Subset calibration report: conditional odds ratio

2024-10-14

Contents

The tables in this section contain performance for estimating the conditional odds ratio (cOR).

Results

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

Table 1: **Synthetic data MAR simulation: oracle conditional odds ratio (cOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome and simple MAR** scenario. The value of the estimand is 0.405. 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 0.012 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	0.073	0.07	0.075	0.07	0.075	0.940	0.950	1.000	100
Complete-case	-0.191	-0.189	0.12	0.119	0.118	0.225	0.223	0.637	0.646	0.442	100
Confounded model	0.204	0.205	0.069	0.067	0.07	0.214	0.217	0.142	0.158	1.000	100
IPW	-0.001	0.002	0.129	0.13	0.128	0.13	0.128	0.953	0.950	0.884	100
Raking (vanilla)	0	0.000	0.082	0.078	0.083	0.078	0.083	0.938	0.950	0.999	100
MICE	0.001	-0.001	0.079	0.076	0.08	0.076	0.08	0.939	0.949	1.000	100
MI-XGB	-0.006	-0.007	0.081	0.077	0.081	0.077	0.082	0.935	0.946	0.999	100
MI-RF	0.005	0.004	0.082	0.074	0.082	0.074	0.082	0.923	0.945	0.999	100
IPCW-TMLE-M	-0.015	-0.013	0.132	0.136	0.129	0.137	0.13	0.953	0.949	0.835	100
IPCW-TMLE-MTO	-0.015	-0.013	0.131	0.134	0.129	0.135	0.13	0.953	0.946	0.842	100

Table 2: **Synthetic data MAR simulation: census conditional odds ratio (cOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome and simple MAR** scenario. The value of the estimand is 0.406. 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 0.012 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	0.073	0.07	0.075	0.07	0.075	0.950	0.940	1.000	100
Complete-case	-0.191	-0.189	0.12	0.119	0.118	0.225	0.223	0.646	0.636	0.442	100
Confounded model	0.203	0.205	0.069	0.067	0.07	0.214	0.216	0.158	0.143	1.000	100
IPW	-0.001	0.002	0.129	0.13	0.128	0.13	0.128	0.950	0.953	0.884	100
Raking (vanilla)	0	0.000	0.082	0.078	0.083	0.078	0.083	0.950	0.938	0.999	100
MICE	0.001	-0.001	0.079	0.076	0.08	0.076	0.08	0.949	0.939	1.000	100
MI-XGB	-0.006	-0.007	0.081	0.077	0.081	0.077	0.082	0.946	0.935	0.999	100
MI-RF	0.005	0.004	0.082	0.074	0.082	0.074	0.082	0.945	0.923	0.999	100
IPCW-TMLE-M	-0.015	-0.014	0.132	0.136	0.129	0.137	0.13	0.949	0.953	0.835	100
IPCW-TMLE-MTO	-0.015	-0.014	0.131	0.134	0.129	0.135	0.13	0.946	0.953	0.842	100

Table 3: **Synthetic data MAR simulation: oracle conditional odds ratio (cOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **complex outcome and simple MAR** scenario. The value of the estimand is 0.405. 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 0.012 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	0.08	0.08	0.08	0.08	0.08	0.954	0.952	0.999	100
Complete-case*	-0.233	-0.235	0.123	0.122	0.122	0.263	0.265	0.514	0.518	0.292	100
Confounded model*	-0.314	-0.313	0.069	0.068	0.07	0.321	0.321	0.006	0.006	0.271	100
IPW*	-0.04	-0.042	0.13	0.13	0.133	0.136	0.139	0.940	0.940	0.801	100
Raking (vanilla)*	-0.033	-0.032	0.081	0.081	0.08	0.088	0.086	0.932	0.931	0.996	100
MICE*	0.041	0.041	0.083	0.083	0.083	0.092	0.092	0.926	0.923	1.000	100
MI-XGB*	0.008	0.008	0.08	0.08	0.08	0.08	0.08	0.948	0.947	0.999	100
MI-RF*	-0.026	-0.026	0.082	0.079	0.082	0.083	0.086	0.925	0.937	0.998	100
IPCW-TMLE-M*	-0.056	-0.058	0.134	0.135	0.135	0.147	0.147	0.936	0.931	0.737	100
IPCW-TMLE-MTO*	-0.04	-0.040	0.125	0.123	0.128	0.129	0.134	0.933	0.941	0.842	100
IPCW-a-TMLE-M*	-0.058	-0.062	0.134	0.135	0.138	0.147	0.151	0.931	0.933	0.728	100
IPCW-a-TMLE-MTO*	-0.041	-0.041	0.126	0.122	0.13	0.129	0.136	0.928	0.943	0.838	100

Table 4: **Synthetic data MAR simulation: census conditional odds ratio (cOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **complex outcome and simple MAR** scenario. The value of the estimand is 0.371. 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 0.012 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	0.002	0.071	0.072	0.07	0.072	0.07	0.950	0.953	1.000	100
Complete-case	-0.199	-0.201	0.123	0.122	0.122	0.234	0.235	0.635	0.630	0.292	100
Confounded model	-0.28	-0.279	0.069	0.068	0.07	0.288	0.288	0.017	0.016	0.271	100
IPW	-0.006	-0.008	0.13	0.13	0.133	0.13	0.133	0.956	0.954	0.801	100
Raking (vanilla)	0.001	0.002	0.081	0.081	0.08	0.081	0.08	0.950	0.950	0.996	100
MICE	0.075	0.075	0.083	0.083	0.083	0.112	0.112	0.856	0.860	1.000	100
MI-XGB	0.043	0.042	0.08	0.08	0.08	0.091	0.09	0.912	0.917	0.999	100
MI-RF	0.008	0.008	0.082	0.079	0.082	0.079	0.082	0.948	0.942	0.998	100
IPCW-TMLE-M	-0.022	-0.024	0.134	0.135	0.135	0.137	0.137	0.948	0.948	0.737	100
IPCW-TMLE-MTO	-0.006	-0.006	0.125	0.123	0.128	0.123	0.128	0.951	0.946	0.842	100
IPCW-a-TMLE-M	-0.024	-0.028	0.134	0.135	0.138	0.137	0.141	0.949	0.951	0.728	100
IPCW-a-TMLE-MTO	-0.007	-0.007	0.126	0.122	0.13	0.122	0.13	0.953	0.943	0.838	100

Table 5: **Synthetic data MAR simulation: oracle conditional odds ratio (cOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome and complex MAR** scenario. The value of the estimand is 0.405. 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 0.012 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	-0.002	0.072	0.07	0.073	0.07	0.073	0.942	0.948	1.000	100
Complete-case	0.214	0.215	0.092	0.092	0.095	0.234	0.235	0.358	0.354	1.000	100
Confounded model	0.201	0.201	0.068	0.067	0.068	0.212	0.212	0.150	0.165	1.000	100
IPW	0.14	0.140	0.096	0.097	0.098	0.17	0.171	0.706	0.690	1.000	100
Raking (vanilla)	0	-0.001	0.077	0.073	0.076	0.073	0.076	0.938	0.951	1.000	100
MICE	-0.002	-0.001	0.075	0.073	0.075	0.073	0.075	0.944	0.947	1.000	100
MI-RF	-0.01	-0.010	0.076	0.073	0.077	0.074	0.077	0.939	0.948	1.000	100
IPCW-TMLE-M	0.052	0.052	0.094	0.106	0.095	0.118	0.108	0.957	0.919	0.998	100
IPCW-TMLE-MTO	0.055	0.056	0.094	0.105	0.096	0.118	0.111	0.950	0.914	0.997	100
IPCW-a-TMLE-M	0.049	0.049	0.096	0.107	0.097	0.117	0.109	0.955	0.924	0.996	100
IPCW-a-TMLE-MTO	0.053	0.053	0.096	0.105	0.098	0.117	0.111	0.946	0.920	0.997	100

Table 6: **Synthetic data MAR simulation: census conditional odds ratio (cOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome and complex MAR** scenario. The value of the estimand is 0.406. 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 0.012 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	-0.002	0.072	0.07	0.073	0.07	0.073	0.948	0.942	1.000	100
Complete-case	0.214	0.215	0.092	0.092	0.095	0.233	0.235	0.354	0.359	1.000	100
Confounded model	0.201	0.201	0.068	0.067	0.068	0.212	0.212	0.165	0.151	1.000	100
IPW	0.14	0.140	0.096	0.097	0.098	0.17	0.171	0.691	0.706	1.000	100
Raking (vanilla)	0	-0.001	0.077	0.073	0.076	0.073	0.076	0.950	0.939	1.000	100
MICE	-0.002	-0.001	0.075	0.073	0.075	0.073	0.075	0.947	0.944	1.000	100
MI-RF	-0.01	-0.010	0.076	0.073	0.077	0.074	0.077	0.947	0.939	1.000	100
IPCW-TMLE-M	0.051	0.051	0.094	0.106	0.095	0.118	0.108	0.919	0.958	0.998	100
IPCW-TMLE-MTO	0.055	0.055	0.094	0.105	0.096	0.118	0.111	0.914	0.950	0.997	100
IPCW-a-TMLE-M	0.049	0.048	0.096	0.107	0.097	0.117	0.109	0.924	0.955	0.996	100
IPCW-a-TMLE-MTO	0.053	0.052	0.096	0.105	0.098	0.117	0.111	0.920	0.946	0.997	100

Table 7: **Synthetic data MAR simulation: oracle conditional odds ratio (cOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **complex outcome and complex MAR** scenario. The value of the estimand is 0.405. 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 0.012 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	0.079	0.08	0.081	0.08	0.081	0.958	0.954	0.999	100
Complete-case*	0.136	0.136	0.09	0.093	0.092	0.165	0.164	0.691	0.667	1.000	100
Confounded model*	-0.316	-0.315	0.068	0.068	0.067	0.323	0.322	0.006	0.005	0.257	100
IPW*	0.053	0.052	0.095	0.096	0.097	0.109	0.11	0.916	0.918	0.998	100
Raking (vanilla)*	-0.027	-0.026	0.075	0.073	0.079	0.078	0.083	0.926	0.938	0.999	100
MICE*	0.02	0.021	0.076	0.077	0.08	0.079	0.083	0.947	0.947	1.000	100
MI-RF*	-0.031	-0.031	0.075	0.076	0.079	0.083	0.085	0.937	0.934	0.999	100
IPCW-TMLE-M*	0.032	0.033	0.093	0.103	0.094	0.108	0.1	0.959	0.932	0.995	100
IPCW-TMLE-MTO*	0.017	0.016	0.088	0.093	0.09	0.094	0.091	0.955	0.944	0.997	100
IPCW-a-TMLE-M*	0.042	0.042	0.095	0.103	0.095	0.111	0.104	0.951	0.921	0.998	100
IPCW-a-TMLE-MTO*	0.023	0.021	0.09	0.092	0.092	0.095	0.094	0.946	0.941	0.997	100

Table 8: **Synthetic data MAR simulation: census conditional odds ratio (cOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **complex outcome and complex MAR** scenario. The value of the estimand is 0.371. 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 0.012 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	0.069	0.072	0.07	0.072	0.07	0.953	0.964	1.000	100
Complete-case	0.171	0.170	0.09	0.093	0.092	0.194	0.193	0.525	0.555	1.000	100
Confounded model	-0.282	-0.281	0.068	0.068	0.067	0.29	0.289	0.015	0.015	0.257	100
IPW	0.087	0.086	0.095	0.096	0.097	0.129	0.13	0.849	0.850	0.998	100
Raking (vanilla)	0.007	0.008	0.075	0.073	0.079	0.074	0.079	0.951	0.946	0.999	100
MICE	0.054	0.055	0.076	0.077	0.08	0.094	0.097	0.894	0.899	1.000	100
MI-RF	0.003	0.003	0.075	0.076	0.079	0.076	0.079	0.950	0.953	0.999	100
IPCW-TMLE-M	0.066	0.067	0.093	0.103	0.094	0.122	0.116	0.884	0.923	0.995	100
IPCW-TMLE-MTO	0.051	0.050	0.088	0.093	0.09	0.106	0.103	0.906	0.923	0.997	100
IPCW-a-TMLE-M	0.077	0.076	0.095	0.103	0.095	0.128	0.121	0.871	0.904	0.998	100
IPCW-a-TMLE-MTO	0.057	0.055	0.09	0.092	0.092	0.109	0.107	0.899	0.910	0.997	100

MAR: 12% outcome proportion, 80% missingness proportion

Table 9: **Synthetic data MAR simulation: oracle conditional odds ratio (cOR), 12% outcome proportion, 80% missing proportion**. Comparing estimators under the **simple outcome and simple MAR** scenario. The value of the estimand is 0.405. 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 0.012 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	0.003	0.069	0.07	0.069	0.07	0.069	0.950	0.948	1.000	100
Complete-case	-0.109	-0.103	0.23	0.231	0.233	0.255	0.254	0.930	0.923	0.264	100
Confounded model	0.207	0.206	0.065	0.067	0.065	0.217	0.216	0.114	0.107	1.000	100
IPW	abs > ln(10)	0.002	abs > ln(10)	abs > ln(10)	0.27	abs > ln(10)	0.27	0.946	1.000	0.326	100
Raking (vanilla)	0.003	0.005	0.109	0.106	0.105	0.106	0.105	0.944	0.945	0.947	100
MICE	0.005	0.006	0.095	0.095	0.092	0.095	0.092	0.948	0.948	0.982	100
MI-RF	0.061	0.063	0.096	0.079	0.091	0.1	0.111	0.824	0.906	0.998	100
IPCW-TMLE-M	-0.03	-0.031	0.275	0.277	0.277	0.279	0.279	0.953	0.949	0.264	100
IPCW-TMLE-MTO	-0.029	-0.027	0.275	0.268	0.285	0.269	0.286	0.944	0.950	0.289	100

Table 10: **Synthetic data MAR simulation: census conditional odds ratio (cOR), 12% outcome proportion, 80% missing proportion**. Comparing estimators under the **simple outcome and simple MAR** scenario. The value of the estimand is 0.406. 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 0.012 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	0.004	0.003	0.069	0.07	0.069	0.07	0.069	0.949	0.950	1.000	100
Complete-case	-0.109	-0.103	0.23	0.231	0.233	0.255	0.254	0.923	0.930	0.264	100
Confounded model	0.207	0.206	0.065	0.067	0.065	0.217	0.216	0.108	0.114	1.000	100
IPW	abs > ln(10)	0.002	abs > ln(10)	abs > ln(10)	0.27	abs > ln(10)	0.27	1.000	0.946	0.326	100
Raking (vanilla)	0.002	0.005	0.109	0.106	0.105	0.106	0.105	0.945	0.944	0.947	100
MICE	0.005	0.006	0.095	0.095	0.092	0.095	0.092	0.948	0.948	0.982	100
MI-RF	0.061	0.063	0.096	0.079	0.091	0.1	0.11	0.906	0.825	0.998	100
IPCW-TMLE-M	-0.03	-0.032	0.275	0.277	0.277	0.279	0.279	0.949	0.953	0.264	100
IPCW-TMLE-MTO	-0.029	-0.028	0.275	0.268	0.285	0.269	0.286	0.950	0.944	0.289	100

Table 11: **Synthetic data MAR simulation: oracle conditional odds ratio (cOR), 12% outcome proportion, 80% missing proportion**. Comparing estimators under the **complex outcome and simple MAR** scenario. The value of the estimand is 0.405. 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 0.012 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	0.082	0.08	0.079	0.08	0.079	0.938	0.942	0.998	100
Complete-case*	-0.196	-0.192	0.243	0.237	0.24	0.308	0.308	0.875	0.874	0.158	100
Confounded model*	-0.317	-0.316	0.069	0.068	0.069	0.325	0.324	0.003	0.003	0.263	100
IPW*	abs > ln(10)	-0.058	abs > ln(10)	abs > ln(10)	0.278	abs > ln(10)	0.284	0.928	0.998	0.277	100
Raking (vanilla)*	-0.037	-0.037	0.121	0.118	0.122	0.124	0.127	0.929	0.936	0.877	100
MICE*	0.068	0.070	0.125	0.119	0.128	0.138	0.145	0.914	0.916	0.984	100
MI-RF*	-0.027	-0.028	0.112	0.086	0.114	0.09	0.117	0.851	0.942	0.972	100
IPCW-TMLE-M*	-0.087	-0.088	0.283	0.274	0.286	0.287	0.3	0.934	0.940	0.220	100
IPCW-TMLE-MTO*	-0.056	-0.057	0.275	0.25	0.282	0.256	0.287	0.915	0.944	0.312	100

Table 12: **Synthetic data MAR simulation: census conditional odds ratio (cOR), 12% outcome proportion, 80% missing proportion**. Comparing estimators under the **complex outcome and simple MAR** scenario. The value of the estimand is 0.371. 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 0.012 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	-0.002	0.072	0.072	0.072	0.072	0.073	0.948	0.950	0.999	100
Complete-case	-0.162	-0.158	0.243	0.237	0.24	0.288	0.288	0.897	0.899	0.158	100
Confounded model	-0.283	-0.282	0.069	0.068	0.069	0.291	0.291	0.014	0.013	0.263	100
IPW	abs > ln(10)	-0.023	abs > ln(10)	abs > ln(10)	0.278	abs > ln(10)	0.279	0.998	0.932	0.277	100
Raking (vanilla)	-0.003	-0.003	0.121	0.118	0.122	0.118	0.122	0.953	0.945	0.877	100
MICE	0.102	0.104	0.125	0.119	0.128	0.157	0.165	0.875	0.878	0.984	100
MI-RF	0.008	0.006	0.112	0.086	0.114	0.086	0.114	0.946	0.870	0.972	100
IPCW-TMLE-M	-0.053	-0.054	0.283	0.274	0.286	0.279	0.291	0.949	0.943	0.220	100
IPCW-TMLE-MTO	-0.022	-0.023	0.275	0.25	0.282	0.251	0.283	0.952	0.925	0.312	100

