation: oracle marginal odds ratio (mOR), 5% outcome proportion, 80% missing proportion**. Comparing estimators under the **simple outcome and MNAR-value** scenario. The value of the estimand is 0.396. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Nominal coverage	Oracle coverage	Power	Prop. completed
Benchmark model	-0.003	-0.004	0.101	0.1	0.103	0.1	0.103	0.955	0.955	0.977	100
Complete-case	-0.126	-0.129	0.325	0.309	0.32	0.333	0.345	0.913	0.929	0.135	100
Confounded model	0.22	0.220	0.098	0.098	0.101	0.241	0.242	0.398	0.404	1.000	100
IPW	-0.123	-0.134	0.383	0.36	0.382	0.38	0.405	0.908	0.938	0.113	100
Raking (vanilla)	-0.113	-0.112	0.167	0.18	0.168	0.213	0.202	0.922	0.901	0.356	100
MICE	-0.119	-0.115	0.154	0.155	0.151	0.195	0.19	0.863	0.871	0.464	100
MI-XGB	-0.1	-0.098	0.157	0.147	0.156	0.178	0.184	0.886	0.896	0.536	100
MI-RF	-0.031	-0.030	0.14	0.115	0.144	0.119	0.147	0.883	0.945	0.832	100
IPCW-TMLE-M	-0.141	-0.158	0.433	0.379	0.416	0.404	0.445	0.886	0.942	0.106	100
IPCW-TMLE-MTO	-0.127	-0.134	0.401	0.345	0.386	0.368	0.408	0.886	0.941	0.140	100

Table 58: **Synthetic data MNAR simulation: census marginal odds ratio (mOR), 5% outcome proportion, 80% missing proportion**. Comparing estimators under the **simple outcome and MNAR-value** scenario. The value of the estimand is 0.39. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Oracle coverage	Nominal coverage	Power	Prop. completed
Benchmark model	0.003	0.002	0.101	0.1	0.103	0.1	0.103	0.954	0.955	0.977	100
Complete-case	-0.119	-0.123	0.325	0.309	0.32	0.331	0.343	0.931	0.914	0.135	100
Confounded model	0.226	0.226	0.098	0.098	0.101	0.246	0.247	0.382	0.375	1.000	100
IPW	-0.117	-0.128	0.383	0.36	0.382	0.378	0.403	0.941	0.910	0.113	100
Raking (vanilla)	-0.107	-0.105	0.167	0.18	0.168	0.209	0.198	0.905	0.926	0.356	100
MICE	-0.113	-0.109	0.154	0.155	0.151	0.191	0.187	0.880	0.871	0.464	100
MI-XGB	-0.094	-0.091	0.157	0.147	0.156	0.174	0.181	0.902	0.890	0.536	100
MI-RF	-0.025	-0.024	0.14	0.115	0.144	0.118	0.146	0.948	0.887	0.832	100
IPCW-TMLE-M	-0.135	-0.152	0.433	0.379	0.416	0.402	0.443	0.944	0.890	0.106	100
IPCW-TMLE-MTO	-0.121	-0.128	0.401	0.345	0.386	0.366	0.406	0.941	0.888	0.140	100

Table 59: **Synthetic data MNAR simulation: oracle marginal odds ratio (mOR), 5% outcome proportion, 80% missing proportion**. Comparing estimators under the **complex outcome and MNAR-value** scenario. The value of the estimand is 0.297. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Nominal coverage	Oracle coverage	Power	Prop. completed
Benchmark model	0.003	0.002	0.089	0.086	0.087	0.086	0.087	0.938	0.944	0.930	100
Complete-case*	-0.064	-0.071	0.257	0.255	0.253	0.263	0.263	0.944	0.945	0.138	100
Confounded model*	-0.27	-0.270	0.098	0.097	0.097	0.287	0.287	0.203	0.206	0.064	100
IPW*	-0.058	-0.066	0.295	0.285	0.285	0.291	0.292	0.928	0.944	0.115	100
Raking (vanilla)*	-0.666	-0.667	0.162	0.172	0.155	0.688	0.685	0.039	0.019	0.599	100
MICE*	-0.697	-0.700	0.14	0.131	0.142	0.709	0.714	0.006	0.002	0.832	100
MI-RF*	-0.656	-0.659	0.126	0.11	0.125	0.665	0.671	0.000	0.000	0.868	100
IPCW-TMLE-M	-0.112	-0.134	0.333	0.302	0.307	0.322	0.335	0.901	0.938	0.094	100
IPCW-TMLE-MTO	-0.106	-0.110	0.306	0.274	0.291	0.294	0.311	0.895	0.939	0.120	100
IPCW-a-TMLE-M	-0.111	-0.132	0.332	0.301	0.307	0.321	0.335	0.900	0.940	0.094	100
IPCW-a-TMLE-MTO	-0.102	-0.108	0.296	0.264	0.278	0.283	0.298	0.892	0.934	0.124	100
r-IPCW-TMLE-MTO	-0.088	-0.100	0.32	0.278	0.297	0.291	0.313	0.893	0.946	0.138	100

Table 60: **Synthetic data MNAR simulation: census marginal odds ratio (mOR), 5% outcome proportion, 80% missing proportion**. Comparing estimators under the **complex outcome and MNAR-value** scenario. The value of the estimand is 0.369. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Oracle coverage	Nominal coverage	Power	Prop. completed
Benchmark model	-0.005	-0.006	0.096	0.095	0.095	0.095	0.095	0.949	0.946	0.970	100
Complete-case	-0.136	-0.143	0.257	0.255	0.253	0.289	0.29	0.925	0.912	0.138	100
Confounded model	-0.342	-0.342	0.098	0.097	0.097	0.356	0.355	0.063	0.062	0.064	100
IPW	-0.13	-0.138	0.295	0.285	0.285	0.314	0.316	0.927	0.901	0.115	100
Raking (vanilla)	-0.738	-0.739	0.162	0.172	0.155	0.757	0.755	0.008	0.022	0.599	100
MICE	-0.769	-0.772	0.14	0.131	0.142	0.78	0.785	0.000	0.004	0.832	100
MI-RF	-0.728	-0.731	0.126	0.11	0.125	0.736	0.741	0.000	0.000	0.868	100
IPCW-TMLE-M*	-0.184	-0.206	0.333	0.302	0.307	0.353	0.37	0.918	0.867	0.094	100
IPCW-TMLE-MTO*	-0.177	-0.182	0.306	0.274	0.291	0.326	0.343	0.914	0.856	0.120	100
IPCW-a-TMLE-M*	-0.183	-0.204	0.332	0.301	0.307	0.353	0.369	0.919	0.868	0.094	100
IPCW-a-TMLE-MTO*	-0.174	-0.180	0.296	0.264	0.278	0.316	0.331	0.910	0.856	0.124	100
r-IPCW-TMLE-MTO*	-0.16	-0.172	0.32	0.278	0.297	0.32	0.343	0.925	0.854	0.138	100