Table 13: **Synthetic data MAR simulation: oracle conditional odds ratio (cOR), 12% outcome proportion, 80% missing proportion**. Comparing estimators under the **simple outcome and complex MAR** scenario. The value of the estimand is 0.405. 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 0.012 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	0.000	0.071	0.07	0.071	0.07	0.071	0.948	0.950	1.000	100
Complete-case	0.634	0.634	0.149	0.156	0.149	0.653	0.652	0.017	0.014	1.000	100
Confounded model	0.203	0.202	0.068	0.067	0.067	0.213	0.213	0.155	0.166	1.000	100
IPW	0.361	0.361	0.183	0.181	0.188	0.404	0.407	0.488	0.496	0.988	100
Raking (vanilla)	0.004	0.006	0.098	0.1	0.097	0.1	0.097	0.957	0.952	0.981	100
MICE	0.003	0.005	0.085	0.084	0.089	0.084	0.089	0.954	0.956	0.998	100
MI-RF	-0.006	-0.005	0.087	0.078	0.09	0.079	0.09	0.929	0.954	0.999	100
IPCW-TMLE-M	0.098	0.102	0.157	0.185	0.162	0.21	0.191	0.958	0.910	0.817	100
IPCW-TMLE-MTO	0.126	0.129	0.159	0.18	0.162	0.22	0.207	0.924	0.875	0.866	100

Table 14: **Synthetic data MAR simulation: census conditional odds ratio (cOR), 12% outcome proportion, 80% missing proportion**. Comparing estimators under the **simple outcome and complex MAR** scenario. The value of the estimand is 0.406. 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 0.012 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	0.071	0.07	0.071	0.07	0.071	0.950	0.946	1.000	100
Complete-case	0.634	0.634	0.149	0.156	0.149	0.653	0.651	0.014	0.017	1.000	100
Confounded model	0.202	0.202	0.068	0.067	0.067	0.213	0.213	0.167	0.155	1.000	100
IPW	0.361	0.361	0.183	0.181	0.188	0.404	0.407	0.496	0.488	0.988	100
Raking (vanilla)	0.004	0.006	0.098	0.1	0.097	0.1	0.097	0.952	0.957	0.981	100
MICE	0.003	0.005	0.085	0.084	0.089	0.084	0.089	0.956	0.954	0.998	100
MI-RF	-0.006	-0.005	0.087	0.078	0.09	0.079	0.09	0.954	0.930	0.999	100
IPCW-TMLE-M	0.098	0.101	0.157	0.185	0.162	0.21	0.191	0.910	0.958	0.817	100
IPCW-TMLE-MTO	0.126	0.128	0.159	0.18	0.162	0.22	0.207	0.875	0.924	0.866	100

Table 15: **Synthetic data MAR simulation: oracle conditional odds ratio (cOR), 12% outcome proportion, 80% missing proportion**. Comparing estimators under the **complex outcome and complex MAR** scenario. The value of the estimand is 0.405. 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 0.012 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	0.081	0.08	0.082	0.08	0.082	0.950	0.950	1.000	100
Complete-case*	0.46	0.456	0.152	0.162	0.15	0.488	0.48	0.167	0.135	0.999	100
Confounded model*	-0.315	-0.314	0.069	0.068	0.068	0.322	0.321	0.003	0.004	0.269	100
IPW*	0.134	0.132	0.175	0.173	0.174	0.219	0.218	0.882	0.880	0.888	100
Raking (vanilla)*	-0.005	-0.007	0.108	0.108	0.107	0.109	0.108	0.952	0.951	0.970	100
MICE*	0.151	0.148	0.105	0.098	0.104	0.18	0.181	0.670	0.715	1.000	100
MI-RF*	0.051	0.047	0.098	0.086	0.097	0.1	0.108	0.882	0.923	0.999	100
IPCW-TMLE-M*	0.066	0.064	0.154	0.181	0.147	0.193	0.16	0.968	0.926	0.779	100
IPCW-TMLE-MTO*	0.049	0.046	0.15	0.164	0.145	0.171	0.152	0.953	0.934	0.816	100

Table 16: **Synthetic data MAR simulation: census conditional odds ratio (cOR), 12% outcome proportion, 80% missing proportion**. Comparing estimators under the **complex outcome and complex MAR** scenario. The value of the estimand is 0.371. 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 0.012 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	-0.001	0.072	0.072	0.071	0.072	0.071	0.949	0.952	1.000	100
Complete-case	0.494	0.490	0.152	0.162	0.15	0.52	0.512	0.090	0.118	0.999	100
Confounded model	-0.281	-0.280	0.069	0.068	0.068	0.289	0.288	0.016	0.016	0.269	100
IPW	0.168	0.166	0.175	0.173	0.174	0.241	0.24	0.839	0.844	0.888	100
Raking (vanilla)	0.029	0.027	0.108	0.108	0.107	0.112	0.111	0.945	0.951	0.970	100
MICE	0.185	0.182	0.105	0.098	0.104	0.209	0.21	0.594	0.541	1.000	100
MI-RF	0.085	0.081	0.098	0.086	0.097	0.121	0.127	0.866	0.812	0.999	100
IPCW-TMLE-M	0.1	0.098	0.154	0.181	0.147	0.207	0.176	0.902	0.956	0.779	100
IPCW-TMLE-MTO	0.083	0.080	0.15	0.164	0.145	0.183	0.166	0.915	0.938	0.816	100

MAR: 5% outcome proportion, 40% missingness proportion

Table 17: **Synthetic data MAR simulation: oracle conditional odds ratio (cOR), 5% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome and simple MAR** scenario. The value of the estimand is 0.405. 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 0.012 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	0.104	0.103	0.106	0.103	0.106	0.946	0.946	0.972	100
Complete-case	-0.182	-0.177	0.182	0.178	0.182	0.255	0.254	0.826	0.836	0.249	100
Confounded model	0.218	0.218	0.1	0.099	0.103	0.239	0.242	0.411	0.418	1.000	100
IPW	0.002	0.003	0.201	0.196	0.196	0.196	0.196	0.944	0.948	0.558	100
Raking (vanilla)	0.004	0.002	0.116	0.114	0.115	0.114	0.115	0.951	0.954	0.943	100
MICE	0.005	0.006	0.112	0.111	0.113	0.111	0.113	0.950	0.949	0.954	100
MI-RF	0.04	0.041	0.113	0.108	0.113	0.116	0.12	0.928	0.940	0.979	100
IPCW-TMLE-M	-0.016	-0.011	0.204	0.203	0.206	0.204	0.206	0.944	0.942	0.491	100
IPCW-TMLE-MTO	-0.016	-0.012	0.203	0.199	0.206	0.2	0.206	0.938	0.942	0.500	100
r-IPCW-TMLE-MTO	-0.016	-0.011	0.203	0.2	0.203	0.2	0.203	0.942	0.945	0.503	100

Table 18: **Synthetic data MAR simulation: census conditional odds ratio (cOR), 5% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome and simple MAR** scenario. The value of the estimand is 0.402. 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 0.012 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	0.104	0.103	0.106	0.104	0.106	0.949	0.947	0.972	100
Complete-case	-0.179	-0.174	0.182	0.178	0.182	0.252	0.252	0.842	0.830	0.249	100
Confounded model	0.221	0.222	0.1	0.099	0.103	0.242	0.245	0.405	0.396	1.000	100
IPW	0.006	0.006	0.201	0.196	0.196	0.196	0.196	0.948	0.944	0.558	100
Raking (vanilla)	0.007	0.006	0.116	0.114	0.115	0.114	0.116	0.954	0.949	0.943	100
MICE	0.008	0.010	0.112	0.111	0.113	0.111	0.114	0.950	0.946	0.954	100
MI-RF	0.044	0.044	0.113	0.108	0.113	0.117	0.121	0.938	0.922	0.979	100
IPCW-TMLE-M	-0.013	-0.008	0.204	0.203	0.206	0.204	0.206	0.943	0.945	0.491	100
IPCW-TMLE-MTO	-0.013	-0.009	0.203	0.199	0.206	0.2	0.206	0.943	0.938	0.500	100
r-IPCW-TMLE-MTO	-0.013	-0.008	0.203	0.2	0.203	0.2	0.203	0.946	0.942	0.503	100

Table 19: **Synthetic data MAR simulation: oracle conditional odds ratio (cOR), 5% outcome proportion, 40% missing proportion**. Comparing estimators under the **complex outcome and simple MAR** scenario. The value of the estimand is 0.405. 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 0.012 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	0.113	0.117	0.111	0.117	0.111	0.950	0.945	0.942	100
Complete-case*	-0.226	-0.225	0.171	0.173	0.173	0.285	0.284	0.748	0.731	0.182	100
Confounded model*	-0.378	-0.378	0.095	0.096	0.094	0.39	0.39	0.026	0.026	0.062	100
IPW*	-0.035	-0.042	0.182	0.18	0.179	0.183	0.184	0.943	0.942	0.537	100
Raking (vanilla)*	-0.032	-0.033	0.113	0.114	0.114	0.119	0.119	0.948	0.944	0.905	100
MICE*	0.068	0.066	0.114	0.116	0.111	0.135	0.129	0.915	0.909	0.986	100
MI-RF*	-0.016	-0.015	0.111	0.11	0.11	0.111	0.111	0.944	0.948	0.944	100
IPCW-TMLE-M*	-0.052	-0.051	0.189	0.187	0.188	0.194	0.195	0.934	0.942	0.478	100
IPCW-TMLE-MTO*	-0.035	-0.038	0.179	0.17	0.176	0.173	0.18	0.929	0.944	0.587	100
r-IPCW-TMLE-MTO*	-0.056	-0.057	0.178	0.172	0.176	0.181	0.186	0.921	0.936	0.531	100

Table 20: **Synthetic data MAR simulation: census conditional odds ratio (cOR), 5% outcome proportion, 40% missing proportion**. Comparing estimators under the **complex outcome and simple MAR** scenario. The value of the estimand is 0.38. 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 0.012 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	0.096	0.102	0.096	0.102	0.096	0.954	0.961	0.969	100
Complete-case	-0.201	-0.200	0.171	0.173	0.173	0.266	0.265	0.778	0.794	0.182	100
Confounded model	-0.353	-0.353	0.095	0.096	0.094	0.366	0.365	0.048	0.048	0.062	100
IPW	-0.009	-0.017	0.182	0.18	0.179	0.18	0.18	0.949	0.948	0.537	100
Raking (vanilla)	-0.007	-0.008	0.113	0.114	0.114	0.114	0.114	0.950	0.954	0.905	100
MICE	0.093	0.092	0.114	0.116	0.111	0.149	0.144	0.872	0.878	0.986	100
MI-RF	0.01	0.010	0.111	0.11	0.11	0.11	0.111	0.950	0.948	0.944	100
IPCW-TMLE-M	-0.027	-0.026	0.189	0.187	0.188	0.189	0.19	0.946	0.943	0.478	100
IPCW-TMLE-MTO	-0.01	-0.013	0.179	0.17	0.176	0.17	0.177	0.948	0.935	0.587	100
r-IPCW-TMLE-MTO	-0.031	-0.032	0.178	0.172	0.176	0.175	0.179	0.945	0.934	0.531	100

Table 21: **Synthetic data MAR simulation: oracle conditional odds ratio (cOR), 5% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome and complex MAR** scenario. The value of the estimand is 0.405. 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 0.012 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	-0.001	0.101	0.103	0.099	0.103	0.099	0.950	0.946	0.969	100
Complete-case	0.231	0.233	0.13	0.135	0.127	0.268	0.265	0.604	0.572	0.998	100
Confounded model	0.212	0.212	0.096	0.099	0.096	0.234	0.233	0.424	0.404	1.000	100
IPW	0.153	0.152	0.139	0.141	0.137	0.208	0.204	0.821	0.811	0.978	100
Raking (vanilla)	-0.004	-0.002	0.107	0.108	0.107	0.108	0.107	0.950	0.950	0.958	100
MICE	-0.004	-0.002	0.104	0.107	0.102	0.107	0.102	0.955	0.946	0.964	100
MI-RF	-0.002	0.001	0.106	0.107	0.105	0.107	0.105	0.950	0.946	0.964	100
IPCW-TMLE-M	0.08	0.084	0.137	0.154	0.138	0.174	0.161	0.950	0.908	0.915	100
IPCW-TMLE-MTO	0.087	0.091	0.137	0.152	0.139	0.175	0.166	0.938	0.901	0.923	100
IPCW-a-TMLE-M	0.085	0.087	0.14	0.154	0.139	0.176	0.164	0.947	0.906	0.918	100
IPCW-a-TMLE-MTO	0.09	0.092	0.141	0.151	0.141	0.176	0.168	0.934	0.902	0.923	100
r-IPCW-TMLE-MTO	0.08	0.084	0.137	0.152	0.139	0.172	0.162	0.947	0.910	0.921	100

Table 22: **Synthetic data MAR simulation: census conditional odds ratio (cOR), 5% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome and complex MAR** scenario. The value of the estimand is 0.402. 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 0.012 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	0.002	0.101	0.103	0.099	0.103	0.099	0.947	0.954	0.969	100
Complete-case	0.235	0.236	0.13	0.135	0.127	0.271	0.268	0.557	0.592	0.998	100
Confounded model	0.215	0.216	0.096	0.099	0.096	0.237	0.236	0.392	0.410	1.000	100
IPW	0.157	0.155	0.139	0.141	0.137	0.211	0.207	0.802	0.813	0.978	100
Raking (vanilla)	-0.001	0.001	0.107	0.108	0.107	0.108	0.107	0.951	0.949	0.958	100
MICE	-0.001	0.002	0.104	0.107	0.102	0.107	0.102	0.949	0.956	0.964	100
MI-RF	0.002	0.005	0.106	0.107	0.105	0.107	0.105	0.948	0.950	0.964	100
IPCW-TMLE-M	0.084	0.087	0.137	0.154	0.138	0.175	0.163	0.904	0.946	0.915	100
IPCW-TMLE-MTO	0.09	0.094	0.137	0.152	0.139	0.176	0.168	0.894	0.936	0.923	100
IPCW-a-TMLE-M	0.088	0.090	0.14	0.154	0.139	0.177	0.166	0.903	0.945	0.918	100
IPCW-a-TMLE-MTO	0.093	0.095	0.141	0.151	0.141	0.178	0.17	0.900	0.929	0.923	100
r-IPCW-TMLE-MTO	0.083	0.087	0.137	0.152	0.139	0.173	0.164	0.906	0.945	0.921	100

Table 23: **Synthetic data MAR simulation: oracle conditional odds ratio (cOR), 5% outcome proportion, 40% missing proportion**. Comparing estimators under the **complex outcome and complex MAR** scenario. The value of the estimand is 0.405. 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 0.012 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	0.116	0.117	0.11	0.117	0.11	0.946	0.943	0.932	100
Complete-case*	0.181	0.182	0.122	0.129	0.122	0.222	0.219	0.712	0.680	0.995	100
Confounded model*	-0.383	-0.382	0.097	0.096	0.091	0.395	0.393	0.017	0.019	0.056	100
IPW*	0.07	0.069	0.127	0.129	0.125	0.147	0.143	0.924	0.920	0.958	100
Raking (vanilla)*	-0.019	-0.019	0.103	0.101	0.1	0.103	0.101	0.939	0.946	0.962	100
MICE*	0.046	0.047	0.103	0.107	0.098	0.116	0.108	0.937	0.928	0.988	100
MI-RF*	-0.01	-0.011	0.103	0.107	0.099	0.107	0.1	0.956	0.949	0.960	100
IPCW-TMLE-M*	0.08	0.079	0.13	0.14	0.128	0.161	0.15	0.936	0.907	0.949	100
IPCW-TMLE-MTO*	0.06	0.059	0.126	0.125	0.124	0.138	0.137	0.917	0.918	0.959	100
IPCW-a-TMLE-M*	0.095	0.093	0.133	0.14	0.13	0.169	0.159	0.919	0.891	0.959	100
IPCW-a-TMLE-MTO*	0.071	0.069	0.127	0.125	0.126	0.144	0.143	0.911	0.913	0.964	100
r-IPCW-TMLE-MTO*	0.052	0.051	0.125	0.127	0.125	0.137	0.134	0.939	0.927	0.953	100

Table 24: **Synthetic data MAR simulation: census conditional odds ratio (cOR), 5% outcome proportion, 40% missing proportion**. Comparing estimators under the **complex outcome and complex MAR** scenario. The value of the estimand is 0.38. 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 0.012 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	0.096	0.102	0.096	0.102	0.097	0.950	0.957	0.962	100
Complete-case	0.206	0.208	0.122	0.129	0.122	0.243	0.241	0.600	0.636	0.995	100
Confounded model	-0.358	-0.357	0.097	0.096	0.091	0.37	0.368	0.038	0.037	0.056	100
IPW	0.095	0.095	0.127	0.129	0.125	0.16	0.157	0.884	0.890	0.958	100
Raking (vanilla)	0.007	0.006	0.103	0.101	0.1	0.101	0.1	0.954	0.950	0.962	100
MICE	0.071	0.072	0.103	0.107	0.098	0.128	0.121	0.892	0.906	0.988	100
MI-RF	0.015	0.014	0.103	0.107	0.099	0.108	0.1	0.946	0.955	0.960	100
IPCW-TMLE-M	0.106	0.104	0.13	0.14	0.128	0.175	0.164	0.870	0.905	0.949	100
IPCW-TMLE-MTO	0.085	0.084	0.126	0.125	0.124	0.151	0.15	0.892	0.893	0.959	100
IPCW-a-TMLE-M	0.12	0.118	0.133	0.14	0.13	0.185	0.175	0.846	0.883	0.959	100
IPCW-a-TMLE-MTO	0.096	0.094	0.127	0.125	0.126	0.158	0.157	0.884	0.881	0.964	100
r-IPCW-TMLE-MTO	0.077	0.076	0.125	0.127	0.125	0.148	0.146	0.903	0.918	0.953	100