Table 61: **Synthetic data MNAR simulation: oracle marginal odds ratio (mOR), 5% outcome proportion, 80% missing proportion**. Comparing estimators under the **simple outcome and MNAR-unobserved** scenario. The value of the estimand is 0.396. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Nominal coverage	Oracle coverage	Power	Prop. completed
Benchmark model	0	0.002	0.102	0.1	0.101	0.1	0.101	0.952	0.955	0.978	100
Complete-case	-0.057	-0.064	0.328	0.32	0.321	0.325	0.328	0.948	0.952	0.179	100
Confounded model	0.224	0.225	0.099	0.098	0.101	0.244	0.247	0.374	0.389	1.000	100
IPW	-0.051	-0.062	0.382	0.363	0.372	0.367	0.377	0.934	0.950	0.154	100
Raking (vanilla)	-0.009	-0.008	0.154	0.179	0.152	0.179	0.152	0.973	0.940	0.600	100
MICE	-0.011	-0.008	0.134	0.133	0.131	0.133	0.131	0.943	0.950	0.814	100
MI-RF	0.108	0.115	0.12	0.112	0.118	0.155	0.164	0.821	0.860	0.986	100
IPCW-TMLE-M	-0.063	-0.085	0.421	0.381	0.406	0.386	0.414	0.922	0.943	0.150	100
IPCW-TMLE-MTO	-0.054	-0.075	0.391	0.35	0.38	0.355	0.388	0.915	0.946	0.189	100
IPCW-a-TMLE-M	-0.063	-0.091	0.42	0.381	0.407	0.386	0.417	0.921	0.946	0.150	100
IPCW-a-TMLE-MTO	-0.053	-0.069	0.387	0.347	0.373	0.351	0.38	0.918	0.947	0.189	100
r-IPCW-TMLE-MTO	-0.057	-0.080	0.394	0.352	0.391	0.356	0.399	0.916	0.947	0.184	100

Table 62: **Synthetic data MNAR simulation: census marginal odds ratio (mOR), 5% outcome proportion, 80% missing proportion**. Comparing estimators under the **simple outcome and MNAR-unobserved** scenario. The value of the estimand is 0.39. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Oracle coverage	Nominal coverage	Power	Prop. completed
Benchmark model	0.006	0.009	0.102	0.1	0.101	0.101	0.102	0.952	0.951	0.978	100
Complete-case	-0.051	-0.058	0.328	0.32	0.321	0.324	0.327	0.953	0.948	0.179	100
Confounded model	0.23	0.231	0.099	0.098	0.101	0.25	0.252	0.363	0.358	1.000	100
IPW	-0.045	-0.055	0.382	0.363	0.372	0.366	0.376	0.951	0.935	0.154	100
Raking (vanilla)	-0.003	-0.002	0.154	0.179	0.152	0.179	0.152	0.944	0.974	0.600	100
MICE	-0.005	-0.002	0.134	0.133	0.131	0.133	0.131	0.952	0.945	0.814	100
MI-RF	0.114	0.121	0.12	0.112	0.118	0.159	0.169	0.847	0.804	0.986	100
IPCW-TMLE-M	-0.057	-0.078	0.421	0.381	0.406	0.385	0.413	0.942	0.923	0.150	100
IPCW-TMLE-MTO	-0.048	-0.069	0.391	0.35	0.38	0.354	0.387	0.947	0.915	0.189	100
IPCW-a-TMLE-M	-0.057	-0.085	0.42	0.381	0.407	0.385	0.416	0.947	0.922	0.150	100
IPCW-a-TMLE-MTO	-0.046	-0.063	0.387	0.347	0.373	0.35	0.379	0.947	0.918	0.189	100
r-IPCW-TMLE-MTO	-0.051	-0.074	0.394	0.352	0.391	0.355	0.397	0.947	0.916	0.184	100

Table 63: **Synthetic data MNAR simulation: oracle marginal odds ratio (mOR), 5% outcome proportion, 80% missing proportion**. Comparing estimators under the **simple outcome (unobserved covariate) and MNAR-unobserved** scenario. The value of the estimand is 0.395. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Nominal coverage	Oracle coverage	Power	Prop. completed
Benchmark model	0	0.000	0.111	0.111	0.112	0.111	0.112	0.952	0.951	0.949	100
Complete-case*	-0.044	-0.053	0.354	0.347	0.345	0.349	0.349	0.945	0.945	0.168	100
Confounded model*	0.224	0.220	0.105	0.105	0.106	0.247	0.244	0.433	0.440	1.000	100
IPW*	-0.043	-0.049	0.413	0.392	0.407	0.394	0.41	0.930	0.952	0.142	100
Raking (vanilla)*	-0.006	-0.004	0.169	0.194	0.166	0.194	0.167	0.974	0.946	0.532	100
MICE*	-0.007	-0.005	0.145	0.142	0.148	0.142	0.148	0.945	0.948	0.768	100
MI-XGB*	0.056	0.058	0.146	0.132	0.152	0.143	0.163	0.891	0.935	0.890	100
MI-RF*	0.122	0.122	0.126	0.119	0.126	0.17	0.176	0.803	0.830	0.985	100
IPCW-TMLE-M	-0.069	-0.077	0.452	0.406	0.439	0.412	0.446	0.915	0.948	0.134	100
IPCW-TMLE-MTO	-0.052	-0.054	0.424	0.376	0.405	0.38	0.408	0.913	0.948	0.165	100
IPCW-a-TMLE-M	-0.068	-0.075	0.452	0.406	0.439	0.411	0.446	0.912	0.946	0.132	100
IPCW-a-TMLE-MTO	-0.049	-0.052	0.419	0.372	0.403	0.375	0.406	0.915	0.946	0.168	100

Table 64: **Synthetic data MNAR simulation: census marginal odds ratio (mOR), 5% outcome proportion, 80% missing proportion**. Comparing estimators under the **simple outcome (unobserved covariate) and MNAR-unobserved** scenario. The value of the estimand is 0.394. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Oracle coverage	Nominal coverage	Power	Prop. completed
Benchmark model	0.001	0.000	0.108	0.108	0.106	0.108	0.106	0.950	0.949	0.956	100
Complete-case	-0.043	-0.052	0.354	0.347	0.345	0.349	0.349	0.945	0.945	0.168	100
Confounded model	0.225	0.221	0.105	0.105	0.106	0.249	0.245	0.435	0.430	1.000	100
IPW	-0.042	-0.048	0.413	0.392	0.407	0.394	0.41	0.952	0.930	0.142	100
Raking (vanilla)	-0.005	-0.003	0.169	0.194	0.166	0.194	0.167	0.946	0.973	0.532	100
MICE	-0.005	-0.004	0.145	0.142	0.148	0.142	0.148	0.949	0.945	0.768	100
MI-XGB	0.057	0.059	0.146	0.132	0.152	0.144	0.163	0.936	0.890	0.890	100
MI-RF	0.123	0.124	0.126	0.119	0.126	0.171	0.177	0.828	0.799	0.985	100
IPCW-TMLE-M*	-0.068	-0.076	0.452	0.406	0.439	0.412	0.445	0.948	0.915	0.134	100
IPCW-TMLE-MTO*	-0.051	-0.053	0.424	0.376	0.405	0.38	0.408	0.948	0.913	0.165	100
IPCW-a-TMLE-M*	-0.067	-0.074	0.452	0.406	0.439	0.411	0.445	0.946	0.912	0.132	100
IPCW-a-TMLE-MTO*	-0.048	-0.051	0.419	0.372	0.403	0.375	0.406	0.948	0.915	0.168	100

Other scenarios

Table 65: **Synthetic data MAR simulation: oracle marginal odds ratio (mOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome (no treatment effect) and simple MAR (no dependence on Y)** scenario. The value of the estimand is 0. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Nominal coverage	Oracle coverage	Power	Prop. completed
Benchmark model	-0.003	-0.004	0.071	0.071	0.072	0.071	0.072	0.950	0.949	0.049	100
Complete-case	-0.003	-0.004	0.095	0.094	0.094	0.094	0.094	0.944	0.945	0.056	100
Confounded model	0.215	0.215	0.071	0.07	0.073	0.226	0.227	0.140	0.142	0.862	100
IPW	-0.004	-0.005	0.109	0.108	0.109	0.109	0.109	0.944	0.950	0.056	100
Raking (vanilla)	-0.002	-0.004	0.077	0.077	0.077	0.077	0.077	0.948	0.950	0.053	100
MICE	-0.002	-0.003	0.075	0.074	0.074	0.074	0.074	0.948	0.952	0.052	100
MI-XGB	-0.006	-0.006	0.077	0.077	0.078	0.077	0.079	0.947	0.946	0.052	100
MI-RF	0.007	0.007	0.076	0.075	0.076	0.075	0.077	0.946	0.948	0.055	100
IPCW-TMLE-M	-0.008	-0.006	0.135	0.128	0.137	0.128	0.137	0.938	0.951	0.062	100
IPCW-TMLE-MTO	-0.005	-0.004	0.125	0.116	0.124	0.116	0.124	0.934	0.948	0.067	100
IPCW-a-TMLE-M	-0.008	-0.007	0.135	0.128	0.136	0.128	0.136	0.939	0.950	0.061	100
IPCW-a-TMLE-MTO	-0.005	-0.005	0.123	0.115	0.121	0.115	0.121	0.931	0.949	0.070	100

Table 66: **Synthetic data MAR simulation: census marginal odds ratio (mOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome (no treatment effect) and simple MAR (no dependence on Y)** scenario. The value of the estimand is 0.005. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Oracle coverage	Nominal coverage	Power	Prop. completed
Benchmark model	-0.007	-0.008	0.071	0.071	0.072	0.072	0.073	0.948	0.949	0.049	100
Complete-case	-0.008	-0.008	0.095	0.094	0.094	0.094	0.094	0.945	0.944	0.056	100
Confounded model	0.21	0.211	0.071	0.07	0.073	0.222	0.223	0.158	0.157	0.862	100
IPW	-0.009	-0.009	0.109	0.108	0.109	0.109	0.109	0.949	0.944	0.056	100
Raking (vanilla)	-0.007	-0.008	0.077	0.077	0.077	0.077	0.077	0.950	0.946	0.053	100
MICE	-0.006	-0.007	0.075	0.074	0.074	0.074	0.075	0.950	0.946	0.052	100
MI-XGB	-0.011	-0.010	0.077	0.077	0.078	0.078	0.079	0.943	0.945	0.052	100
MI-RF	0.003	0.003	0.076	0.075	0.076	0.075	0.076	0.948	0.946	0.055	100
IPCW-TMLE-M	-0.012	-0.011	0.135	0.128	0.137	0.129	0.137	0.950	0.936	0.062	100
IPCW-TMLE-MTO	-0.01	-0.008	0.125	0.116	0.124	0.116	0.124	0.949	0.931	0.067	100
IPCW-a-TMLE-M	-0.012	-0.011	0.135	0.128	0.136	0.128	0.137	0.951	0.935	0.061	100
IPCW-a-TMLE-MTO	-0.009	-0.010	0.123	0.115	0.121	0.115	0.121	0.949	0.930	0.070	100

Table 67: **Synthetic data MAR simulation: oracle marginal odds ratio (mOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome (no treatment effect) and simple MAR** scenario. The value of the estimand is 0. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Nominal coverage	Oracle coverage	Power	Prop. completed
Benchmark model	-0.001	0.000	0.071	0.071	0.072	0.071	0.072	0.945	0.945	0.055	100
Complete-case	-0.189	-0.188	0.127	0.124	0.128	0.226	0.227	0.664	0.679	0.335	100
Confounded model	0.216	0.217	0.071	0.07	0.07	0.228	0.228	0.134	0.134	0.867	100
IPW	-0.007	-0.007	0.136	0.134	0.136	0.135	0.137	0.945	0.952	0.055	100
Raking (vanilla)	-0.001	0.000	0.078	0.079	0.078	0.079	0.078	0.951	0.948	0.049	100
MICE	0	0.001	0.076	0.077	0.075	0.077	0.075	0.950	0.947	0.050	100
MI-XGB	-0.003	-0.001	0.078	0.078	0.077	0.078	0.077	0.952	0.949	0.048	100
MI-RF	0.011	0.014	0.078	0.076	0.078	0.077	0.079	0.942	0.948	0.058	100
IPCW-TMLE-M	-0.029	-0.028	0.16	0.155	0.161	0.158	0.163	0.940	0.949	0.060	100
IPCW-TMLE-MTO	-0.035	-0.033	0.149	0.143	0.154	0.147	0.158	0.933	0.945	0.066	100

Table 68: **Synthetic data MAR simulation: census marginal odds ratio (mOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome (no treatment effect) and simple MAR** scenario. The value of the estimand is 0.005. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Oracle coverage	Nominal coverage	Power	Prop. completed
Benchmark model	-0.005	-0.004	0.071	0.071	0.072	0.072	0.072	0.944	0.944	0.055	100
Complete-case	-0.193	-0.192	0.127	0.124	0.128	0.23	0.231	0.667	0.652	0.335	100
Confounded model	0.212	0.213	0.071	0.07	0.07	0.223	0.224	0.149	0.147	0.867	100
IPW	-0.011	-0.011	0.136	0.134	0.136	0.135	0.137	0.950	0.944	0.055	100
Raking (vanilla)	-0.006	-0.005	0.078	0.079	0.078	0.079	0.078	0.950	0.952	0.049	100
MICE	-0.004	-0.003	0.076	0.077	0.075	0.077	0.075	0.946	0.952	0.050	100
MI-XGB	-0.007	-0.006	0.078	0.078	0.077	0.078	0.077	0.946	0.949	0.048	100
MI-RF	0.007	0.010	0.078	0.076	0.078	0.076	0.078	0.946	0.943	0.058	100
IPCW-TMLE-M	-0.033	-0.032	0.16	0.155	0.161	0.159	0.164	0.945	0.937	0.060	100
IPCW-TMLE-MTO	-0.04	-0.037	0.149	0.143	0.154	0.148	0.159	0.944	0.930	0.066	100