MAR: 5% outcome proportion, 80% missingness proportion

Table 25: **Synthetic data MAR simulation: oracle conditional odds ratio (cOR), 5% outcome proportion, 80% missing proportion**. Comparing estimators under the **simple outcome and simple MAR** scenario. The value of the estimand is 0.405. 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 0.012 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	0.103	0.103	0.104	0.103	0.104	0.947	0.947	0.971	100
Complete-case	-0.113	-0.110	0.357	0.352	0.346	0.37	0.364	0.943	0.936	0.134	100
Confounded model	0.218	0.218	0.099	0.099	0.095	0.24	0.238	0.406	0.408	1.000	100
IPW	-0.102	-0.105	0.426	0.401	0.406	0.414	0.419	0.920	0.941	0.119	100
Raking (vanilla)	-0.004	-0.002	0.165	0.19	0.161	0.19	0.161	0.974	0.945	0.581	100
MICE	0.002	0.001	0.142	0.139	0.14	0.139	0.14	0.939	0.948	0.818	100
MI-RF	0.121	0.122	0.122	0.112	0.118	0.165	0.17	0.788	0.834	0.989	100
IPCW-TMLE-M	-0.098	-0.101	0.447	0.413	0.426	0.425	0.438	0.919	0.944	0.125	100
IPCW-TMLE-MTO	-0.093	-0.095	0.451	0.401	0.439	0.412	0.449	0.908	0.946	0.145	100
r-IPCW-TMLE-MTO	-0.097	-0.099	0.447	0.402	0.43	0.414	0.441	0.913	0.945	0.142	100

Table 26: **Synthetic data MAR simulation: census conditional odds ratio (cOR), 5% outcome proportion, 80% missing proportion**. Comparing estimators under the **simple outcome and simple MAR** scenario. The value of the estimand is 0.402. 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 0.012 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	0.005	0.103	0.103	0.104	0.104	0.104	0.948	0.948	0.971	100
Complete-case	-0.109	-0.107	0.357	0.352	0.346	0.369	0.363	0.936	0.942	0.134	100
Confounded model	0.222	0.222	0.099	0.099	0.095	0.243	0.241	0.396	0.392	1.000	100
IPW	-0.099	-0.101	0.426	0.401	0.406	0.413	0.418	0.940	0.920	0.119	100
Raking (vanilla)	-0.001	0.002	0.165	0.19	0.161	0.19	0.161	0.945	0.974	0.581	100
MICE	0.006	0.004	0.142	0.139	0.14	0.139	0.14	0.947	0.939	0.818	100
MI-RF	0.125	0.126	0.122	0.112	0.118	0.168	0.172	0.827	0.780	0.989	100
IPCW-TMLE-M	-0.095	-0.098	0.447	0.413	0.426	0.424	0.437	0.944	0.919	0.125	100
IPCW-TMLE-MTO	-0.09	-0.092	0.451	0.401	0.439	0.411	0.448	0.947	0.909	0.145	100
r-IPCW-TMLE-MTO	-0.093	-0.096	0.447	0.402	0.43	0.413	0.441	0.946	0.914	0.142	100

Table 27: **Synthetic data MAR simulation: oracle conditional odds ratio (cOR), 5% outcome proportion, 80% missing proportion**. Comparing estimators under the **complex outcome and simple MAR** scenario. The value of the estimand is 0.405. 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 0.012 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	0.005	0.116	0.117	0.117	0.117	0.118	0.952	0.952	0.940	100
Complete-case*	-0.184	-0.177	0.341	0.338	0.331	0.385	0.375	0.937	0.916	0.112	100
Confounded model*	-0.378	-0.377	0.098	0.096	0.094	0.39	0.389	0.026	0.027	0.062	100
IPW*	-0.152	-0.148	0.377	0.357	0.379	0.388	0.407	0.915	0.935	0.117	100
Raking (vanilla)*	-0.032	-0.028	0.184	0.196	0.186	0.199	0.188	0.956	0.949	0.496	100
MICE*	0.115	0.114	0.18	0.163	0.177	0.199	0.211	0.876	0.905	0.895	100
MI-RF*	-0.068	-0.069	0.143	0.119	0.145	0.137	0.16	0.854	0.923	0.772	100
IPCW-TMLE-M*	-0.148	-0.146	0.399	0.369	0.385	0.397	0.411	0.914	0.937	0.119	100
IPCW-TMLE-MTO*	-0.112	-0.112	0.402	0.345	0.403	0.363	0.419	0.888	0.942	0.181	100
r-IPCW-TMLE-MTO*	-0.154	-0.154	0.392	0.355	0.388	0.387	0.417	0.900	0.936	0.131	100

Table 28: **Synthetic data MAR simulation: census conditional odds ratio (cOR), 5% outcome proportion, 80% missing proportion**. Comparing estimators under the **complex outcome and simple MAR** scenario. The value of the estimand is 0.38. 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 0.012 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	-0.004	0.098	0.102	0.097	0.102	0.097	0.948	0.955	0.961	100
Complete-case	-0.158	-0.152	0.341	0.338	0.331	0.374	0.364	0.926	0.945	0.112	100
Confounded model	-0.353	-0.352	0.098	0.096	0.094	0.366	0.364	0.048	0.043	0.062	100
IPW	-0.127	-0.123	0.377	0.357	0.379	0.379	0.398	0.941	0.921	0.117	100
Raking (vanilla)	-0.006	-0.003	0.184	0.196	0.186	0.196	0.186	0.948	0.964	0.496	100
MICE	0.14	0.139	0.18	0.163	0.177	0.215	0.225	0.879	0.849	0.895	100
MI-RF	-0.043	-0.044	0.143	0.119	0.145	0.126	0.151	0.936	0.876	0.772	100
IPCW-TMLE-M	-0.122	-0.121	0.399	0.369	0.385	0.388	0.403	0.941	0.920	0.119	100
IPCW-TMLE-MTO	-0.087	-0.087	0.402	0.345	0.403	0.356	0.413	0.943	0.895	0.181	100
r-IPCW-TMLE-MTO	-0.128	-0.129	0.392	0.355	0.388	0.377	0.409	0.940	0.912	0.131	100

Table 29: **Synthetic data MAR simulation: oracle conditional odds ratio (cOR), 5% outcome proportion, 80% missing proportion**. Comparing estimators under the **simple outcome and complex MAR** scenario. The value of the estimand is 0.405. 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 0.012 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	0.103	0.103	0.107	0.103	0.107	0.953	0.952	0.980	100
Complete-case	0.697	0.699	0.224	0.224	0.222	0.732	0.733	0.126	0.122	0.998	100
Confounded model	0.216	0.216	0.097	0.099	0.099	0.237	0.238	0.417	0.404	1.000	100
IPW	0.442	0.443	0.269	0.258	0.268	0.512	0.518	0.604	0.625	0.909	100
Raking (vanilla)	0.005	0.004	0.142	0.15	0.141	0.15	0.141	0.966	0.949	0.794	100
MICE	0.002	0.001	0.12	0.121	0.121	0.121	0.121	0.949	0.946	0.921	100
MI-RF	0.032	0.030	0.121	0.112	0.122	0.116	0.125	0.916	0.940	0.965	100
IPCW-TMLE-M	0.127	0.122	0.259	0.266	0.255	0.295	0.282	0.943	0.922	0.519	100
IPCW-TMLE-MTO	0.166	0.162	0.263	0.257	0.268	0.306	0.313	0.904	0.908	0.607	100
IPCW-a-TMLE-M	0.121	0.114	0.274	0.271	0.274	0.297	0.297	0.941	0.925	0.496	100
IPCW-a-TMLE-MTO	0.171	0.169	0.28	0.26	0.288	0.311	0.334	0.892	0.908	0.600	100
r-IPCW-TMLE-MTO	0.125	0.123	0.259	0.26	0.262	0.288	0.289	0.935	0.918	0.533	100

Table 30: **Synthetic data MAR simulation: census conditional odds ratio (cOR), 5% outcome proportion, 80% missing proportion**. Comparing estimators under the **simple outcome and complex MAR** scenario. The value of the estimand is 0.402. 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 0.012 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	0.103	0.103	0.107	0.103	0.107	0.953	0.953	0.980	100
Complete-case	0.7	0.702	0.224	0.224	0.222	0.735	0.736	0.119	0.122	0.998	100
Confounded model	0.219	0.220	0.097	0.099	0.099	0.24	0.241	0.392	0.402	1.000	100
IPW	0.446	0.446	0.269	0.258	0.268	0.515	0.521	0.623	0.600	0.909	100
Raking (vanilla)	0.008	0.007	0.142	0.15	0.141	0.15	0.142	0.949	0.965	0.794	100
MICE	0.006	0.005	0.12	0.121	0.121	0.121	0.121	0.947	0.948	0.921	100
MI-RF	0.035	0.034	0.121	0.112	0.122	0.117	0.126	0.938	0.914	0.965	100
IPCW-TMLE-M	0.13	0.125	0.259	0.266	0.255	0.296	0.284	0.920	0.941	0.519	100
IPCW-TMLE-MTO	0.17	0.165	0.263	0.257	0.268	0.308	0.315	0.906	0.903	0.607	100
IPCW-a-TMLE-M	0.125	0.117	0.274	0.271	0.274	0.298	0.298	0.925	0.940	0.496	100
IPCW-a-TMLE-MTO	0.174	0.172	0.28	0.26	0.288	0.313	0.336	0.906	0.890	0.600	100
r-IPCW-TMLE-MTO	0.128	0.126	0.259	0.26	0.262	0.29	0.291	0.915	0.932	0.533	100

Table 31: **Synthetic data MAR simulation: oracle conditional odds ratio (cOR), 5% outcome proportion, 80% missing proportion**. Comparing estimators under the **complex outcome and complex MAR** scenario. The value of the estimand is 0.405. 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 0.012 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	-0.004	0.119	0.117	0.12	0.117	0.12	0.949	0.954	0.934	100
Complete-case*	0.552	0.553	0.209	0.218	0.202	0.593	0.589	0.279	0.247	0.992	100
Confounded model*	-0.382	-0.384	0.098	0.096	0.1	0.394	0.397	0.022	0.026	0.066	100
IPW*	0.187	0.187	0.228	0.222	0.219	0.29	0.288	0.859	0.869	0.762	100
Raking (vanilla)*	0.012	0.007	0.153	0.154	0.152	0.155	0.153	0.955	0.949	0.787	100
MICE*	0.219	0.218	0.14	0.131	0.135	0.255	0.256	0.620	0.670	0.998	100
MI-RF*	0.095	0.090	0.132	0.118	0.131	0.151	0.159	0.848	0.891	0.984	100
IPCW-TMLE-M*	0.133	0.130	0.231	0.242	0.23	0.276	0.264	0.936	0.917	0.609	100
IPCW-TMLE-MTO*	0.123	0.123	0.224	0.215	0.218	0.247	0.25	0.899	0.910	0.689	100
IPCW-a-TMLE-M*	0.144	0.142	0.239	0.243	0.239	0.283	0.278	0.921	0.912	0.627	100
IPCW-a-TMLE-MTO*	0.144	0.145	0.228	0.217	0.228	0.26	0.27	0.884	0.903	0.699	100
r-IPCW-TMLE-MTO*	0.08	0.078	0.225	0.223	0.222	0.236	0.235	0.942	0.940	0.594	100

Table 32: **Synthetic data MAR simulation: census conditional odds ratio (cOR), 5% outcome proportion, 80% missing proportion**. Comparing estimators under the **complex outcome and complex MAR** scenario. The value of the estimand is 0.38. 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 0.012 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	0.1	0.102	0.096	0.102	0.097	0.946	0.953	0.952	100
Complete-case	0.577	0.578	0.209	0.218	0.202	0.617	0.612	0.215	0.244	0.992	100
Confounded model	-0.356	-0.359	0.098	0.096	0.1	0.369	0.372	0.051	0.046	0.066	100
IPW	0.212	0.212	0.228	0.222	0.219	0.307	0.305	0.844	0.840	0.762	100
Raking (vanilla)	0.038	0.032	0.153	0.154	0.152	0.159	0.156	0.945	0.948	0.787	100
MICE	0.244	0.243	0.14	0.131	0.135	0.277	0.278	0.599	0.545	0.998	100
MI-RF	0.12	0.115	0.132	0.118	0.131	0.168	0.174	0.854	0.800	0.984	100
IPCW-TMLE-M	0.158	0.155	0.231	0.242	0.23	0.289	0.277	0.902	0.922	0.609	100
IPCW-TMLE-MTO	0.148	0.148	0.224	0.215	0.218	0.26	0.263	0.890	0.886	0.689	100
IPCW-a-TMLE-M	0.169	0.167	0.239	0.243	0.239	0.296	0.291	0.891	0.909	0.627	100
IPCW-a-TMLE-MTO	0.17	0.170	0.228	0.217	0.228	0.275	0.284	0.883	0.858	0.699	100
r-IPCW-TMLE-MTO	0.105	0.103	0.225	0.223	0.222	0.246	0.244	0.932	0.932	0.594	100

MNAR: 12% outcome proportion, 40% missingness proportion

Table 33: **Synthetic data MNAR simulation: oracle conditional odds ratio (cOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome and MNAR-value** scenario. The value of the estimand is 0.405. 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 0.012 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	0.000	0.072	0.07	0.072	0.07	0.072	0.944	0.949	1.000	100
Complete-case	-0.14	-0.140	0.109	0.11	0.107	0.178	0.176	0.762	0.758	0.681	100
Confounded model	0.201	0.203	0.069	0.067	0.068	0.211	0.214	0.158	0.178	1.000	100
IPW	-0.147	-0.147	0.115	0.117	0.116	0.187	0.187	0.756	0.755	0.600	100
Raking (vanilla)	-0.116	-0.113	0.081	0.086	0.079	0.145	0.138	0.750	0.703	0.926	100
MICE	-0.115	-0.111	0.08	0.077	0.081	0.138	0.138	0.682	0.703	0.955	100
MI-XGB	-0.116	-0.113	0.081	0.097	0.082	0.151	0.14	0.821	0.711	0.870	100
MI-RF	-0.113	-0.110	0.079	0.075	0.079	0.135	0.136	0.676	0.708	0.968	100
IPCW-TMLE-M	-0.146	-0.148	0.124	0.124	0.122	0.192	0.192	0.779	0.786	0.551	100
IPCW-TMLE-MTO	-0.146	-0.149	0.123	0.122	0.12	0.19	0.192	0.772	0.785	0.565	100

Table 34: **Synthetic data MNAR simulation: census conditional odds ratio (cOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome and MNAR-value** scenario. The value of the estimand is 0.406. 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 0.012 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	0.072	0.07	0.072	0.07	0.072	0.949	0.944	1.000	100
Complete-case	-0.14	-0.140	0.109	0.11	0.107	0.178	0.176	0.758	0.762	0.681	100
Confounded model	0.201	0.203	0.069	0.067	0.068	0.211	0.214	0.178	0.158	1.000	100
IPW	-0.147	-0.147	0.115	0.117	0.116	0.187	0.187	0.755	0.755	0.600	100
Raking (vanilla)	-0.116	-0.113	0.081	0.086	0.079	0.145	0.138	0.702	0.749	0.926	100
MICE	-0.115	-0.112	0.08	0.077	0.081	0.138	0.138	0.703	0.681	0.955	100
MI-XGB	-0.116	-0.114	0.081	0.097	0.082	0.151	0.14	0.710	0.820	0.870	100
MI-RF	-0.113	-0.110	0.079	0.075	0.079	0.135	0.136	0.707	0.676	0.968	100
IPCW-TMLE-M	-0.146	-0.149	0.124	0.124	0.122	0.192	0.192	0.786	0.779	0.551	100
IPCW-TMLE-MTO	-0.146	-0.150	0.123	0.122	0.12	0.19	0.192	0.784	0.772	0.565	100

Table 35: **Synthetic data MNAR simulation: oracle conditional odds ratio (cOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **complex outcome and MNAR-value** scenario. The value of the estimand is 0.405. 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 0.012 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	0.081	0.08	0.081	0.08	0.081	0.945	0.947	0.998	100
Complete-case*	-0.177	-0.178	0.116	0.115	0.113	0.211	0.211	0.662	0.663	0.501	100
Confounded model*	-0.316	-0.317	0.069	0.068	0.069	0.323	0.324	0.004	0.004	0.266	100
IPW*	-0.17	-0.172	0.121	0.121	0.119	0.208	0.209	0.706	0.714	0.496	100
Raking (vanilla)*	-0.505	-0.504	0.086	0.096	0.085	0.514	0.512	0.000	0.000	0.147	100
MICE*	-0.505	-0.507	0.081	0.081	0.081	0.512	0.513	0.000	0.000	0.233	100
MI-XGB*	-0.389	-0.389	0.086	0.091	0.082	0.4	0.398	0.008	0.007	0.043	100
MI-RF*	-0.527	-0.528	0.083	0.081	0.08	0.533	0.534	0.000	0.000	0.317	100
IPCW-TMLE-M*	-0.17	-0.168	0.128	0.129	0.127	0.213	0.211	0.736	0.744	0.456	100
IPCW-TMLE-MTO*	-0.145	-0.143	0.124	0.122	0.123	0.189	0.189	0.766	0.784	0.585	100
IPCW-a-TMLE-M*	-0.17	-0.169	0.128	0.129	0.128	0.213	0.212	0.736	0.743	0.456	100
IPCW-a-TMLE-MTO*	-0.144	-0.142	0.125	0.121	0.123	0.188	0.188	0.764	0.786	0.584	100

Table 36: **Synthetic data MNAR simulation: census conditional odds ratio (cOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **complex outcome and MNAR-value** scenario. The value of the estimand is 0.371. 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 0.012 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	0.072	0.07	0.072	0.07	0.945	0.950	0.999	100
Complete-case	-0.143	-0.144	0.116	0.115	0.113	0.184	0.183	0.777	0.773	0.501	100
Confounded model	-0.282	-0.283	0.069	0.068	0.069	0.29	0.291	0.019	0.016	0.266	100
IPW	-0.136	-0.138	0.121	0.121	0.119	0.181	0.182	0.804	0.791	0.496	100
Raking (vanilla)	-0.471	-0.470	0.086	0.096	0.085	0.481	0.478	0.000	0.000	0.147	100
MICE	-0.471	-0.473	0.081	0.081	0.081	0.478	0.479	0.000	0.000	0.233	100
MI-XGB	-0.355	-0.355	0.086	0.091	0.082	0.367	0.365	0.015	0.020	0.043	100
MI-RF	-0.492	-0.494	0.083	0.081	0.08	0.499	0.5	0.000	0.000	0.317	100
IPCW-TMLE-M	-0.135	-0.134	0.128	0.129	0.127	0.187	0.185	0.820	0.813	0.456	100
IPCW-TMLE-MTO	-0.111	-0.109	0.124	0.122	0.123	0.165	0.165	0.855	0.838	0.585	100
IPCW-a-TMLE-M	-0.135	-0.135	0.128	0.129	0.128	0.187	0.186	0.818	0.813	0.456	100
IPCW-a-TMLE-MTO	-0.11	-0.108	0.125	0.121	0.123	0.164	0.164	0.854	0.837	0.584	100

Table 37: **Synthetic data MNAR simulation: oracle conditional odds ratio (cOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome and MNAR-unobserved** scenario. The value of the estimand is 0.405. 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 0.012 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	0.069	0.07	0.068	0.07	0.068	0.954	0.950	1.000	100
Complete-case	-0.077	-0.079	0.104	0.105	0.103	0.13	0.129	0.894	0.889	0.886	100
Confounded model	0.202	0.202	0.066	0.067	0.065	0.213	0.212	0.140	0.135	1.000	100
IPW	-0.078	-0.080	0.108	0.11	0.107	0.135	0.133	0.894	0.893	0.857	100
Raking (vanilla)	-0.008	-0.008	0.075	0.085	0.075	0.085	0.075	0.972	0.945	1.000	100
MICE	-0.008	-0.007	0.073	0.074	0.073	0.075	0.073	0.952	0.946	1.000	100
MI-XGB	-0.014	-0.013	0.075	0.077	0.075	0.079	0.076	0.952	0.946	1.000	100
MI-RF	-0.008	-0.008	0.074	0.073	0.075	0.074	0.075	0.943	0.946	1.000	100
IPCW-TMLE-M	-0.083	-0.083	0.115	0.116	0.111	0.143	0.139	0.886	0.895	0.801	100
IPCW-TMLE-MTO	-0.083	-0.082	0.115	0.114	0.111	0.141	0.138	0.886	0.896	0.812	100
IPCW-a-TMLE-M	-0.083	-0.083	0.115	0.116	0.111	0.142	0.139	0.886	0.894	0.800	100
IPCW-a-TMLE-MTO	-0.082	-0.081	0.115	0.114	0.111	0.14	0.138	0.882	0.897	0.812	100

Table 38: **Synthetic data MNAR simulation: census conditional odds ratio (cOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome and MNAR-unobserved** scenario. The value of the estimand is 0.406. 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 0.012 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	0.069	0.07	0.068	0.07	0.068	0.951	0.954	1.000	100
Complete-case	-0.077	-0.079	0.104	0.105	0.103	0.131	0.129	0.889	0.894	0.886	100
Confounded model	0.202	0.202	0.066	0.067	0.065	0.212	0.212	0.135	0.141	1.000	100
IPW	-0.078	-0.080	0.108	0.11	0.107	0.135	0.133	0.893	0.894	0.857	100
Raking (vanilla)	-0.008	-0.008	0.075	0.085	0.075	0.085	0.075	0.945	0.972	1.000	100
MICE	-0.008	-0.007	0.073	0.074	0.073	0.075	0.073	0.946	0.952	1.000	100
MI-XGB	-0.014	-0.014	0.075	0.077	0.075	0.079	0.076	0.946	0.951	1.000	100
MI-RF	-0.008	-0.008	0.074	0.073	0.075	0.074	0.075	0.946	0.943	1.000	100
IPCW-TMLE-M	-0.083	-0.084	0.115	0.116	0.111	0.143	0.139	0.895	0.885	0.801	100
IPCW-TMLE-MTO	-0.083	-0.083	0.115	0.114	0.111	0.141	0.139	0.896	0.885	0.812	100
IPCW-a-TMLE-M	-0.083	-0.084	0.115	0.116	0.111	0.143	0.139	0.894	0.884	0.800	100
IPCW-a-TMLE-MTO	-0.083	-0.082	0.115	0.114	0.111	0.14	0.138	0.897	0.882	0.812	100

Table 39: **Synthetic data MNAR simulation: oracle conditional odds ratio (cOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome (unobserved covariate) and MNAR-unobserved** scenario. The value of the estimand is 0.405. 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 0.012 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	0.077	0.075	0.078	0.075	0.078	0.947	0.954	0.999	100
Complete-case*	-0.075	-0.073	0.11	0.109	0.109	0.133	0.131	0.895	0.895	0.859	100
Confounded model*	0.202	0.206	0.072	0.069	0.071	0.214	0.218	0.172	0.195	1.000	100
IPW*	-0.078	-0.076	0.114	0.114	0.111	0.138	0.135	0.893	0.896	0.828	100
Raking (vanilla)*	-0.008	-0.007	0.08	0.088	0.082	0.088	0.082	0.966	0.948	0.996	100
MICE*	-0.007	-0.007	0.079	0.077	0.08	0.077	0.08	0.940	0.949	0.999	100
MI-RF*	-0.006	-0.005	0.08	0.076	0.08	0.076	0.08	0.936	0.949	0.998	100
IPCW-TMLE-M*	-0.082	-0.082	0.119	0.12	0.117	0.145	0.143	0.894	0.895	0.784	100
IPCW-TMLE-MTO*	-0.082	-0.082	0.118	0.118	0.116	0.144	0.142	0.890	0.896	0.790	100
IPCW-a-TMLE-M*	-0.082	-0.081	0.119	0.12	0.117	0.145	0.143	0.894	0.896	0.784	100
IPCW-a-TMLE-MTO*	-0.082	-0.080	0.118	0.118	0.117	0.143	0.142	0.889	0.896	0.796	100

Table 40: **Synthetic data MNAR simulation: census conditional odds ratio (cOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome (unobserved covariate) and MNAR-unobserved** scenario. The value of the estimand is 0.404. 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 0.012 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	0.075	0.073	0.074	0.073	0.074	0.948	0.942	0.999	100
Complete-case	-0.074	-0.072	0.11	0.109	0.109	0.132	0.13	0.895	0.895	0.859	100
Confounded model	0.204	0.207	0.072	0.069	0.071	0.215	0.219	0.188	0.171	1.000	100
IPW	-0.077	-0.075	0.114	0.114	0.111	0.137	0.134	0.896	0.894	0.828	100
Raking (vanilla)	-0.007	-0.006	0.08	0.088	0.082	0.088	0.082	0.949	0.966	0.996	100
MICE	-0.006	-0.006	0.079	0.077	0.08	0.077	0.08	0.948	0.942	0.999	100
MI-RF	-0.005	-0.004	0.08	0.076	0.08	0.076	0.08	0.948	0.936	0.998	100
IPCW-TMLE-M	-0.081	-0.081	0.119	0.12	0.117	0.145	0.143	0.896	0.896	0.784	100
IPCW-TMLE-MTO	-0.081	-0.081	0.118	0.118	0.116	0.143	0.142	0.895	0.891	0.790	100
IPCW-a-TMLE-M	-0.081	-0.080	0.119	0.12	0.117	0.145	0.142	0.897	0.894	0.784	100
IPCW-a-TMLE-MTO	-0.081	-0.079	0.118	0.118	0.117	0.143	0.142	0.897	0.890	0.796	100

MNAR: 12% outcome proportion, 80% missingness proportion

Table 41: **Synthetic data MNAR simulation: oracle conditional odds ratio (cOR), 12% outcome proportion, 80% missing proportion**. Comparing estimators under the **simple outcome and MNAR-value** scenario. The value of the estimand is 0.405. 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 0.012 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	0.072	0.07	0.074	0.07	0.074	0.951	0.956	1.000	100
Complete-case	-0.143	-0.149	0.212	0.208	0.216	0.252	0.263	0.889	0.900	0.250	100
Confounded model	0.204	0.203	0.068	0.067	0.071	0.215	0.215	0.142	0.154	1.000	100
IPW	-0.133	-0.134	0.257	0.247	0.261	0.281	0.293	0.892	0.922	0.195	100
Raking (vanilla)	-0.105	-0.101	0.117	0.124	0.113	0.163	0.151	0.882	0.856	0.696	100
MICE	-0.113	-0.111	0.113	0.113	0.111	0.16	0.157	0.807	0.836	0.739	100
MI-XGB	-0.121	-0.118	0.113	0.122	0.109	0.172	0.161	0.860	0.816	0.653	100
MI-RF	-0.095	-0.094	0.102	0.08	0.099	0.124	0.137	0.738	0.848	0.924	100
IPCW-TMLE-M	-0.131	-0.135	0.272	0.26	0.273	0.292	0.305	0.893	0.923	0.177	100
IPCW-TMLE-MTO	-0.13	-0.133	0.271	0.252	0.271	0.284	0.302	0.881	0.924	0.198	100

Table 42: **Synthetic data MNAR simulation: census conditional odds ratio (cOR), 12% outcome proportion, 80% missing proportion**. Comparing estimators under the **simple outcome and MNAR-value** scenario. The value of the estimand is 0.406. 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 0.012 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	0.002	0.072	0.07	0.074	0.07	0.074	0.956	0.951	1.000	100
Complete-case	-0.143	-0.149	0.212	0.208	0.216	0.252	0.263	0.900	0.889	0.250	100
Confounded model	0.204	0.203	0.068	0.067	0.071	0.215	0.215	0.155	0.143	1.000	100
IPW	-0.134	-0.134	0.257	0.247	0.261	0.281	0.293	0.922	0.892	0.195	100
Raking (vanilla)	-0.105	-0.101	0.117	0.124	0.113	0.163	0.152	0.856	0.881	0.696	100
MICE	-0.113	-0.111	0.113	0.113	0.111	0.16	0.157	0.835	0.807	0.739	100
MI-XGB	-0.122	-0.118	0.113	0.122	0.109	0.172	0.161	0.815	0.860	0.653	100
MI-RF	-0.095	-0.095	0.102	0.08	0.099	0.124	0.137	0.848	0.738	0.924	100
IPCW-TMLE-M	-0.131	-0.136	0.272	0.26	0.273	0.292	0.305	0.923	0.893	0.177	100
IPCW-TMLE-MTO	-0.131	-0.134	0.271	0.252	0.271	0.284	0.302	0.924	0.881	0.198	100

Table 43: **Synthetic data MNAR simulation: oracle conditional odds ratio (cOR), 12% outcome proportion, 80% missing proportion**. Comparing estimators under the **complex outcome and MNAR-value** scenario. The value of the estimand is 0.405. 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 0.012 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	0.081	0.08	0.081	0.08	0.081	0.948	0.952	0.999	100
Complete-case*	-0.176	-0.178	0.204	0.202	0.203	0.268	0.27	0.856	0.863	0.207	100
Confounded model*	-0.314	-0.314	0.068	0.068	0.071	0.322	0.322	0.003	0.003	0.272	100
IPW*	-0.156	-0.155	0.242	0.235	0.242	0.282	0.288	0.876	0.902	0.181	100
Raking (vanilla)*	-0.664	-0.663	0.132	0.139	0.132	0.679	0.676	0.002	0.000	0.456	100
MICE*	-0.664	-0.663	0.124	0.115	0.125	0.674	0.675	0.010	0.001	0.621	100
MI-RF*	-0.68	-0.679	0.108	0.093	0.108	0.687	0.688	0.000	0.000	0.812	100
IPCW-TMLE-M*	-0.154	-0.159	0.258	0.246	0.258	0.29	0.303	0.882	0.916	0.172	100
IPCW-TMLE-MTO*	-0.147	-0.151	0.254	0.233	0.25	0.275	0.292	0.874	0.914	0.211	100
IPCW-a-TMLE-M*	-0.155	-0.157	0.257	0.245	0.258	0.29	0.302	0.882	0.917	0.171	100
IPCW-a-TMLE-MTO*	-0.144	-0.149	0.255	0.23	0.256	0.272	0.296	0.866	0.918	0.221	100

Table 44: **Synthetic data MNAR simulation: census conditional odds ratio (cOR), 12% outcome proportion, 80% missing proportion**. Comparing estimators under the **complex outcome and MNAR-value** scenario. The value of the estimand is 0.371. 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 0.012 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	0.001	0.07	0.072	0.07	0.072	0.07	0.950	0.957	1.000	100
Complete-case	-0.142	-0.144	0.204	0.202	0.203	0.247	0.249	0.894	0.892	0.207	100
Confounded model	-0.28	-0.280	0.068	0.068	0.071	0.288	0.288	0.011	0.012	0.272	100
IPW	-0.121	-0.121	0.242	0.235	0.242	0.264	0.271	0.922	0.899	0.181	100
Raking (vanilla)	-0.63	-0.629	0.132	0.139	0.132	0.645	0.643	0.001	0.003	0.456	100
MICE	-0.63	-0.629	0.124	0.115	0.125	0.64	0.641	0.002	0.012	0.621	100
MI-RF	-0.646	-0.645	0.108	0.093	0.108	0.653	0.654	0.000	0.000	0.812	100
IPCW-TMLE-M	-0.12	-0.125	0.258	0.246	0.258	0.273	0.287	0.929	0.906	0.172	100
IPCW-TMLE-MTO	-0.112	-0.117	0.254	0.233	0.25	0.259	0.276	0.926	0.897	0.211	100
IPCW-a-TMLE-M	-0.121	-0.123	0.257	0.245	0.258	0.273	0.286	0.931	0.904	0.171	100
IPCW-a-TMLE-MTO	-0.11	-0.115	0.255	0.23	0.256	0.255	0.28	0.931	0.891	0.221	100

Table 45: **Synthetic data MNAR simulation: oracle conditional odds ratio (cOR), 12% outcome proportion, 80% missing proportion**. Comparing estimators under the **simple outcome and MNAR-unobserved** scenario. The value of the estimand is 0.405. 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 0.012 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	0.069	0.07	0.069	0.07	0.069	0.952	0.950	1.000	100
Complete-case	-0.064	-0.061	0.21	0.213	0.217	0.223	0.225	0.951	0.945	0.355	100
Confounded model	0.201	0.201	0.065	0.067	0.066	0.212	0.211	0.140	0.132	1.000	100
IPW	-0.064	-0.063	0.247	0.246	0.242	0.254	0.25	0.940	0.942	0.272	100
Raking (vanilla)	-0.008	-0.008	0.107	0.12	0.104	0.12	0.105	0.967	0.944	0.925	100
MICE	-0.011	-0.011	0.093	0.092	0.095	0.093	0.095	0.947	0.947	0.982	100
MI-XGB	0.002	0.004	0.107	0.1	0.103	0.1	0.103	0.931	0.950	0.950	100
MI-RF	0.035	0.037	0.095	0.079	0.095	0.087	0.102	0.878	0.937	0.998	100
IPCW-TMLE-M	-0.07	-0.073	0.26	0.256	0.261	0.266	0.271	0.932	0.943	0.243	100
IPCW-TMLE-MTO	-0.068	-0.070	0.259	0.249	0.254	0.258	0.264	0.924	0.942	0.267	100
IPCW-a-TMLE-M	-0.071	-0.071	0.26	0.256	0.256	0.266	0.266	0.932	0.942	0.246	100
IPCW-a-TMLE-MTO	-0.066	-0.068	0.259	0.246	0.252	0.255	0.261	0.924	0.942	0.286	100

Table 46: **Synthetic data MNAR simulation: census conditional odds ratio (cOR), 12% outcome proportion, 80% missing proportion**. Comparing estimators under the **simple outcome and MNAR-unobserved** scenario. The value of the estimand is 0.406. 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 0.012 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	0.069	0.07	0.069	0.07	0.069	0.950	0.952	1.000	100
Complete-case	-0.064	-0.061	0.21	0.213	0.217	0.223	0.225	0.945	0.950	0.355	100
Confounded model	0.201	0.201	0.065	0.067	0.066	0.212	0.211	0.132	0.140	1.000	100
IPW	-0.064	-0.063	0.247	0.246	0.242	0.254	0.25	0.942	0.940	0.272	100
Raking (vanilla)	-0.009	-0.008	0.107	0.12	0.104	0.12	0.105	0.945	0.967	0.925	100
MICE	-0.011	-0.011	0.093	0.092	0.095	0.093	0.095	0.947	0.947	0.982	100
MI-XGB	0.002	0.004	0.107	0.1	0.103	0.1	0.103	0.950	0.931	0.950	100
MI-RF	0.035	0.037	0.095	0.079	0.095	0.087	0.102	0.937	0.878	0.998	100
IPCW-TMLE-M	-0.07	-0.074	0.26	0.256	0.261	0.266	0.271	0.943	0.932	0.243	100
IPCW-TMLE-MTO	-0.068	-0.071	0.259	0.249	0.254	0.258	0.264	0.942	0.924	0.267	100
IPCW-a-TMLE-M	-0.071	-0.072	0.26	0.256	0.256	0.266	0.266	0.942	0.932	0.246	100
IPCW-a-TMLE-MTO	-0.066	-0.069	0.259	0.246	0.252	0.255	0.261	0.942	0.924	0.286	100