Table 69: **Synthetic data MAR simulation: oracle marginal odds ratio (mOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome and simple MAR (no dependence on Y)** scenario. The value of the estimand is 0.382. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Nominal coverage	Oracle coverage	Power	Prop. completed
Benchmark model	0.001	0.000	0.066	0.066	0.067	0.066	0.067	0.954	0.954	1.000	100
Complete-case	0	-0.001	0.089	0.088	0.091	0.088	0.091	0.945	0.949	0.993	100
Confounded model	0.217	0.219	0.066	0.065	0.066	0.227	0.228	0.086	0.086	1.000	100
IPW	-0.002	-0.005	0.105	0.101	0.104	0.101	0.105	0.940	0.947	0.969	100
Raking (vanilla)	0.001	0.001	0.072	0.071	0.074	0.071	0.074	0.945	0.950	1.000	100
MICE	0	0.002	0.069	0.069	0.072	0.069	0.072	0.953	0.954	1.000	100
MI-XGB	-0.005	-0.005	0.071	0.072	0.072	0.072	0.072	0.951	0.951	1.000	100
MI-RF	0.008	0.009	0.07	0.07	0.071	0.07	0.072	0.950	0.951	1.000	100
IPCW-TMLE-M	-0.003	-0.008	0.124	0.118	0.119	0.118	0.12	0.936	0.949	0.906	100
IPCW-TMLE-MTO	-0.002	-0.005	0.117	0.106	0.114	0.107	0.114	0.920	0.944	0.944	100

Table 70: **Synthetic data MAR simulation: census marginal odds ratio (mOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome and simple MAR (no dependence on Y)** scenario. The value of the estimand is 0.381. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Oracle coverage	Nominal coverage	Power	Prop. completed
Benchmark model	0.001	0.001	0.066	0.066	0.067	0.066	0.067	0.953	0.954	1.000	100
Complete-case	0.001	0.000	0.089	0.088	0.091	0.088	0.091	0.949	0.946	0.993	100
Confounded model	0.218	0.219	0.066	0.065	0.066	0.227	0.229	0.083	0.084	1.000	100
IPW	-0.002	-0.004	0.105	0.101	0.104	0.101	0.104	0.947	0.941	0.969	100
Raking (vanilla)	0.001	0.001	0.072	0.071	0.074	0.071	0.074	0.950	0.946	1.000	100
MICE	0.001	0.002	0.069	0.069	0.072	0.069	0.072	0.954	0.953	1.000	100
MI-XGB	-0.004	-0.005	0.071	0.072	0.072	0.072	0.072	0.950	0.951	1.000	100
MI-RF	0.009	0.009	0.07	0.07	0.071	0.07	0.072	0.951	0.950	1.000	100
IPCW-TMLE-M	-0.002	-0.007	0.124	0.118	0.119	0.118	0.12	0.949	0.936	0.906	100
IPCW-TMLE-MTO	-0.002	-0.004	0.117	0.106	0.114	0.107	0.114	0.945	0.920	0.944	100

Table 71: **Synthetic data MAR simulation: oracle marginal odds ratio (mOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome and simple MAR (no dependence on Y)** scenario. The value of the estimand is 0.382. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Nominal coverage	Oracle coverage	Power	Prop. completed
Benchmark model	0	0.002	0.068	0.066	0.069	0.066	0.069	0.948	0.952	1.000	100
Complete-case	0	-0.003	0.16	0.157	0.157	0.157	0.157	0.944	0.946	0.681	100
Confounded model	0.215	0.216	0.067	0.065	0.068	0.225	0.227	0.096	0.103	1.000	100
IPW	0.009	-0.010	0.66	0.23	0.246	0.23	0.246	0.939	0.998	0.369	100
Raking (vanilla)	-0.003	-0.004	0.104	0.102	0.105	0.102	0.105	0.939	0.953	0.950	100
MICE	-0.002	-0.002	0.084	0.081	0.085	0.081	0.085	0.944	0.954	0.994	100
MI-RF	0.027	0.027	0.089	0.078	0.089	0.083	0.093	0.905	0.937	0.997	100
IPCW-TMLE-M	-0.015	-0.016	0.27	0.248	0.277	0.249	0.277	0.930	0.950	0.322	100
IPCW-TMLE-MTO	-0.007	-0.008	0.243	0.214	0.248	0.214	0.248	0.916	0.953	0.427	100

Table 72: **Synthetic data MAR simulation: census marginal odds ratio (mOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome and simple MAR (no dependence on Y)** scenario. The value of the estimand is 0.381. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Oracle coverage	Nominal coverage	Power	Prop. completed
Benchmark model	0	0.002	0.068	0.066	0.069	0.066	0.069	0.951	0.948	1.000	100
Complete-case	0.001	-0.003	0.16	0.157	0.157	0.157	0.157	0.946	0.944	0.681	100
Confounded model	0.216	0.217	0.067	0.065	0.068	0.226	0.228	0.101	0.094	1.000	100
IPW	0.01	-0.009	0.66	0.23	0.246	0.231	0.246	0.998	0.940	0.369	100
Raking (vanilla)	-0.002	-0.003	0.104	0.102	0.105	0.102	0.105	0.952	0.939	0.950	100
MICE	-0.002	-0.002	0.084	0.081	0.085	0.081	0.085	0.956	0.945	0.994	100
MI-RF	0.028	0.028	0.089	0.078	0.089	0.083	0.093	0.937	0.904	0.997	100
IPCW-TMLE-M	-0.014	-0.015	0.27	0.248	0.277	0.249	0.277	0.950	0.931	0.322	100
IPCW-TMLE-MTO	-0.006	-0.007	0.243	0.214	0.248	0.214	0.248	0.953	0.916	0.427	100