Table 47: **Synthetic data MNAR simulation: oracle conditional odds ratio (cOR), 12% outcome proportion, 80% missing proportion**. Comparing estimators under the **simple outcome (unobserved covariate) and MNAR-unobserved** scenario. The value of the estimand is 0.405. 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 0.012 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	0.002	0.077	0.075	0.079	0.075	0.079	0.952	0.956	1.000	100
Complete-case*	-0.067	-0.065	0.22	0.222	0.216	0.232	0.225	0.944	0.938	0.331	100
Confounded model*	0.206	0.205	0.071	0.069	0.073	0.217	0.218	0.158	0.172	1.000	100
IPW*	-0.068	-0.068	0.255	0.255	0.251	0.264	0.26	0.931	0.936	0.252	100
Raking (vanilla)*	-0.007	-0.009	0.109	0.124	0.112	0.125	0.112	0.975	0.948	0.908	100
MICE*	-0.01	-0.012	0.098	0.096	0.098	0.097	0.099	0.946	0.949	0.977	100
MI-XGB*	-0.001	0.001	0.103	0.098	0.104	0.098	0.104	0.934	0.950	0.970	100
MI-RF*	0.042	0.043	0.098	0.082	0.1	0.092	0.109	0.867	0.930	0.997	100
IPCW-TMLE-M*	-0.07	-0.066	0.271	0.267	0.265	0.276	0.274	0.927	0.940	0.228	100
IPCW-TMLE-MTO*	-0.067	-0.066	0.269	0.259	0.265	0.267	0.274	0.915	0.940	0.251	100
IPCW-a-TMLE-M*	-0.069	-0.069	0.271	0.267	0.265	0.275	0.274	0.926	0.939	0.224	100
IPCW-a-TMLE-MTO*	-0.066	-0.067	0.269	0.256	0.263	0.264	0.272	0.914	0.938	0.265	100

Table 48: **Synthetic data MNAR simulation: census conditional odds ratio (cOR), 12% outcome proportion, 80% missing proportion**. Comparing estimators under the **simple outcome (unobserved covariate) and MNAR-unobserved** scenario. The value of the estimand is 0.404. 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 0.012 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	0.075	0.073	0.076	0.073	0.076	0.956	0.951	0.999	100
Complete-case	-0.066	-0.064	0.22	0.222	0.216	0.232	0.225	0.939	0.945	0.331	100
Confounded model	0.207	0.206	0.071	0.069	0.073	0.218	0.219	0.166	0.154	1.000	100
IPW	-0.067	-0.067	0.255	0.255	0.251	0.264	0.26	0.937	0.931	0.252	100
Raking (vanilla)	-0.006	-0.008	0.109	0.124	0.112	0.125	0.112	0.949	0.975	0.908	100
MICE	-0.009	-0.011	0.098	0.096	0.098	0.096	0.098	0.950	0.945	0.977	100
MI-XGB	0	0.002	0.103	0.098	0.104	0.098	0.104	0.950	0.934	0.970	100
MI-RF	0.043	0.044	0.098	0.082	0.1	0.093	0.109	0.930	0.866	0.997	100
IPCW-TMLE-M	-0.069	-0.065	0.271	0.267	0.265	0.275	0.273	0.940	0.927	0.228	100
IPCW-TMLE-MTO	-0.066	-0.065	0.269	0.259	0.265	0.267	0.273	0.941	0.916	0.251	100
IPCW-a-TMLE-M	-0.068	-0.068	0.271	0.267	0.265	0.275	0.274	0.939	0.926	0.224	100
IPCW-a-TMLE-MTO	-0.065	-0.066	0.269	0.256	0.263	0.264	0.271	0.938	0.914	0.265	100

MNAR: 5% outcome proportion, 40% missingness proportion

Table 49: **Synthetic data MNAR simulation: oracle conditional odds ratio (cOR), 5% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome and MNAR-value** scenario. The value of the estimand is 0.405. 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 0.012 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	0.000	0.099	0.103	0.096	0.103	0.096	0.961	0.952	0.984	100
Complete-case	-0.139	-0.137	0.16	0.164	0.163	0.215	0.213	0.868	0.859	0.370	100
Confounded model	0.216	0.214	0.094	0.099	0.092	0.238	0.233	0.404	0.366	1.000	100
IPW	-0.144	-0.142	0.173	0.173	0.172	0.225	0.223	0.857	0.861	0.328	100
Raking (vanilla)	-0.113	-0.115	0.112	0.129	0.11	0.172	0.159	0.902	0.828	0.630	100
MICE	-0.115	-0.117	0.11	0.114	0.109	0.161	0.16	0.839	0.821	0.732	100
MI-XGB	-0.114	-0.115	0.111	0.126	0.112	0.17	0.161	0.892	0.820	0.653	100
MI-RF	-0.105	-0.104	0.108	0.109	0.108	0.152	0.15	0.840	0.838	0.782	100
IPCW-TMLE-M	-0.146	-0.143	0.183	0.183	0.179	0.234	0.23	0.864	0.870	0.286	100
IPCW-TMLE-MTO	-0.145	-0.141	0.182	0.18	0.179	0.231	0.228	0.855	0.872	0.298	100

Table 50: **Synthetic data MNAR simulation: census conditional odds ratio (cOR), 5% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome and MNAR-value** scenario. The value of the estimand is 0.402. 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 0.012 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	0.004	0.003	0.099	0.103	0.096	0.103	0.096	0.952	0.963	0.984	100
Complete-case	-0.136	-0.134	0.16	0.164	0.163	0.213	0.211	0.863	0.872	0.370	100
Confounded model	0.22	0.217	0.094	0.099	0.092	0.241	0.236	0.351	0.391	1.000	100
IPW	-0.141	-0.139	0.173	0.173	0.172	0.223	0.221	0.864	0.864	0.328	100
Raking (vanilla)	-0.109	-0.112	0.112	0.129	0.11	0.169	0.157	0.836	0.907	0.630	100
MICE	-0.111	-0.113	0.11	0.114	0.109	0.159	0.157	0.832	0.847	0.732	100
MI-XGB	-0.11	-0.112	0.111	0.126	0.112	0.168	0.158	0.834	0.896	0.653	100
MI-RF	-0.102	-0.101	0.108	0.109	0.108	0.149	0.148	0.845	0.848	0.782	100
IPCW-TMLE-M	-0.142	-0.140	0.183	0.183	0.179	0.232	0.228	0.874	0.866	0.286	100
IPCW-TMLE-MTO	-0.141	-0.138	0.182	0.18	0.179	0.229	0.226	0.875	0.857	0.298	100

Table 51: **Synthetic data MNAR simulation: oracle conditional odds ratio (cOR), 5% outcome proportion, 40% missing proportion**. Comparing estimators under the **complex outcome and MNAR-value** scenario. The value of the estimand is 0.405. 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 0.012 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	0.117	0.117	0.115	0.117	0.116	0.944	0.946	0.932	100
Complete-case*	-0.171	-0.173	0.165	0.167	0.159	0.239	0.235	0.829	0.830	0.279	100
Confounded model*	-0.379	-0.376	0.097	0.096	0.097	0.391	0.388	0.021	0.021	0.060	100
IPW*	-0.164	-0.165	0.17	0.172	0.166	0.237	0.234	0.834	0.837	0.284	100
Raking (vanilla)*	-0.598	-0.598	0.123	0.143	0.123	0.615	0.61	0.005	0.002	0.234	100
MICE*	-0.627	-0.627	0.113	0.114	0.111	0.638	0.636	0.000	0.000	0.495	100
MI-RF*	-0.606	-0.604	0.114	0.112	0.113	0.617	0.615	0.000	0.000	0.431	100
IPCW-TMLE-M*	-0.165	-0.167	0.18	0.183	0.176	0.246	0.243	0.852	0.860	0.245	100
IPCW-TMLE-MTO*	-0.139	-0.144	0.176	0.175	0.173	0.223	0.226	0.866	0.882	0.327	100
IPCW-a-TMLE-M*	-0.165	-0.168	0.179	0.183	0.175	0.246	0.243	0.852	0.855	0.246	100
IPCW-a-TMLE-MTO*	-0.139	-0.141	0.176	0.174	0.172	0.222	0.223	0.858	0.878	0.335	100
r-IPCW-TMLE-MTO*	-0.151	-0.155	0.174	0.175	0.173	0.232	0.232	0.852	0.864	0.299	100

Table 52: **Synthetic data MNAR simulation: census conditional odds ratio (cOR), 5% outcome proportion, 40% missing proportion**. Comparing estimators under the **complex outcome and MNAR-value** scenario. The value of the estimand is 0.38. 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 0.012 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	0.097	0.102	0.097	0.102	0.097	0.949	0.959	0.958	100
Complete-case	-0.145	-0.148	0.165	0.167	0.159	0.221	0.217	0.866	0.866	0.279	100
Confounded model	-0.354	-0.350	0.097	0.096	0.097	0.367	0.364	0.040	0.036	0.060	100
IPW	-0.139	-0.140	0.17	0.172	0.166	0.221	0.217	0.877	0.868	0.284	100
Raking (vanilla)	-0.573	-0.572	0.123	0.143	0.123	0.59	0.586	0.003	0.009	0.234	100
MICE	-0.602	-0.601	0.113	0.114	0.111	0.613	0.612	0.000	0.000	0.495	100
MI-RF	-0.581	-0.579	0.114	0.112	0.113	0.592	0.59	0.000	0.000	0.431	100
IPCW-TMLE-M	-0.14	-0.142	0.18	0.183	0.176	0.23	0.227	0.883	0.876	0.245	100
IPCW-TMLE-MTO	-0.114	-0.119	0.176	0.175	0.173	0.208	0.211	0.906	0.894	0.327	100
IPCW-a-TMLE-M	-0.14	-0.143	0.179	0.183	0.175	0.23	0.226	0.884	0.878	0.246	100
IPCW-a-TMLE-MTO	-0.114	-0.116	0.176	0.174	0.172	0.208	0.208	0.908	0.891	0.335	100
r-IPCW-TMLE-MTO	-0.126	-0.130	0.174	0.175	0.173	0.216	0.216	0.892	0.886	0.299	100

Table 53: **Synthetic data MNAR simulation: oracle conditional odds ratio (cOR), 5% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome and MNAR-unobserved** scenario. The value of the estimand is 0.405. 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 0.012 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	0.000	0.104	0.103	0.104	0.103	0.104	0.948	0.950	0.976	100
Complete-case	-0.075	-0.078	0.16	0.158	0.157	0.175	0.176	0.920	0.925	0.545	100
Confounded model	0.215	0.216	0.1	0.099	0.101	0.237	0.238	0.410	0.425	1.000	100
IPW	-0.078	-0.080	0.165	0.164	0.164	0.182	0.183	0.914	0.920	0.513	100
Raking (vanilla)	-0.007	-0.007	0.112	0.128	0.111	0.129	0.111	0.977	0.948	0.906	100
MICE	-0.007	-0.008	0.11	0.109	0.112	0.109	0.112	0.948	0.948	0.953	100
MI-RF	0.015	0.014	0.11	0.107	0.111	0.108	0.112	0.946	0.948	0.970	100
IPCW-TMLE-M	-0.083	-0.087	0.175	0.173	0.17	0.192	0.191	0.911	0.923	0.456	100
IPCW-TMLE-MTO	-0.083	-0.086	0.174	0.17	0.168	0.189	0.189	0.908	0.924	0.470	100
IPCW-a-TMLE-M	-0.083	-0.086	0.175	0.173	0.17	0.192	0.19	0.912	0.924	0.457	100
IPCW-a-TMLE-MTO	-0.082	-0.084	0.175	0.169	0.17	0.188	0.19	0.907	0.921	0.475	100
r-IPCW-TMLE-MTO	-0.083	-0.086	0.174	0.17	0.17	0.189	0.191	0.909	0.925	0.469	100

Table 54: **Synthetic data MNAR simulation: census conditional odds ratio (cOR), 5% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome and MNAR-unobserved** scenario. The value of the estimand is 0.402. 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 0.012 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	0.004	0.104	0.103	0.104	0.103	0.104	0.950	0.948	0.976	100
Complete-case	-0.072	-0.074	0.16	0.158	0.157	0.174	0.174	0.928	0.922	0.545	100
Confounded model	0.219	0.219	0.1	0.099	0.101	0.24	0.241	0.411	0.396	1.000	100
IPW	-0.075	-0.077	0.165	0.164	0.164	0.18	0.181	0.921	0.917	0.513	100
Raking (vanilla)	-0.003	-0.003	0.112	0.128	0.111	0.128	0.111	0.950	0.976	0.906	100
MICE	-0.004	-0.005	0.11	0.109	0.112	0.109	0.112	0.950	0.950	0.953	100
MI-RF	0.019	0.017	0.11	0.107	0.111	0.109	0.112	0.947	0.945	0.970	100
IPCW-TMLE-M	-0.08	-0.084	0.175	0.173	0.17	0.19	0.189	0.926	0.915	0.456	100
IPCW-TMLE-MTO	-0.08	-0.083	0.174	0.17	0.168	0.188	0.187	0.928	0.911	0.470	100
IPCW-a-TMLE-M	-0.08	-0.083	0.175	0.173	0.17	0.19	0.189	0.927	0.914	0.457	100
IPCW-a-TMLE-MTO	-0.079	-0.081	0.175	0.169	0.17	0.187	0.189	0.924	0.908	0.475	100
r-IPCW-TMLE-MTO	-0.08	-0.083	0.174	0.17	0.17	0.188	0.19	0.926	0.909	0.469	100

Table 55: **Synthetic data MNAR simulation: oracle conditional odds ratio (cOR), 5% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome (unobserved covariate) and MNAR-unobserved** scenario. The value of the estimand is 0.405. 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 0.012 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	0.11	0.114	0.108	0.114	0.108	0.958	0.950	0.957	100
Complete-case*	-0.071	-0.068	0.169	0.17	0.169	0.184	0.182	0.928	0.926	0.513	100
Confounded model*	0.219	0.216	0.102	0.106	0.1	0.243	0.238	0.464	0.440	1.000	100
IPW*	-0.072	-0.070	0.178	0.176	0.175	0.19	0.189	0.921	0.930	0.479	100
Raking (vanilla)*	-0.005	-0.003	0.116	0.138	0.116	0.138	0.116	0.980	0.950	0.872	100
MICE*	-0.005	-0.006	0.113	0.117	0.112	0.117	0.112	0.956	0.949	0.940	100
MI-RF*	0.024	0.023	0.113	0.115	0.112	0.117	0.114	0.946	0.942	0.967	100
IPCW-TMLE-M*	-0.077	-0.076	0.189	0.185	0.185	0.2	0.2	0.917	0.929	0.434	100
IPCW-TMLE-MTO*	-0.076	-0.074	0.189	0.182	0.187	0.197	0.201	0.914	0.929	0.441	100
IPCW-a-TMLE-M*	-0.077	-0.075	0.189	0.184	0.187	0.2	0.201	0.916	0.929	0.435	100
IPCW-a-TMLE-MTO*	-0.076	-0.074	0.189	0.181	0.185	0.197	0.2	0.911	0.930	0.449	100
r-IPCW-TMLE-MTO*	-0.077	-0.076	0.188	0.182	0.185	0.198	0.2	0.914	0.928	0.441	100

Table 56: **Synthetic data MNAR simulation: census conditional odds ratio (cOR), 5% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome (unobserved covariate) and MNAR-unobserved** scenario. The value of the estimand is 0.405. 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 0.012 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	0.107	0.111	0.106	0.111	0.106	0.952	0.960	0.966	100
Complete-case	-0.07	-0.067	0.169	0.17	0.169	0.184	0.181	0.926	0.928	0.513	100
Confounded model	0.22	0.217	0.102	0.106	0.1	0.244	0.239	0.437	0.462	1.000	100
IPW	-0.071	-0.069	0.178	0.176	0.175	0.19	0.188	0.930	0.920	0.479	100
Raking (vanilla)	-0.004	-0.003	0.116	0.138	0.116	0.138	0.116	0.951	0.980	0.872	100
MICE	-0.004	-0.005	0.113	0.117	0.112	0.117	0.112	0.950	0.957	0.940	100
MI-RF	0.025	0.024	0.113	0.115	0.112	0.117	0.114	0.941	0.946	0.967	100
IPCW-TMLE-M	-0.076	-0.075	0.189	0.185	0.185	0.2	0.199	0.929	0.917	0.434	100
IPCW-TMLE-MTO	-0.076	-0.074	0.189	0.182	0.187	0.197	0.201	0.929	0.914	0.441	100
IPCW-a-TMLE-M	-0.076	-0.075	0.189	0.184	0.187	0.2	0.201	0.930	0.916	0.435	100
IPCW-a-TMLE-MTO	-0.075	-0.074	0.189	0.181	0.185	0.196	0.2	0.930	0.911	0.449	100
r-IPCW-TMLE-MTO	-0.076	-0.076	0.188	0.182	0.185	0.197	0.2	0.929	0.913	0.441	100

MNAR: 5% outcome proportion, 80% missingness proportion

Table 57: **Synthetic data MNAR simulation: oracle conditional odds ratio (cOR), 5% outcome proportion, 80% missing proportion**. Comparing estimators under the **simple outcome and MNAR-value** scenario. The value of the estimand is 0.405. 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 0.012 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	0.104	0.103	0.107	0.103	0.107	0.955	0.955	0.977	100
Complete-case	-0.129	-0.132	0.333	0.316	0.328	0.341	0.353	0.917	0.928	0.136	100
Confounded model	0.216	0.216	0.099	0.099	0.102	0.237	0.238	0.424	0.431	1.000	100
IPW	-0.126	-0.135	0.393	0.369	0.394	0.39	0.416	0.910	0.937	0.112	100
Raking (vanilla)	-0.112	-0.111	0.172	0.186	0.173	0.218	0.205	0.932	0.904	0.364	100
MICE	-0.119	-0.114	0.16	0.16	0.157	0.2	0.194	0.880	0.879	0.471	100
MI-XGB	-0.101	-0.098	0.162	0.152	0.16	0.183	0.188	0.898	0.900	0.535	100
MI-RF	-0.032	-0.031	0.142	0.117	0.146	0.121	0.149	0.889	0.943	0.834	100
IPCW-TMLE-M	-0.13	-0.143	0.415	0.385	0.412	0.406	0.436	0.902	0.945	0.099	100
IPCW-TMLE-MTO	-0.129	-0.141	0.416	0.373	0.412	0.395	0.436	0.890	0.942	0.122	100

Table 58: **Synthetic data MNAR simulation: census conditional odds ratio (cOR), 5% outcome proportion, 80% missing proportion**. Comparing estimators under the **simple outcome and MNAR-value** scenario. The value of the estimand is 0.402. 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 0.012 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	0.104	0.103	0.107	0.103	0.107	0.954	0.955	0.977	100
Complete-case	-0.126	-0.128	0.333	0.316	0.328	0.34	0.352	0.929	0.917	0.136	100
Confounded model	0.219	0.219	0.099	0.099	0.102	0.24	0.242	0.414	0.408	1.000	100
IPW	-0.123	-0.131	0.393	0.369	0.394	0.389	0.415	0.938	0.910	0.112	100
Raking (vanilla)	-0.109	-0.107	0.172	0.186	0.173	0.216	0.203	0.906	0.933	0.364	100
MICE	-0.116	-0.111	0.16	0.16	0.157	0.198	0.192	0.883	0.882	0.471	100
MI-XGB	-0.097	-0.094	0.162	0.152	0.16	0.181	0.186	0.901	0.900	0.535	100
MI-RF	-0.029	-0.027	0.142	0.117	0.146	0.121	0.149	0.946	0.890	0.834	100
IPCW-TMLE-M	-0.126	-0.140	0.415	0.385	0.412	0.405	0.435	0.945	0.904	0.099	100
IPCW-TMLE-MTO	-0.126	-0.138	0.416	0.373	0.412	0.394	0.435	0.942	0.892	0.122	100

Table 59: **Synthetic data MNAR simulation: oracle conditional odds ratio (cOR), 5% outcome proportion, 80% missing proportion**. Comparing estimators under the **complex outcome and MNAR-value** scenario. The value of the estimand is 0.405. 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 0.012 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	0.000	0.121	0.117	0.119	0.117	0.119	0.938	0.946	0.930	100
Complete-case*	-0.148	-0.154	0.285	0.283	0.281	0.319	0.321	0.924	0.926	0.144	100
Confounded model*	-0.379	-0.378	0.098	0.096	0.097	0.391	0.39	0.024	0.028	0.067	100
IPW*	-0.139	-0.146	0.33	0.32	0.321	0.349	0.352	0.905	0.926	0.118	100
Raking (vanilla)*	-0.824	-0.821	0.194	0.2	0.185	0.848	0.841	0.020	0.011	0.564	100
MICE*	-0.869	-0.867	0.171	0.155	0.174	0.882	0.885	0.004	0.001	0.829	100
MI-RF*	-0.8	-0.799	0.143	0.124	0.145	0.809	0.812	0.000	0.000	0.863	100
IPCW-TMLE-M*	-0.138	-0.148	0.347	0.331	0.335	0.359	0.366	0.913	0.930	0.121	100
IPCW-TMLE-MTO*	-0.13	-0.136	0.348	0.319	0.337	0.344	0.364	0.901	0.934	0.145	100
IPCW-a-TMLE-M*	-0.138	-0.144	0.347	0.331	0.334	0.359	0.364	0.908	0.930	0.120	100
IPCW-a-TMLE-MTO*	-0.128	-0.131	0.346	0.315	0.335	0.34	0.36	0.900	0.930	0.150	100
r-IPCW-TMLE-MTO*	-0.138	-0.144	0.346	0.323	0.34	0.351	0.369	0.901	0.934	0.134	100

Table 60: **Synthetic data MNAR simulation: census conditional odds ratio (cOR), 5% outcome proportion, 80% missing proportion**. Comparing estimators under the **complex outcome and MNAR-value** scenario. The value of the estimand is 0.38. 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 0.012 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	-0.007	0.1	0.102	0.098	0.102	0.098	0.950	0.954	0.965	100
Complete-case	-0.122	-0.129	0.285	0.283	0.281	0.308	0.309	0.934	0.930	0.144	100
Confounded model	-0.353	-0.353	0.098	0.096	0.097	0.366	0.366	0.052	0.046	0.067	100
IPW	-0.114	-0.121	0.33	0.32	0.321	0.339	0.343	0.934	0.914	0.118	100
Raking (vanilla)	-0.799	-0.796	0.194	0.2	0.185	0.823	0.817	0.015	0.025	0.564	100
MICE	-0.843	-0.842	0.171	0.155	0.174	0.857	0.86	0.001	0.005	0.829	100
MI-RF	-0.774	-0.774	0.143	0.124	0.145	0.784	0.787	0.000	0.000	0.863	100
IPCW-TMLE-M	-0.113	-0.123	0.347	0.331	0.335	0.35	0.357	0.934	0.918	0.121	100
IPCW-TMLE-MTO	-0.105	-0.111	0.348	0.319	0.337	0.336	0.355	0.940	0.909	0.145	100
IPCW-a-TMLE-M	-0.113	-0.119	0.347	0.331	0.334	0.35	0.355	0.936	0.918	0.120	100
IPCW-a-TMLE-MTO	-0.103	-0.106	0.346	0.315	0.335	0.332	0.352	0.935	0.911	0.150	100
r-IPCW-TMLE-MTO	-0.113	-0.119	0.346	0.323	0.34	0.342	0.36	0.936	0.912	0.134	100

Table 61: **Synthetic data MNAR simulation: oracle conditional odds ratio (cOR), 5% outcome proportion, 80% missing proportion**. Comparing estimators under the **simple outcome and MNAR-unobserved** scenario. The value of the estimand is 0.405. 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 0.012 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	0.105	0.103	0.105	0.103	0.105	0.952	0.954	0.978	100
Complete-case	-0.061	-0.068	0.334	0.327	0.327	0.332	0.334	0.949	0.951	0.178	100
Confounded model	0.22	0.221	0.1	0.099	0.102	0.241	0.243	0.397	0.411	1.000	100
IPW	-0.053	-0.065	0.39	0.371	0.383	0.375	0.388	0.936	0.950	0.154	100
Raking (vanilla)	-0.005	-0.002	0.157	0.184	0.156	0.184	0.156	0.975	0.943	0.608	100
MICE	-0.007	-0.003	0.138	0.136	0.135	0.136	0.135	0.945	0.951	0.823	100
MI-RF	0.106	0.112	0.122	0.113	0.119	0.155	0.164	0.827	0.866	0.986	100
IPCW-TMLE-M	-0.052	-0.072	0.41	0.387	0.397	0.39	0.404	0.929	0.948	0.145	100
IPCW-TMLE-MTO	-0.048	-0.061	0.412	0.376	0.405	0.379	0.409	0.922	0.948	0.160	100
IPCW-a-TMLE-M	-0.051	-0.071	0.41	0.386	0.4	0.39	0.406	0.932	0.947	0.146	100
IPCW-a-TMLE-MTO	-0.047	-0.067	0.415	0.371	0.405	0.374	0.411	0.922	0.948	0.179	100
r-IPCW-TMLE-MTO	-0.052	-0.069	0.41	0.377	0.403	0.381	0.408	0.925	0.949	0.159	100

Table 62: **Synthetic data MNAR simulation: census conditional odds ratio (cOR), 5% outcome proportion, 80% missing proportion**. Comparing estimators under the **simple outcome and MNAR-unobserved** scenario. The value of the estimand is 0.402. 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 0.012 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	0.009	0.105	0.103	0.105	0.104	0.105	0.952	0.950	0.978	100
Complete-case	-0.057	-0.065	0.334	0.327	0.327	0.332	0.333	0.952	0.949	0.178	100
Confounded model	0.223	0.224	0.1	0.099	0.102	0.244	0.246	0.397	0.386	1.000	100
IPW	-0.05	-0.061	0.39	0.371	0.383	0.375	0.388	0.950	0.936	0.154	100
Raking (vanilla)	-0.002	0.001	0.157	0.184	0.156	0.184	0.156	0.944	0.975	0.608	100
MICE	-0.003	0.000	0.138	0.136	0.135	0.136	0.135	0.950	0.945	0.823	100
MI-RF	0.11	0.116	0.122	0.113	0.119	0.157	0.166	0.861	0.818	0.986	100
IPCW-TMLE-M	-0.048	-0.069	0.41	0.387	0.397	0.39	0.403	0.948	0.930	0.145	100
IPCW-TMLE-MTO	-0.045	-0.058	0.412	0.376	0.405	0.379	0.409	0.947	0.923	0.160	100
IPCW-a-TMLE-M	-0.048	-0.068	0.41	0.386	0.4	0.389	0.405	0.946	0.931	0.146	100
IPCW-a-TMLE-MTO	-0.044	-0.064	0.415	0.371	0.405	0.374	0.411	0.949	0.922	0.179	100
r-IPCW-TMLE-MTO	-0.048	-0.066	0.41	0.377	0.403	0.38	0.408	0.948	0.925	0.159	100

Table 63: **Synthetic data MNAR simulation: oracle conditional odds ratio (cOR), 5% outcome proportion, 80% missing proportion**. Comparing estimators under the **simple outcome (unobserved covariate) and MNAR-unobserved** scenario. The value of the estimand is 0.405. 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 0.012 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	0.114	0.114	0.115	0.114	0.115	0.952	0.952	0.948	100
Complete-case*	-0.049	-0.056	0.36	0.353	0.351	0.357	0.356	0.942	0.944	0.168	100
Confounded model*	0.218	0.215	0.106	0.106	0.107	0.243	0.24	0.470	0.470	1.000	100
IPW*	-0.048	-0.052	0.421	0.4	0.412	0.403	0.415	0.931	0.950	0.141	100
Raking (vanilla)*	-0.004	-0.003	0.172	0.2	0.168	0.2	0.168	0.975	0.946	0.538	100
MICE*	-0.005	-0.004	0.148	0.145	0.151	0.145	0.151	0.947	0.950	0.775	100
MI-XGB*	0.054	0.056	0.148	0.134	0.153	0.145	0.163	0.899	0.940	0.889	100
MI-RF*	0.119	0.119	0.127	0.12	0.127	0.168	0.174	0.809	0.843	0.985	100
IPCW-TMLE-M*	-0.055	-0.061	0.441	0.414	0.43	0.417	0.434	0.927	0.948	0.125	100
IPCW-TMLE-MTO*	-0.049	-0.052	0.442	0.403	0.433	0.406	0.436	0.918	0.950	0.148	100
IPCW-a-TMLE-M*	-0.054	-0.061	0.442	0.414	0.431	0.417	0.436	0.926	0.948	0.126	100
IPCW-a-TMLE-MTO*	-0.045	-0.056	0.444	0.399	0.435	0.401	0.439	0.915	0.949	0.154	100

Table 64: **Synthetic data MNAR simulation: census conditional odds ratio (cOR), 5% outcome proportion, 80% missing proportion**. Comparing estimators under the **simple outcome (unobserved covariate) and MNAR-unobserved** scenario. The value of the estimand is 0.405. 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 0.012 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	0.111	0.111	0.11	0.111	0.11	0.950	0.950	0.958	100
Complete-case	-0.049	-0.055	0.36	0.353	0.351	0.357	0.356	0.944	0.942	0.168	100
Confounded model	0.219	0.215	0.106	0.106	0.107	0.243	0.241	0.468	0.468	1.000	100
IPW	-0.047	-0.051	0.421	0.4	0.412	0.403	0.415	0.950	0.931	0.141	100
Raking (vanilla)	-0.004	-0.002	0.172	0.2	0.168	0.2	0.168	0.947	0.975	0.538	100
MICE	-0.004	-0.003	0.148	0.145	0.151	0.145	0.151	0.950	0.947	0.775	100
MI-XGB	0.055	0.057	0.148	0.134	0.153	0.145	0.164	0.939	0.897	0.889	100
MI-RF	0.119	0.120	0.127	0.12	0.127	0.169	0.175	0.841	0.807	0.985	100
IPCW-TMLE-M	-0.054	-0.061	0.441	0.414	0.43	0.417	0.434	0.949	0.927	0.125	100
IPCW-TMLE-MTO	-0.048	-0.052	0.442	0.403	0.433	0.406	0.436	0.950	0.919	0.148	100
IPCW-a-TMLE-M	-0.053	-0.061	0.442	0.414	0.431	0.417	0.436	0.948	0.926	0.126	100
IPCW-a-TMLE-MTO	-0.045	-0.056	0.444	0.399	0.435	0.401	0.439	0.948	0.915	0.154	100

Other scenarios

Table 65: **Synthetic data MAR simulation: oracle conditional odds ratio (cOR), 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 0.012 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	0.075	0.075	0.076	0.075	0.076	0.951	0.949	0.049	100
Complete-case	-0.003	-0.003	0.1	0.099	0.099	0.099	0.099	0.943	0.946	0.057	100
Confounded model	0.218	0.219	0.072	0.071	0.074	0.23	0.231	0.137	0.140	0.863	100
IPW	-0.004	-0.004	0.115	0.115	0.115	0.115	0.115	0.944	0.950	0.056	100
Raking (vanilla)	-0.002	-0.004	0.082	0.081	0.081	0.081	0.082	0.948	0.950	0.052	100
MICE	-0.002	-0.003	0.079	0.078	0.078	0.078	0.079	0.948	0.950	0.052	100
MI-XGB	-0.006	-0.006	0.081	0.082	0.083	0.082	0.083	0.949	0.946	0.051	100
MI-RF	0.008	0.008	0.08	0.079	0.08	0.079	0.081	0.944	0.948	0.056	100
IPCW-TMLE-M	-0.004	-0.003	0.122	0.12	0.121	0.12	0.121	0.946	0.951	0.054	100
IPCW-TMLE-MTO	-0.004	-0.002	0.121	0.118	0.121	0.118	0.121	0.943	0.951	0.057	100
IPCW-a-TMLE-M	-0.004	-0.004	0.121	0.119	0.119	0.12	0.119	0.947	0.950	0.053	100
IPCW-a-TMLE-MTO	-0.004	-0.003	0.121	0.117	0.12	0.117	0.12	0.947	0.951	0.053	100

Table 66: **Synthetic data MAR simulation: census conditional odds ratio (cOR), 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 0.012 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	-0.008	-0.008	0.075	0.075	0.076	0.076	0.077	0.948	0.950	0.049	100
Complete-case	-0.008	-0.008	0.1	0.099	0.099	0.1	0.099	0.944	0.944	0.057	100
Confounded model	0.213	0.214	0.072	0.071	0.074	0.225	0.226	0.159	0.158	0.863	100
IPW	-0.009	-0.009	0.115	0.115	0.115	0.115	0.115	0.948	0.944	0.056	100
Raking (vanilla)	-0.007	-0.009	0.082	0.081	0.081	0.081	0.082	0.950	0.946	0.052	100
MICE	-0.007	-0.008	0.079	0.078	0.078	0.079	0.079	0.949	0.945	0.052	100
MI-XGB	-0.011	-0.011	0.081	0.082	0.083	0.083	0.084	0.942	0.946	0.051	100
MI-RF	0.003	0.003	0.08	0.079	0.08	0.079	0.08	0.949	0.946	0.056	100
IPCW-TMLE-M	-0.009	-0.008	0.122	0.12	0.121	0.12	0.121	0.950	0.944	0.054	100
IPCW-TMLE-MTO	-0.009	-0.007	0.121	0.118	0.121	0.118	0.121	0.951	0.941	0.057	100
IPCW-a-TMLE-M	-0.009	-0.009	0.121	0.119	0.119	0.12	0.12	0.948	0.944	0.053	100
IPCW-a-TMLE-MTO	-0.009	-0.008	0.121	0.117	0.12	0.117	0.12	0.951	0.944	0.053	100

Table 67: **Synthetic data MAR simulation: oracle conditional odds ratio (cOR), 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 0.012 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	0.075	0.075	0.076	0.075	0.076	0.944	0.944	0.056	100
Complete-case	-0.196	-0.195	0.132	0.129	0.133	0.235	0.236	0.666	0.680	0.334	100
Confounded model	0.22	0.221	0.072	0.071	0.071	0.232	0.232	0.132	0.131	0.868	100
IPW	-0.007	-0.007	0.144	0.142	0.144	0.142	0.144	0.945	0.952	0.055	100
Raking (vanilla)	-0.001	0.000	0.083	0.084	0.082	0.084	0.082	0.950	0.948	0.050	100
MICE	0	0.002	0.08	0.081	0.08	0.081	0.08	0.951	0.948	0.049	100
MI-XGB	-0.003	-0.001	0.082	0.083	0.082	0.083	0.082	0.953	0.948	0.047	100
MI-RF	0.012	0.015	0.082	0.08	0.081	0.081	0.083	0.940	0.947	0.060	100
IPCW-TMLE-M	-0.025	-0.022	0.146	0.148	0.15	0.15	0.152	0.954	0.952	0.046	100
IPCW-TMLE-MTO	-0.025	-0.021	0.146	0.146	0.15	0.148	0.151	0.948	0.950	0.052	100