Table 73: **Synthetic data MAR simulation: oracle marginal odds ratio (mOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **semi-complex outcome and simple MAR** scenario. The value of the estimand is 0. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star. The semi-complex outcome is a function of exponentiated and squared terms on Z.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Nominal coverage	Oracle coverage	Power	Prop. completed
Benchmark model	-0.002	-0.001	0.038	0.037	0.038	0.037	0.038	0.945	0.953	0.055	100
Complete-case*	0.077	0.079	0.11	0.108	0.105	0.133	0.132	0.879	0.892	0.121	100
Confounded model*	0.128	0.128	0.048	0.048	0.047	0.137	0.137	0.245	0.240	0.755	100
IPW*	0.068	0.069	0.106	0.103	0.105	0.123	0.126	0.890	0.898	0.110	100
Raking (vanilla)*	0.071	0.071	0.056	0.057	0.057	0.091	0.091	0.752	0.757	0.248	100
MICE*	0.077	0.077	0.055	0.055	0.054	0.094	0.094	0.718	0.711	0.283	100
MI-XGB*	0.094	0.095	0.056	0.055	0.056	0.109	0.11	0.598	0.615	0.402	100
MI-RF*	0.1	0.099	0.055	0.053	0.054	0.113	0.113	0.543	0.565	0.457	100
IPCW-TMLE-M	-0.069	-0.070	0.185	0.162	0.182	0.176	0.195	0.859	0.930	0.141	100
IPCW-TMLE-MTO	-0.026	-0.027	0.1	0.088	0.094	0.092	0.098	0.895	0.939	0.105	100

Table 74: **Synthetic data MAR simulation: census marginal odds ratio (mOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **semi-complex outcome and simple MAR** scenario. The value of the estimand is 0.076. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star. The semi-complex outcome is a function of exponentiated and squared terms on Z.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Oracle coverage	Nominal coverage	Power	Prop. completed
Benchmark model	-0.004	-0.004	0.05	0.05	0.049	0.05	0.049	0.943	0.948	0.296	100
Complete-case	0.001	0.003	0.11	0.108	0.105	0.108	0.106	0.951	0.939	0.121	100
Confounded model	0.052	0.052	0.048	0.048	0.047	0.071	0.07	0.812	0.806	0.755	100
IPW	-0.008	-0.008	0.106	0.103	0.105	0.103	0.105	0.951	0.940	0.110	100
Raking (vanilla)	-0.005	-0.006	0.056	0.057	0.057	0.057	0.057	0.950	0.951	0.248	100
MICE	0	0.001	0.055	0.055	0.054	0.055	0.054	0.949	0.948	0.283	100
MI-XGB	0.018	0.018	0.056	0.055	0.056	0.058	0.059	0.931	0.926	0.402	100
MI-RF	0.023	0.023	0.055	0.053	0.054	0.058	0.058	0.924	0.916	0.457	100
IPCW-TMLE-M*	-0.145	-0.146	0.185	0.162	0.182	0.218	0.233	0.878	0.774	0.141	100
IPCW-TMLE-MTO*	-0.103	-0.103	0.1	0.088	0.094	0.135	0.139	0.832	0.738	0.105	100

Table 75: **Synthetic data MAR simulation: oracle marginal odds ratio (mOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **semi-complex outcome and simple MAR** scenario. The value of the estimand is -0.177. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star. The semi-complex outcome is a function of exponentiated and squared terms on Z.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Nominal coverage	Oracle coverage	Power	Prop. completed
Benchmark model	-0.001	-0.001	0.038	0.038	0.037	0.038	0.037	0.940	0.944	0.997	100
Complete-case*	0.077	0.078	0.115	0.115	0.114	0.138	0.139	0.886	0.896	0.128	100
Confounded model*	0.145	0.146	0.052	0.051	0.053	0.154	0.155	0.191	0.196	0.088	100
IPW*	0.086	0.087	0.109	0.109	0.109	0.139	0.139	0.874	0.883	0.137	100
Raking (vanilla)*	0.09	0.091	0.061	0.059	0.061	0.108	0.109	0.658	0.678	0.312	100
MICE*	0.097	0.097	0.059	0.058	0.057	0.113	0.113	0.607	0.621	0.281	100
MI-XGB*	0.115	0.116	0.059	0.058	0.06	0.129	0.131	0.484	0.502	0.181	100
MI-RF*	0.121	0.121	0.059	0.056	0.058	0.133	0.134	0.416	0.449	0.176	100
IPCW-TMLE-M	-0.076	-0.076	0.198	0.172	0.194	0.188	0.209	0.858	0.932	0.390	100
IPCW-TMLE-MTO	-0.029	-0.025	0.113	0.096	0.112	0.1	0.114	0.884	0.941	0.566	100

Table 76: **Synthetic data MAR simulation: census marginal odds ratio (mOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **semi-complex outcome and simple MAR** scenario. The value of the estimand is -0.083. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star. The semi-complex outcome is a function of exponentiated and squared terms on Z.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Oracle coverage	Nominal coverage	Power	Prop. completed
Benchmark model	-0.003	-0.003	0.054	0.053	0.054	0.053	0.054	0.951	0.944	0.375	100
Complete-case	-0.016	-0.015	0.115	0.115	0.114	0.116	0.115	0.946	0.949	0.128	100
Confounded model	0.052	0.052	0.052	0.051	0.053	0.073	0.074	0.829	0.813	0.088	100
IPW	-0.007	-0.006	0.109	0.109	0.109	0.109	0.109	0.947	0.944	0.137	100
Raking (vanilla)	-0.003	-0.003	0.061	0.059	0.061	0.059	0.061	0.950	0.940	0.312	100
MICE	0.004	0.004	0.059	0.058	0.057	0.058	0.058	0.950	0.945	0.281	100
MI-XGB	0.022	0.023	0.059	0.058	0.06	0.062	0.064	0.934	0.918	0.181	100
MI-RF	0.028	0.028	0.059	0.056	0.058	0.062	0.064	0.923	0.904	0.176	100
IPCW-TMLE-M*	-0.17	-0.169	0.198	0.172	0.194	0.241	0.258	0.866	0.746	0.390	100
IPCW-TMLE-MTO*	-0.122	-0.118	0.113	0.096	0.112	0.155	0.162	0.811	0.700	0.566	100

Table 77: **Synthetic data MAR simulation: oracle marginal odds ratio (mOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **semi-complex outcome and simple MAR** scenario. The value of the estimand is 0. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star. The semi-complex outcome is a function of exponentiated and squared terms on W.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Nominal coverage	Oracle coverage	Power	Prop. completed
Benchmark model	0.001	0.001	0.037	0.037	0.038	0.037	0.038	0.949	0.950	0.051	100
Complete-case*	0.026	0.028	0.095	0.095	0.096	0.098	0.1	0.932	0.940	0.068	100
Confounded model*	-0.249	-0.250	0.072	0.071	0.072	0.259	0.26	0.060	0.071	0.941	100
IPW*	0.071	0.072	0.091	0.092	0.089	0.116	0.115	0.878	0.879	0.121	100
Raking (vanilla)*	0.077	0.077	0.073	0.07	0.074	0.104	0.106	0.792	0.818	0.206	100
MICE*	0.057	0.057	0.058	0.06	0.058	0.083	0.082	0.854	0.833	0.146	100
MI-XGB*	0.067	0.069	0.085	0.077	0.083	0.103	0.108	0.819	0.884	0.179	100
MI-RF*	0.126	0.125	0.067	0.063	0.067	0.14	0.142	0.490	0.525	0.510	100
IPCW-TMLE-M	-0.053	-0.051	0.156	0.142	0.148	0.151	0.156	0.892	0.937	0.108	100
IPCW-TMLE-MTO	-0.019	-0.019	0.087	0.08	0.087	0.082	0.089	0.919	0.947	0.082	100