Table 68: **Synthetic data MAR simulation: census conditional odds ratio (cOR), 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 0.012 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	-0.004	0.075	0.075	0.076	0.076	0.076	0.944	0.945	0.056	100
Complete-case	-0.201	-0.200	0.132	0.129	0.133	0.239	0.24	0.667	0.652	0.334	100
Confounded model	0.215	0.216	0.072	0.071	0.071	0.227	0.228	0.149	0.148	0.868	100
IPW	-0.012	-0.012	0.144	0.142	0.144	0.143	0.145	0.950	0.945	0.055	100
Raking (vanilla)	-0.006	-0.005	0.083	0.084	0.082	0.084	0.082	0.949	0.953	0.050	100
MICE	-0.005	-0.003	0.08	0.081	0.08	0.082	0.08	0.947	0.952	0.049	100
MI-XGB	-0.008	-0.006	0.082	0.083	0.082	0.083	0.082	0.947	0.951	0.047	100
MI-RF	0.007	0.010	0.082	0.08	0.081	0.08	0.082	0.948	0.942	0.060	100
IPCW-TMLE-M	-0.03	-0.028	0.146	0.148	0.15	0.151	0.153	0.950	0.952	0.046	100
IPCW-TMLE-MTO	-0.03	-0.026	0.146	0.146	0.15	0.149	0.152	0.948	0.946	0.052	100

Table 69: **Synthetic data MAR simulation: oracle conditional odds ratio (cOR), 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 0.405. 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 0.012 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	0.07	0.07	0.072	0.07	0.072	0.954	0.952	1.000	100
Complete-case	0	-0.001	0.094	0.093	0.097	0.093	0.097	0.946	0.948	0.993	100
Confounded model	0.204	0.206	0.067	0.067	0.067	0.215	0.216	0.135	0.135	1.000	100
IPW	-0.001	-0.003	0.111	0.107	0.111	0.107	0.111	0.939	0.948	0.970	100
Raking (vanilla)	0.002	0.002	0.076	0.075	0.078	0.075	0.078	0.945	0.950	1.000	100
MICE	0.001	0.003	0.073	0.073	0.076	0.073	0.076	0.952	0.953	1.000	100
MI-XGB	-0.004	-0.003	0.075	0.076	0.076	0.076	0.076	0.952	0.950	1.000	100
MI-RF	0.008	0.009	0.074	0.073	0.075	0.074	0.076	0.951	0.952	1.000	100
IPCW-TMLE-M	0	-0.002	0.116	0.112	0.109	0.112	0.109	0.936	0.948	0.962	100
IPCW-TMLE-MTO	0	0.001	0.116	0.11	0.11	0.11	0.11	0.933	0.946	0.962	100

Table 70: **Synthetic data MAR simulation: census conditional odds ratio (cOR), 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 0.406. 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 0.012 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	0.07	0.07	0.072	0.07	0.072	0.952	0.954	1.000	100
Complete-case	0	-0.001	0.094	0.093	0.097	0.093	0.097	0.948	0.946	0.993	100
Confounded model	0.204	0.206	0.067	0.067	0.067	0.215	0.216	0.136	0.136	1.000	100
IPW	-0.002	-0.003	0.111	0.107	0.111	0.107	0.111	0.948	0.939	0.970	100
Raking (vanilla)	0.001	0.002	0.076	0.075	0.078	0.075	0.078	0.950	0.945	1.000	100
MICE	0.001	0.003	0.073	0.073	0.076	0.073	0.076	0.953	0.952	1.000	100
MI-XGB	-0.004	-0.003	0.075	0.076	0.076	0.076	0.076	0.950	0.952	1.000	100
MI-RF	0.008	0.008	0.074	0.073	0.075	0.074	0.076	0.952	0.951	1.000	100
IPCW-TMLE-M	0	-0.002	0.116	0.112	0.109	0.112	0.109	0.948	0.936	0.962	100
IPCW-TMLE-MTO	0	0.000	0.116	0.11	0.11	0.11	0.11	0.946	0.933	0.962	100

Table 71: **Synthetic data MAR simulation: oracle conditional odds ratio (cOR), 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 0.405. 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 0.012 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	0.002	0.072	0.07	0.072	0.07	0.072	0.947	0.953	1.000	100
Complete-case	0	-0.003	0.169	0.166	0.166	0.166	0.166	0.945	0.946	0.686	100
Confounded model	0.202	0.203	0.068	0.067	0.069	0.213	0.215	0.146	0.157	1.000	100
IPW	abs > ln(10)	-0.002	abs > ln(10)	abs > ln(10)	0.261	abs > ln(10)	0.261	0.939	0.997	0.372	100
Raking (vanilla)	-0.001	-0.001	0.109	0.107	0.109	0.107	0.109	0.943	0.954	0.954	100
MICE	-0.001	-0.001	0.088	0.085	0.089	0.085	0.089	0.946	0.952	0.994	100
MI-RF	0.025	0.026	0.092	0.081	0.091	0.085	0.095	0.910	0.940	0.997	100
IPCW-TMLE-M	-0.004	-0.006	0.259	0.25	0.268	0.251	0.268	0.944	0.955	0.365	100
IPCW-TMLE-MTO	0.001	0.001	0.257	0.239	0.267	0.239	0.267	0.933	0.957	0.412	100

Table 72: **Synthetic data MAR simulation: census conditional odds ratio (cOR), 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 0.406. 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 0.012 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	0.002	0.072	0.07	0.072	0.07	0.072	0.954	0.947	1.000	100
Complete-case	0	-0.003	0.169	0.166	0.166	0.166	0.166	0.946	0.945	0.686	100
Confounded model	0.202	0.203	0.068	0.067	0.069	0.213	0.214	0.158	0.146	1.000	100
IPW	abs > ln(10)	-0.002	abs > ln(10)	abs > ln(10)	0.261	abs > ln(10)	0.261	0.997	0.939	0.372	100
Raking (vanilla)	-0.001	-0.001	0.109	0.107	0.109	0.107	0.109	0.954	0.943	0.954	100
MICE	-0.001	-0.002	0.088	0.085	0.089	0.085	0.089	0.952	0.946	0.994	100
MI-RF	0.025	0.026	0.092	0.081	0.091	0.085	0.095	0.940	0.910	0.997	100
IPCW-TMLE-M	-0.004	-0.007	0.259	0.25	0.268	0.251	0.268	0.956	0.944	0.365	100
IPCW-TMLE-MTO	0.001	0.000	0.257	0.239	0.267	0.239	0.267	0.957	0.933	0.412	100

Table 73: **Synthetic data MAR simulation: oracle conditional odds ratio (cOR), 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 0.012 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	-0.006	-0.003	0.145	0.142	0.147	0.142	0.147	0.948	0.952	0.052	100
Complete-case*	0.094	0.097	0.135	0.159	0.129	0.185	0.161	0.945	0.892	0.055	100
Confounded model*	0.193	0.192	0.073	0.087	0.07	0.212	0.205	0.376	0.242	0.624	100
IPW*	0.105	0.105	0.162	0.157	0.159	0.188	0.191	0.893	0.901	0.107	100
Raking (vanilla)*	0.108	0.107	0.086	0.086	0.086	0.138	0.138	0.755	0.758	0.245	100
MICE*	0.116	0.117	0.083	0.097	0.082	0.151	0.143	0.812	0.717	0.188	100
MI-XGB*	0.142	0.143	0.085	0.097	0.084	0.172	0.166	0.711	0.616	0.289	100
MI-RF*	0.151	0.150	0.083	0.095	0.081	0.178	0.171	0.664	0.564	0.336	100
IPCW-TMLE-M*	0.086	0.083	0.165	0.161	0.163	0.182	0.183	0.919	0.916	0.081	100
IPCW-TMLE-MTO*	0.105	0.103	0.126	0.117	0.123	0.157	0.16	0.849	0.871	0.151	100

Table 74: **Synthetic data MAR simulation: census conditional odds ratio (cOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **semi-complex outcome and simple MAR** scenario. The value of the estimand is 0.115. 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 0.012 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	-0.005	-0.006	0.076	0.091	0.074	0.091	0.074	0.944	0.980	0.179	100
Complete-case	-0.021	-0.018	0.135	0.159	0.129	0.16	0.13	0.944	0.974	0.055	100
Confounded model	0.078	0.077	0.073	0.087	0.07	0.117	0.104	0.818	0.902	0.624	100
IPW	-0.011	-0.010	0.162	0.157	0.159	0.157	0.16	0.955	0.940	0.107	100
Raking (vanilla)	-0.007	-0.008	0.086	0.086	0.086	0.086	0.087	0.950	0.952	0.245	100
MICE	0.001	0.002	0.083	0.097	0.082	0.097	0.082	0.950	0.980	0.188	100
MI-XGB	0.027	0.028	0.085	0.097	0.084	0.101	0.089	0.932	0.968	0.289	100
MI-RF	0.036	0.035	0.083	0.095	0.081	0.101	0.089	0.926	0.960	0.336	100
IPCW-TMLE-M	-0.029	-0.032	0.165	0.161	0.163	0.163	0.166	0.948	0.931	0.081	100
IPCW-TMLE-MTO	-0.011	-0.012	0.126	0.117	0.123	0.118	0.124	0.944	0.925	0.151	100

Table 75: **Synthetic data MAR simulation: oracle conditional odds ratio (cOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **semi-complex outcome and simple MAR** scenario. The value of the estimand is -0.693. 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 0.012 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	-0.006	-0.008	0.152	0.152	0.147	0.152	0.148	0.942	0.941	0.996	100
Complete-case*	0.572	0.573	0.14	0.168	0.14	0.596	0.59	0.054	0.018	0.064	100
Confounded model*	0.646	0.646	0.079	0.092	0.08	0.652	0.651	0.000	0.000	0.044	100
IPW*	0.555	0.556	0.167	0.166	0.165	0.58	0.58	0.082	0.082	0.142	100
Raking (vanilla)*	0.561	0.562	0.093	0.09	0.094	0.568	0.57	0.000	0.000	0.314	100
MICE*	0.572	0.571	0.089	0.102	0.088	0.581	0.578	0.000	0.000	0.187	100
MI-XGB*	0.599	0.601	0.091	0.102	0.091	0.608	0.607	0.000	0.000	0.117	100
MI-RF*	0.609	0.608	0.089	0.1	0.088	0.617	0.614	0.000	0.000	0.105	100
IPCW-TMLE-M*	0.54	0.541	0.17	0.169	0.17	0.566	0.567	0.102	0.111	0.170	100
IPCW-TMLE-MTO*	0.551	0.550	0.132	0.124	0.129	0.565	0.565	0.010	0.010	0.250	100

Table 76: **Synthetic data MAR simulation: census conditional odds ratio (cOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **semi-complex outcome and simple MAR** scenario. The value of the estimand is -0.127. 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 0.012 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	-0.005	0.082	0.096	0.082	0.096	0.082	0.950	0.976	0.240	100
Complete-case	0.006	0.007	0.14	0.168	0.14	0.169	0.14	0.948	0.986	0.064	100
Confounded model	0.08	0.080	0.079	0.092	0.08	0.122	0.113	0.825	0.893	0.044	100
IPW	-0.011	-0.010	0.167	0.166	0.165	0.166	0.165	0.949	0.943	0.142	100
Raking (vanilla)	-0.005	-0.004	0.093	0.09	0.094	0.09	0.094	0.950	0.937	0.314	100
MICE	0.006	0.005	0.089	0.102	0.088	0.102	0.088	0.951	0.973	0.187	100
MI-XGB	0.033	0.035	0.091	0.102	0.091	0.107	0.097	0.933	0.961	0.117	100
MI-RF	0.043	0.042	0.089	0.1	0.088	0.108	0.098	0.920	0.952	0.105	100
IPCW-TMLE-M	-0.026	-0.025	0.17	0.169	0.17	0.171	0.172	0.945	0.937	0.170	100
IPCW-TMLE-MTO	-0.015	-0.016	0.132	0.124	0.129	0.125	0.13	0.948	0.925	0.250	100

Table 77: **Synthetic data MAR simulation: oracle conditional odds ratio (cOR), 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 0.012 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	0.001	0.144	0.143	0.145	0.143	0.145	0.950	0.953	0.050	100
Complete-case*	0.036	0.038	0.133	0.157	0.133	0.161	0.138	0.970	0.938	0.030	100
Confounded model*	-0.254	-0.254	0.073	0.073	0.073	0.264	0.265	0.066	0.069	0.934	100
IPW*	0.109	0.110	0.141	0.142	0.138	0.179	0.176	0.885	0.881	0.115	100
Raking (vanilla)*	0.118	0.116	0.113	0.109	0.113	0.16	0.162	0.802	0.819	0.198	100
MICE*	0.092	0.091	0.093	0.108	0.094	0.141	0.131	0.906	0.834	0.094	100
MI-XGB*	0.092	0.095	0.117	0.119	0.114	0.151	0.149	0.880	0.880	0.120	100
MI-RF*	0.198	0.197	0.106	0.111	0.107	0.227	0.224	0.573	0.538	0.427	100
IPCW-TMLE-M*	0.1	0.100	0.149	0.148	0.145	0.178	0.176	0.897	0.895	0.103	100
IPCW-TMLE-MTO*	0.116	0.114	0.115	0.107	0.116	0.158	0.162	0.786	0.826	0.214	100

Table 78: **Synthetic data MAR simulation: census conditional odds ratio (cOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **semi-complex outcome and simple MAR** scenario. The value of the estimand is 0.116. 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 0.012 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	0.079	0.092	0.078	0.092	0.078	0.948	0.977	0.212	100
Complete-case	-0.08	-0.078	0.133	0.157	0.133	0.176	0.154	0.916	0.955	0.030	100
Confounded model	-0.37	-0.370	0.073	0.073	0.073	0.377	0.378	0.002	0.002	0.934	100
IPW	-0.007	-0.006	0.141	0.142	0.138	0.142	0.138	0.946	0.952	0.115	100
Raking (vanilla)	0.002	0.000	0.113	0.109	0.113	0.109	0.113	0.947	0.942	0.198	100
MICE	-0.024	-0.025	0.093	0.108	0.094	0.111	0.098	0.942	0.969	0.094	100
MI-XGB	-0.024	-0.021	0.117	0.119	0.114	0.121	0.116	0.944	0.949	0.120	100
MI-RF	0.082	0.080	0.106	0.111	0.107	0.138	0.134	0.873	0.895	0.427	100
IPCW-TMLE-M	-0.016	-0.016	0.149	0.148	0.145	0.149	0.146	0.949	0.942	0.103	100
IPCW-TMLE-MTO	0	-0.002	0.115	0.107	0.116	0.107	0.116	0.952	0.929	0.214	100

Table 79: **Synthetic data MAR simulation: oracle conditional odds ratio (cOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **semi-complex outcome and simple MAR** scenario. The value of the estimand is -0.693. 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 0.012 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	-0.003	0.002	0.154	0.153	0.154	0.153	0.154	0.949	0.951	0.997	100
Complete-case*	0.488	0.490	0.138	0.166	0.142	0.515	0.51	0.130	0.062	0.189	100
Confounded model*	0.247	0.247	0.077	0.077	0.078	0.258	0.259	0.110	0.104	1.000	100
IPW*	0.563	0.560	0.15	0.15	0.15	0.583	0.579	0.040	0.038	0.142	100
Raking (vanilla)*	0.568	0.568	0.113	0.114	0.114	0.579	0.58	0.003	0.002	0.198	100
MICE*	0.581	0.580	0.091	0.112	0.089	0.591	0.587	0.000	0.000	0.124	100
MI-XGB*	0.591	0.590	0.117	0.125	0.117	0.604	0.601	0.004	0.002	0.112	100
MI-RF*	0.65	0.651	0.104	0.116	0.107	0.661	0.659	0.000	0.000	0.040	100
IPCW-TMLE-M*	0.552	0.550	0.155	0.155	0.153	0.573	0.571	0.060	0.058	0.155	100
IPCW-TMLE-MTO*	0.56	0.560	0.121	0.114	0.122	0.571	0.573	0.004	0.005	0.244	100

Table 80: **Synthetic data MAR simulation: census conditional odds ratio (cOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **semi-complex outcome and simple MAR** scenario. The value of the estimand is -0.128. 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 0.012 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	0.003	0.003	0.082	0.096	0.081	0.096	0.081	0.953	0.980	0.213	100
Complete-case	-0.077	-0.075	0.138	0.166	0.142	0.183	0.16	0.910	0.966	0.189	100
Confounded model	-0.318	-0.318	0.077	0.077	0.078	0.328	0.327	0.014	0.013	1.000	100
IPW	-0.002	-0.005	0.15	0.15	0.15	0.15	0.15	0.952	0.951	0.142	100
Raking (vanilla)	0.003	0.003	0.113	0.114	0.114	0.114	0.114	0.950	0.949	0.198	100
MICE	0.016	0.016	0.091	0.112	0.089	0.113	0.09	0.944	0.981	0.124	100
MI-XGB	0.026	0.025	0.117	0.125	0.117	0.127	0.12	0.943	0.951	0.112	100
MI-RF	0.086	0.086	0.104	0.116	0.107	0.144	0.137	0.863	0.910	0.040	100
IPCW-TMLE-M	-0.013	-0.015	0.155	0.155	0.153	0.156	0.153	0.944	0.946	0.155	100
IPCW-TMLE-MTO	-0.005	-0.005	0.121	0.114	0.122	0.114	0.122	0.951	0.934	0.244	100