Table 78: **Synthetic data MAR simulation: census marginal odds ratio (mOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **semi-complex outcome and simple MAR** scenario. The value of the estimand is 0.076. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star. The semi-complex outcome is a function of exponentiated and squared terms on W.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Oracle coverage	Nominal coverage	Power	Prop. completed
Benchmark model	0	0.000	0.052	0.05	0.051	0.05	0.051	0.950	0.943	0.330	100
Complete-case	-0.051	-0.048	0.095	0.095	0.096	0.107	0.107	0.926	0.929	0.068	100
Confounded model	-0.326	-0.326	0.072	0.071	0.072	0.333	0.334	0.006	0.005	0.941	100
IPW	-0.005	-0.004	0.091	0.092	0.089	0.092	0.089	0.950	0.953	0.121	100
Raking (vanilla)	0.001	0.000	0.073	0.07	0.074	0.07	0.074	0.950	0.940	0.206	100
MICE	-0.019	-0.019	0.058	0.06	0.058	0.063	0.061	0.940	0.945	0.146	100
MI-XGB	-0.009	-0.007	0.085	0.077	0.083	0.078	0.083	0.950	0.921	0.179	100
MI-RF	0.049	0.049	0.067	0.063	0.067	0.08	0.083	0.883	0.855	0.510	100
IPCW-TMLE-M*	-0.129	-0.127	0.156	0.142	0.148	0.192	0.195	0.863	0.777	0.108	100
IPCW-TMLE-MTO*	-0.095	-0.095	0.087	0.08	0.087	0.124	0.129	0.806	0.734	0.082	100

Table 79: **Synthetic data MAR simulation: oracle marginal odds ratio (mOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **semi-complex outcome and simple MAR** scenario. The value of the estimand is -0.175. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star. The semi-complex outcome is a function of exponentiated and squared terms on W.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Nominal coverage	Oracle coverage	Power	Prop. completed
Benchmark model	-0.001	0.000	0.038	0.038	0.039	0.038	0.039	0.946	0.950	0.997	100
Complete-case*	0.028	0.030	0.099	0.1	0.102	0.104	0.106	0.945	0.947	0.304	100
Confounded model*	-0.264	-0.263	0.076	0.075	0.077	0.274	0.274	0.052	0.062	1.000	100
IPW*	0.091	0.090	0.097	0.097	0.097	0.133	0.132	0.836	0.842	0.140	100
Raking (vanilla)*	0.094	0.095	0.073	0.073	0.074	0.119	0.12	0.742	0.745	0.193	100
MICE*	0.105	0.106	0.056	0.062	0.055	0.122	0.119	0.617	0.538	0.176	100
MI-XGB*	0.101	0.100	0.083	0.081	0.084	0.129	0.131	0.734	0.770	0.162	100
MI-RF*	0.148	0.149	0.065	0.065	0.068	0.162	0.164	0.383	0.378	0.064	100
IPCW-TMLE-M	-0.054	-0.061	0.166	0.148	0.167	0.158	0.178	0.894	0.944	0.415	100
IPCW-TMLE-MTO	-0.016	-0.017	0.098	0.086	0.098	0.087	0.099	0.905	0.945	0.596	100

Table 80: **Synthetic data MAR simulation: census marginal odds ratio (mOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **semi-complex outcome and simple MAR** scenario. The value of the estimand is -0.083. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star. The semi-complex outcome is a function of exponentiated and squared terms on W.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Oracle coverage	Nominal coverage	Power	Prop. completed
Benchmark model	0.002	0.002	0.053	0.053	0.052	0.053	0.052	0.951	0.948	0.325	100
Complete-case	-0.064	-0.062	0.099	0.1	0.102	0.119	0.119	0.898	0.915	0.304	100
Confounded model	-0.356	-0.355	0.076	0.075	0.077	0.364	0.364	0.004	0.003	1.000	100
IPW	-0.001	-0.003	0.097	0.097	0.097	0.097	0.097	0.950	0.952	0.140	100
Raking (vanilla)	0.002	0.003	0.073	0.073	0.074	0.073	0.075	0.951	0.950	0.193	100
MICE	0.013	0.014	0.056	0.062	0.055	0.064	0.057	0.944	0.963	0.176	100
MI-XGB	0.009	0.008	0.083	0.081	0.084	0.081	0.085	0.950	0.930	0.162	100
MI-RF	0.056	0.057	0.065	0.065	0.068	0.086	0.088	0.857	0.857	0.064	100
IPCW-TMLE-M*	-0.146	-0.153	0.166	0.148	0.167	0.208	0.226	0.862	0.750	0.415	100
IPCW-TMLE-MTO*	-0.108	-0.109	0.098	0.086	0.098	0.138	0.146	0.808	0.706	0.596	100

Table 81: **Synthetic data MAR simulation: oracle marginal odds ratio (mOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **semi-complex outcome and simple MAR (no dependence on Y)** scenario. The value of the estimand is -0.175. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star. The semi-complex outcome is a function of exponentiated and squared terms on W.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Nominal coverage	Oracle coverage	Power	Prop. completed
Benchmark model	-0.002	-0.003	0.038	0.038	0.038	0.038	0.038	0.952	0.952	0.997	100
Complete-case*	0.066	0.066	0.141	0.139	0.136	0.153	0.151	0.906	0.917	0.115	100
Confounded model*	-0.267	-0.267	0.074	0.075	0.075	0.278	0.277	0.047	0.048	1.000	100
IPW*	0.097	0.087	0.646	0.18	0.192	0.205	0.211	0.898	1.000	0.105	100
Raking (vanilla)*	0.096	0.096	0.149	0.135	0.149	0.165	0.177	0.840	0.904	0.118	100
MICE*	-0.009	-0.008	0.064	0.074	0.063	0.075	0.063	0.973	0.946	0.728	100
MI-RF*	0.156	0.158	0.094	0.08	0.094	0.176	0.184	0.496	0.605	0.100	100
IPCW-TMLE-M	-0.071	-0.077	0.305	0.249	0.29	0.259	0.3	0.876	0.946	0.255	100
IPCW-TMLE-MTO	-0.011	0.002	0.193	0.155	0.177	0.156	0.177	0.893	0.953	0.270	100

Table 82: **Synthetic data MAR simulation: census marginal odds ratio (mOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **semi-complex outcome and simple MAR (no dependence on Y)** scenario. The value of the estimand is -0.083. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star. The semi-complex outcome is a function of exponentiated and squared terms on W.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Oracle coverage	Nominal coverage	Power	Prop. completed
Benchmark model	0.001	0.000	0.052	0.053	0.054	0.053	0.054	0.951	0.954	0.343	100
Complete-case	-0.026	-0.026	0.141	0.139	0.136	0.141	0.138	0.944	0.942	0.115	100
Confounded model	-0.359	-0.359	0.074	0.075	0.075	0.367	0.367	0.002	0.001	1.000	100
IPW	0.005	-0.005	0.646	0.18	0.192	0.18	0.192	1.000	0.923	0.105	100
Raking (vanilla)	0.004	0.004	0.149	0.135	0.149	0.135	0.149	0.948	0.921	0.118	100
MICE	-0.101	-0.100	0.064	0.074	0.063	0.125	0.118	0.662	0.755	0.728	100
MI-RF	0.064	0.066	0.094	0.08	0.094	0.102	0.115	0.903	0.819	0.100	100
IPCW-TMLE-M*	-0.163	-0.169	0.305	0.249	0.29	0.298	0.335	0.919	0.819	0.255	100
IPCW-TMLE-MTO*	-0.103	-0.090	0.193	0.155	0.177	0.186	0.199	0.914	0.838	0.270	100

Table 83: **Synthetic data MAR simulation: oracle marginal odds ratio (mOR), 12% outcome proportion, 80% missing proportion**. Comparing estimators under the **semi-complex outcome and simple MAR** scenario. The value of the estimand is -0.175. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star. The semi-complex outcome is a function of exponentiated and squared terms on W.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Nominal coverage	Oracle coverage	Power	Prop. completed
Benchmark model	-0.001	0.000	0.039	0.038	0.039	0.038	0.039	0.947	0.952	0.996	100
Complete-case*	0.095	0.102	0.214	0.207	0.2	0.228	0.225	0.895	0.931	0.060	100
Confounded model*	-0.267	-0.266	0.074	0.075	0.072	0.277	0.276	0.048	0.051	1.000	100
IPW*	0.068	0.076	0.214	0.194	0.206	0.206	0.22	0.903	0.942	0.100	100
Raking (vanilla)*	0.094	0.094	0.139	0.127	0.134	0.158	0.164	0.860	0.897	0.128	100
MICE*	0.113	0.109	0.085	0.084	0.085	0.141	0.138	0.736	0.744	0.134	100
MI-RF*	0.188	0.186	0.1	0.078	0.103	0.203	0.213	0.370	0.534	0.132	100
IPCW-TMLE-M	-0.139	-0.146	0.355	0.27	0.335	0.303	0.365	0.834	0.930	0.306	100
IPCW-TMLE-MTO	-0.068	-0.048	0.225	0.174	0.213	0.187	0.218	0.867	0.938	0.334	100

Table 84: **Synthetic data MAR simulation: census marginal odds ratio (mOR), 12% outcome proportion, 80% missing proportion**. Comparing estimators under the **semi-complex outcome and simple MAR** scenario. The value of the estimand is -0.083. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star. The semi-complex outcome is a function of exponentiated and squared terms on W.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Oracle coverage	Nominal coverage	Power	Prop. completed
Benchmark model	0.001	0.001	0.052	0.053	0.053	0.053	0.053	0.954	0.956	0.347	100
Complete-case	0.003	0.010	0.214	0.207	0.2	0.207	0.201	0.950	0.945	0.060	100
Confounded model	-0.359	-0.358	0.074	0.075	0.072	0.367	0.365	0.003	0.003	1.000	100
IPW	-0.024	-0.016	0.214	0.194	0.206	0.196	0.207	0.948	0.932	0.100	100
Raking (vanilla)	0.002	0.002	0.139	0.127	0.134	0.127	0.134	0.947	0.924	0.128	100
MICE	0.021	0.017	0.085	0.084	0.085	0.087	0.086	0.942	0.942	0.134	100
MI-RF	0.096	0.094	0.1	0.078	0.103	0.123	0.139	0.844	0.714	0.132	100
IPCW-TMLE-M*	-0.231	-0.238	0.355	0.27	0.335	0.355	0.41	0.909	0.777	0.306	100
IPCW-TMLE-MTO*	-0.16	-0.140	0.225	0.174	0.213	0.236	0.255	0.895	0.786	0.334	100

Table 85: **Synthetic data MAR simulation: oracle marginal odds ratio (mOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **complex outcome and simple MAR** scenario. The value of the estimand is 0.001. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Nominal coverage	Oracle coverage	Power	Prop. completed
Benchmark model	-0.001	-0.002	0.064	0.065	0.063	0.065	0.063	0.954	0.950	0.044	100
Complete-case*	-0.134	-0.133	0.123	0.127	0.124	0.184	0.182	0.834	0.808	0.163	100
Confounded model*	-0.225	-0.225	0.072	0.074	0.072	0.236	0.237	0.134	0.128	0.862	100
IPW*	0.055	0.059	0.13	0.134	0.13	0.145	0.142	0.939	0.936	0.062	100
Raking (vanilla)*	0.057	0.058	0.08	0.082	0.076	0.1	0.096	0.894	0.890	0.108	100
MICE*	0.123	0.124	0.08	0.082	0.078	0.148	0.147	0.684	0.664	0.324	100
MI-XGB*	0.092	0.092	0.078	0.08	0.074	0.122	0.118	0.798	0.790	0.205	100
MI-RF*	0.069	0.069	0.081	0.079	0.078	0.105	0.104	0.847	0.858	0.156	100
IPCW-TMLE-M	-0.054	-0.055	0.186	0.177	0.186	0.185	0.194	0.908	0.946	0.092	100
IPCW-TMLE-MTO	-0.05	-0.046	0.147	0.141	0.147	0.149	0.154	0.914	0.937	0.086	100

Table 86: **Synthetic data MAR simulation: census marginal odds ratio (mOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **complex outcome and simple MAR** scenario. The value of the estimand is 0.061. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Oracle coverage	Nominal coverage	Power	Prop. completed
Benchmark model	-0.003	-0.004	0.071	0.073	0.07	0.073	0.071	0.952	0.956	0.127	100
Complete-case	-0.194	-0.193	0.123	0.127	0.124	0.231	0.229	0.647	0.672	0.163	100
Confounded model	-0.285	-0.286	0.072	0.074	0.072	0.294	0.294	0.022	0.024	0.862	100
IPW	-0.005	-0.001	0.13	0.134	0.13	0.134	0.13	0.951	0.955	0.062	100
Raking (vanilla)	-0.003	-0.002	0.08	0.082	0.076	0.082	0.076	0.950	0.956	0.108	100
MICE	0.063	0.064	0.08	0.082	0.078	0.103	0.101	0.878	0.885	0.324	100
MI-XGB	0.032	0.032	0.078	0.08	0.074	0.086	0.08	0.930	0.933	0.205	100
MI-RF	0.009	0.009	0.081	0.079	0.078	0.079	0.078	0.944	0.936	0.156	100
IPCW-TMLE-M*	-0.114	-0.115	0.186	0.177	0.186	0.21	0.219	0.904	0.848	0.092	100
IPCW-TMLE-MTO*	-0.11	-0.106	0.147	0.141	0.147	0.179	0.181	0.889	0.853	0.086	100

Table 87: **Synthetic data MAR simulation: oracle marginal odds ratio (mOR), 12% outcome proportion, 80% missing proportion**. Comparing estimators under the **complex outcome and complex MAR (no dependence on Y)** scenario. The value of the estimand is 0.307. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Nominal coverage	Oracle coverage	Power	Prop. completed
Benchmark model	-0.003	-0.002	0.062	0.061	0.06	0.061	0.06	0.948	0.952	0.999	100.00
Complete-case*	0.019	0.015	0.152	0.152	0.159	0.153	0.16	0.952	0.954	0.562	100.00
Confounded model*	-0.218	-0.220	0.07	0.069	0.069	0.229	0.23	0.116	0.120	0.256	100.00
IPW*	0.013	-0.158	abs > ln(10)	abs > ln(10)	0.716	abs > ln(10)	0.733	0.834	0.968	0.136	100.00
Raking (vanilla)*	0.513	0.204	abs > ln(10)	0.505	0.579	0.72	0.614	0.890	0.987	0.278	94.24
MICE*	-0.013	-0.010	0.115	0.097	0.115	0.098	0.115	0.884	0.947	0.831	100.00
MI-RF*	-0.07	-0.066	0.096	0.089	0.099	0.113	0.119	0.847	0.886	0.738	100.00
IPCW-TMLE-M	-0.13	-0.135	0.483	0.399	0.46	0.42	0.479	0.857	0.941	0.126	100.00

Table 88: **Synthetic data MAR simulation: census marginal odds ratio (mOR), 12% outcome proportion, 80% missing proportion**. Comparing estimators under the **complex outcome and complex MAR (no dependence on Y)** scenario. The value of the estimand is 0.362. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Oracle coverage	Nominal coverage	Power	Prop. completed
Benchmark model	-0.005	-0.006	0.07	0.068	0.067	0.068	0.067	0.950	0.945	0.999	100.00
Complete-case	-0.036	-0.040	0.152	0.152	0.159	0.156	0.164	0.942	0.941	0.562	100.00
Confounded model	-0.273	-0.274	0.07	0.069	0.069	0.281	0.283	0.024	0.024	0.256	100.00
IPW	-0.042	-0.212	abs > ln(10)	abs > ln(10)	0.716	abs > ln(10)	0.747	0.968	0.821	0.136	100.00
Raking (vanilla)	0.459	0.150	abs > ln(10)	0.505	0.579	0.682	0.598	0.987	0.900	0.278	94.24
MICE	-0.067	-0.064	0.115	0.097	0.115	0.118	0.132	0.907	0.822	0.831	100.00
MI-RF	-0.125	-0.121	0.096	0.089	0.099	0.153	0.156	0.740	0.687	0.738	100.00
IPCW-TMLE-M*	-0.184	-0.189	0.483	0.399	0.46	0.44	0.497	0.936	0.839	0.126	100.00

Table 89: **Synthetic data MAR simulation: oracle marginal odds ratio (mOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **complex outcome and simple MAR (no dependence on Y)** scenario. The value of the estimand is 0.307. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Nominal coverage	Oracle coverage	Power	Prop. completed
Benchmark model	0.001	0.000	0.061	0.061	0.06	0.061	0.06	0.950	0.951	0.999	100
Complete-case*	0.012	0.011	0.156	0.154	0.159	0.154	0.16	0.946	0.951	0.544	100
Confounded model*	-0.216	-0.215	0.068	0.069	0.066	0.227	0.225	0.108	0.107	0.260	100
IPW*	0.058	0.033	1.577	0.219	0.24	0.226	0.242	0.928	0.996	0.350	100
Raking (vanilla)*	0.047	0.049	0.117	0.11	0.115	0.12	0.125	0.911	0.931	0.885	100
MICE*	0.149	0.148	0.094	0.092	0.095	0.175	0.176	0.641	0.646	0.997	100
MI-RF*	0.059	0.058	0.093	0.083	0.094	0.102	0.11	0.854	0.901	0.983	100
IPCW-TMLE-M	-0.046	-0.066	0.307	0.269	0.297	0.273	0.304	0.910	0.942	0.185	100
IPCW-TMLE-MTO	-0.039	-0.043	0.244	0.21	0.241	0.214	0.245	0.902	0.947	0.283	100

Table 90: **Synthetic data MAR simulation: census marginal odds ratio (mOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **complex outcome and simple MAR (no dependence on Y)** scenario. The value of the estimand is 0.362. The sample size is n = 10000. Maximum observed Monte-Carlo error over the 2500 simulation replications was 0.009 for all summaries besides coverage and 0.011 for coverage. ESE = empirical standard error, ASE = asymptotic standard error, MAD = mean absolute deviation, RMSE = root mean squared error, rRMSE = robust RMSE (using median bias and MAD), Oracle coverage = coverage of a confidence interval based on the ESE, Nominal coverage = coverage of a confidence interval based on the ASE. Estimators that are mismatched with the estimand (i.e., are estimating a different parameter) are emphasized using a star.

Estimator	Mean bias	Median bias	ESE	ASE	MAD	RMSE	rRMSE	Oracle coverage	Nominal coverage	Power	Prop. completed
Benchmark model	-0.003	-0.003	0.068	0.068	0.067	0.068	0.067	0.949	0.950	0.999	100
Complete-case	-0.043	-0.044	0.156	0.154	0.159	0.159	0.165	0.944	0.943	0.544	100
Confounded model	-0.27	-0.270	0.068	0.069	0.066	0.279	0.278	0.022	0.022	0.260	100
IPW	0.003	-0.021	1.577	0.219	0.24	0.219	0.241	0.996	0.924	0.350	100
Raking (vanilla)	-0.007	-0.006	0.117	0.11	0.115	0.111	0.116	0.946	0.930	0.885	100
MICE	0.094	0.093	0.094	0.092	0.095	0.131	0.133	0.816	0.811	0.997	100
MI-RF	0.005	0.004	0.093	0.083	0.094	0.083	0.094	0.949	0.920	0.983	100
IPCW-TMLE-M*	-0.101	-0.121	0.307	0.269	0.297	0.287	0.321	0.935	0.892	0.185	100
IPCW-TMLE-MTO*	-0.094	-0.098	0.244	0.21	0.241	0.23	0.26	0.937	0.872	0.283	100