Table 81: **Synthetic data MAR simulation: oracle conditional odds ratio (cOR), 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 -0.693. 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 0.012 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	-0.009	-0.012	0.153	0.153	0.154	0.153	0.154	0.954	0.949	0.998	100
Complete-case*	0.547	0.546	0.189	0.226	0.183	0.592	0.576	0.286	0.168	0.058	100
Confounded model*	0.243	0.244	0.075	0.077	0.076	0.255	0.255	0.115	0.095	1.000	100
IPW*	abs > ln(10)	0.551	abs > ln(10)	abs > ln(10)	0.306	abs > ln(10)	0.63	0.499	0.996	0.110	100
Raking (vanilla)*	0.571	0.568	0.237	0.213	0.226	0.609	0.611	0.250	0.330	0.121	100
MICE*	0.399	0.396	0.097	0.127	0.096	0.418	0.408	0.056	0.017	0.686	100
MI-RF*	0.666	0.665	0.149	0.136	0.149	0.679	0.682	0.006	0.006	0.085	100
IPCW-TMLE-M*	0.555	0.558	0.319	0.291	0.322	0.627	0.644	0.510	0.589	0.110	100
IPCW-TMLE-MTO*	0.562	0.561	0.271	0.219	0.267	0.603	0.621	0.305	0.457	0.163	100

Table 82: **Synthetic data MAR simulation: census conditional odds ratio (cOR), 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 -0.128. 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 0.012 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	0.08	0.096	0.083	0.096	0.083	0.951	0.980	0.227	100
Complete-case	-0.018	-0.018	0.189	0.226	0.183	0.226	0.184	0.946	0.983	0.058	100
Confounded model	-0.322	-0.321	0.075	0.077	0.076	0.331	0.33	0.010	0.012	1.000	100
IPW	abs > ln(10)	-0.014	abs > ln(10)	abs > ln(10)	0.306	abs > ln(10)	0.306	0.996	0.924	0.110	100
Raking (vanilla)	0.006	0.003	0.237	0.213	0.226	0.213	0.226	0.949	0.924	0.121	100
MICE	-0.166	-0.169	0.097	0.127	0.096	0.209	0.194	0.594	0.778	0.686	100
MI-RF	0.101	0.100	0.149	0.136	0.149	0.169	0.18	0.903	0.869	0.085	100
IPCW-TMLE-M	-0.01	-0.007	0.319	0.291	0.322	0.291	0.322	0.950	0.924	0.110	100
IPCW-TMLE-MTO	-0.003	-0.004	0.271	0.219	0.267	0.219	0.267	0.950	0.871	0.163	100

Table 83: **Synthetic data MAR simulation: oracle conditional odds ratio (cOR), 12% outcome proportion, 80% missing proportion**. Comparing estimators under the **semi-complex outcome and simple MAR** scenario. The value of the estimand is -0.693. 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 0.012 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	-0.006	-0.001	0.155	0.153	0.152	0.153	0.152	0.951	0.953	0.996	100
Complete-case*	0.587	0.596	0.289	0.327	0.269	0.672	0.654	0.549	0.459	0.034	100
Confounded model*	0.243	0.244	0.075	0.077	0.072	0.255	0.254	0.104	0.093	1.000	100
IPW*	0.528	0.536	0.334	0.306	0.325	0.61	0.627	0.565	0.641	0.102	100
Raking (vanilla)*	0.567	0.566	0.221	0.201	0.211	0.602	0.604	0.210	0.266	0.129	100
MICE*	0.593	0.585	0.14	0.147	0.138	0.611	0.601	0.005	0.004	0.112	100
MI-RF*	0.716	0.712	0.163	0.136	0.167	0.728	0.731	0.002	0.003	0.101	100
IPCW-TMLE-M*	0.509	0.507	0.343	0.315	0.325	0.599	0.602	0.618	0.693	0.116	100
IPCW-TMLE-MTO*	0.528	0.527	0.29	0.238	0.277	0.579	0.595	0.401	0.563	0.166	100

Table 84: **Synthetic data MAR simulation: census conditional odds ratio (cOR), 12% outcome proportion, 80% missing proportion**. Comparing estimators under the **semi-complex outcome and simple MAR** scenario. The value of the estimand is -0.128. 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 0.012 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	0.003	0.081	0.096	0.083	0.096	0.083	0.955	0.980	0.222	100
Complete-case	0.022	0.031	0.289	0.327	0.269	0.328	0.27	0.950	0.973	0.034	100
Confounded model	-0.322	-0.321	0.075	0.077	0.072	0.331	0.329	0.008	0.008	1.000	100
IPW	-0.036	-0.029	0.334	0.306	0.325	0.308	0.326	0.953	0.929	0.102	100
Raking (vanilla)	0.002	0.001	0.221	0.201	0.211	0.201	0.211	0.950	0.926	0.129	100
MICE	0.028	0.020	0.14	0.147	0.138	0.15	0.139	0.945	0.959	0.112	100
MI-RF	0.151	0.147	0.163	0.136	0.167	0.203	0.222	0.855	0.767	0.101	100
IPCW-TMLE-M	-0.056	-0.058	0.343	0.315	0.325	0.319	0.33	0.944	0.929	0.116	100
IPCW-TMLE-MTO	-0.037	-0.038	0.29	0.238	0.277	0.241	0.279	0.947	0.886	0.166	100

Table 85: **Synthetic data MAR simulation: oracle conditional odds ratio (cOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **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 0.012 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	-0.001	0.085	0.086	0.084	0.086	0.084	0.956	0.952	0.044	100
Complete-case*	-0.136	-0.136	0.127	0.131	0.128	0.189	0.187	0.838	0.814	0.162	100
Confounded model*	-0.224	-0.225	0.072	0.073	0.072	0.235	0.236	0.134	0.132	0.866	100
IPW*	0.059	0.063	0.135	0.139	0.135	0.151	0.149	0.939	0.934	0.061	100
Raking (vanilla)*	0.061	0.062	0.084	0.085	0.08	0.105	0.101	0.894	0.888	0.106	100
MICE*	0.132	0.133	0.085	0.087	0.084	0.159	0.157	0.684	0.664	0.316	100
MI-XGB*	0.098	0.097	0.082	0.084	0.077	0.129	0.124	0.798	0.785	0.202	100
MI-RF*	0.074	0.073	0.085	0.083	0.081	0.111	0.109	0.851	0.855	0.149	100
IPCW-TMLE-M*	0.042	0.042	0.139	0.145	0.141	0.151	0.147	0.956	0.943	0.044	100
IPCW-TMLE-MTO*	0.053	0.052	0.132	0.132	0.132	0.142	0.142	0.934	0.934	0.066	100

Table 86: **Synthetic data MAR simulation: census conditional odds ratio (cOR), 12% outcome proportion, 40% missing proportion**. Comparing estimators under the **complex outcome and simple MAR** scenario. The value of the estimand is 0.064. 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 0.012 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	0.074	0.077	0.073	0.077	0.074	0.952	0.959	0.118	100
Complete-case	-0.2	-0.200	0.127	0.131	0.128	0.239	0.237	0.647	0.669	0.162	100
Confounded model	-0.287	-0.288	0.072	0.073	0.072	0.297	0.297	0.021	0.021	0.866	100
IPW	-0.004	-0.001	0.135	0.139	0.135	0.139	0.135	0.952	0.956	0.061	100
Raking (vanilla)	-0.003	-0.002	0.084	0.085	0.08	0.085	0.08	0.950	0.956	0.106	100
MICE	0.069	0.069	0.085	0.087	0.084	0.111	0.109	0.874	0.886	0.316	100
MI-XGB	0.035	0.034	0.082	0.084	0.077	0.091	0.084	0.928	0.936	0.202	100
MI-RF	0.01	0.009	0.085	0.083	0.081	0.084	0.082	0.943	0.940	0.149	100
IPCW-TMLE-M	-0.022	-0.022	0.139	0.145	0.141	0.147	0.143	0.949	0.954	0.044	100
IPCW-TMLE-MTO	-0.011	-0.011	0.132	0.132	0.132	0.132	0.132	0.951	0.945	0.066	100

Table 87: **Synthetic data MAR simulation: oracle conditional odds ratio (cOR), 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 0.405. 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 0.012 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 cover-age	Oracle cover-age	Power	Prop. com-pleted
Benchmark model	-0.002	0.000	0.082	0.08	0.08	0.08	0.08	0.947	0.954	0.999	100.00
Complete-case*	-0.068	-0.072	0.158	0.159	0.165	0.173	0.18	0.931	0.931	0.556	100.00
Confounded model*	-0.316	-0.318	0.07	0.068	0.069	0.324	0.325	0.006	0.007	0.261	100.00
IPW*	abs > ln(10)	0.209	abs > ln(10)	abs > ln(10)	abs > ln(10)	abs > ln(10)	abs > ln(10)	0.632	0.926	0.347	100.00
Raking (vanilla)*	abs > ln(10)	0.272	abs > ln(10)	abs > ln(10)	0.867	abs > ln(10)	0.909	0.895	0.941	0.193	94.24
MICE*	-0.095	-0.094	0.124	0.105	0.124	0.142	0.156	0.769	0.876	0.826	100.00
MI-RF*	-0.161	-0.157	0.1	0.094	0.102	0.186	0.188	0.584	0.642	0.732	100.00
IPCW-TMLE-M*	-0.069	-0.081	0.406	0.367	0.378	0.373	0.387	0.908	0.944	0.158	100.00

Table 88: **Synthetic data MAR simulation: census conditional odds ratio (cOR), 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 0.371. 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 0.012 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 cover-age	Nominal cover-age	Power	Prop. com-pleted
Benchmark model	0	-0.001	0.073	0.072	0.07	0.072	0.07	0.950	0.949	0.999	100.00
Complete-case	-0.034	-0.038	0.158	0.159	0.165	0.163	0.169	0.944	0.947	0.556	100.00
Confounded model	-0.282	-0.284	0.07	0.068	0.069	0.29	0.292	0.016	0.016	0.261	100.00
IPW	abs > ln(10)	0.243	abs > ln(10)	abs > ln(10)	abs > ln(10)	abs > ln(10)	abs > ln(10)	0.926	0.636	0.347	100.00
Raking (vanilla)	abs > ln(10)	0.306	abs > ln(10)	abs > ln(10)	0.867	abs > ln(10)	0.92	0.941	0.897	0.193	94.24
MICE	-0.061	-0.060	0.124	0.105	0.124	0.121	0.138	0.919	0.835	0.826	100.00
MI-RF	-0.127	-0.123	0.1	0.094	0.102	0.157	0.16	0.751	0.700	0.732	100.00
IPCW-TMLE-M	-0.035	-0.047	0.406	0.367	0.378	0.369	0.381	0.947	0.919	0.158	100.00

Table 89: **Synthetic data MAR simulation: oracle conditional odds ratio (cOR), 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 0.405. 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 0.012 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	0.081	0.08	0.079	0.081	0.079	0.950	0.951	0.999	100
Complete-case*	-0.069	-0.071	0.166	0.162	0.168	0.176	0.183	0.929	0.935	0.544	100
Confounded model*	-0.314	-0.313	0.068	0.068	0.066	0.321	0.32	0.004	0.004	0.266	100
IPW*	abs > ln(10)	-0.046	abs > ln(10)	abs > ln(10)	0.253	abs > ln(10)	0.257	0.909	0.986	0.344	100
Raking (vanilla)*	-0.034	-0.035	0.127	0.119	0.126	0.124	0.131	0.922	0.940	0.878	100
MICE*	0.089	0.086	0.107	0.105	0.109	0.138	0.139	0.867	0.860	0.997	100
MI-RF*	-0.022	-0.023	0.1	0.089	0.099	0.092	0.102	0.916	0.948	0.982	100
IPCW-TMLE-M*	-0.039	-0.043	0.256	0.24	0.251	0.243	0.254	0.925	0.948	0.344	100
IPCW-TMLE-MTO*	-0.014	-0.021	0.253	0.215	0.248	0.216	0.249	0.898	0.954	0.450	100

Table 90: **Synthetic data MAR simulation: census conditional odds ratio (cOR), 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 0.371. 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 0.012 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	0.002	0.071	0.072	0.07	0.072	0.07	0.947	0.951	0.999	100
Complete-case	-0.035	-0.037	0.166	0.162	0.168	0.166	0.172	0.947	0.944	0.544	100
Confounded model	-0.28	-0.279	0.068	0.068	0.066	0.288	0.287	0.017	0.017	0.266	100
IPW	abs > ln(10)	-0.012	abs > ln(10)	abs > ln(10)	0.253	abs > ln(10)	0.254	0.986	0.922	0.344	100
Raking (vanilla)	0	0.000	0.127	0.119	0.126	0.119	0.126	0.944	0.931	0.878	100
MICE	0.123	0.120	0.107	0.105	0.109	0.162	0.162	0.781	0.792	0.997	100
MI-RF	0.012	0.011	0.1	0.089	0.099	0.09	0.1	0.948	0.918	0.982	100
IPCW-TMLE-M	-0.005	-0.009	0.256	0.24	0.251	0.24	0.251	0.949	0.931	0.344	100
IPCW-TMLE-MTO	0.02	0.013	0.253	0.215	0.248	0.216	0.249	0.953	0.898	0.450	100

Table 91: **Synthetic data MAR simulation: oracle conditional odds ratio (cOR), 1% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome and simple MAR** scenario. The value of the estimand is 0.405. 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 0.012 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	0.005	0.002	0.229	0.228	0.225	0.228	0.225	0.948	0.946	0.429	100
Complete-case	-0.186	-0.177	0.418	0.404	0.395	0.445	0.433	0.928	0.928	0.086	100
Confounded model	0.23	0.231	0.222	0.219	0.215	0.318	0.316	0.819	0.828	0.832	100
IPW	-0.01	-0.018	0.465	0.433	0.435	0.433	0.435	0.929	0.946	0.150	100
Raking (vanilla)	0.009	0.003	0.257	0.261	0.257	0.261	0.257	0.950	0.952	0.349	100
MICE	0.011	0.012	0.245	0.244	0.242	0.245	0.242	0.951	0.948	0.400	100
MI-RF	0.131	0.128	0.23	0.235	0.232	0.269	0.265	0.922	0.912	0.640	100
IPCW-TMLE-M	-0.031	-0.042	0.48	0.445	0.462	0.447	0.464	0.931	0.948	0.142	100
IPCW-TMLE-MTO	-0.03	-0.042	0.482	0.438	0.464	0.439	0.466	0.927	0.948	0.155	100

Table 92: **Synthetic data MAR simulation: census conditional odds ratio (cOR), 1% outcome proportion, 40% missing proportion**. Comparing estimators under the **simple outcome and simple MAR** scenario. The value of the estimand is 0.4. 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 0.012 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	0.011	0.008	0.229	0.228	0.225	0.228	0.225	0.948	0.947	0.429	100
Complete-case	-0.18	-0.171	0.418	0.404	0.395	0.443	0.431	0.929	0.930	0.086	100
Confounded model	0.236	0.237	0.222	0.219	0.215	0.322	0.32	0.819	0.814	0.832	100
IPW	-0.004	-0.012	0.465	0.433	0.435	0.433	0.435	0.946	0.929	0.150	100
Raking (vanilla)	0.014	0.009	0.257	0.261	0.257	0.261	0.257	0.952	0.951	0.349	100
MICE	0.017	0.018	0.245	0.244	0.242	0.245	0.242	0.946	0.948	0.400	100
MI-RF	0.137	0.134	0.23	0.235	0.232	0.272	0.267	0.906	0.919	0.640	100
IPCW-TMLE-M	-0.025	-0.036	0.48	0.445	0.462	0.446	0.463	0.947	0.932	0.142	100
IPCW-TMLE-MTO	-0.024	-0.037	0.482	0.438	0.464	0.439	0.465	0.948	0.928	0.155	100

Table 93: **Synthetic data MAR simulation: oracle conditional odds ratio (cOR), 1% outcome proportion, 40% missing proportion**. Comparing estimators under the **complex outcome and simple MAR** scenario. The value of the estimand is 0.405. 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 0.012 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 cover-age	Oracle cover-age	Power	Prop. com-pleted
Benchmark model	-0.003	-0.001	0.275	0.28	0.274	0.28	0.274	0.956	0.950	0.299	100
Complete-case*	-0.256	-0.244	0.396	0.398	0.389	0.473	0.459	0.927	0.900	0.071	100
Confounded model*	-0.627	-0.625	0.219	0.219	0.212	0.664	0.66	0.174	0.180	0.162	100
IPW*	-0.072	-0.073	0.408	0.38	0.393	0.387	0.4	0.936	0.951	0.168	100
Raking (vanilla)*	-0.042	-0.043	0.274	0.264	0.267	0.267	0.271	0.946	0.951	0.298	100
MICE*	0.102	0.100	0.262	0.256	0.248	0.275	0.268	0.925	0.928	0.511	100
MI-RF*	-0.189	-0.189	0.226	0.243	0.219	0.308	0.289	0.900	0.868	0.131	100
IPCW-TMLE-M*	-0.086	-0.089	0.422	0.39	0.409	0.399	0.419	0.935	0.944	0.154	100
IPCW-TMLE-MTO*	-0.069	-0.076	0.418	0.362	0.411	0.368	0.418	0.916	0.942	0.203	100

Table 94: **Synthetic data MAR simulation: census conditional odds ratio (cOR), 1% outcome proportion, 40% missing proportion**. Comparing estimators under the **complex outcome and simple MAR** scenario. The value of the estimand is 0.379. 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 0.012 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 cover-age	Nominal cover-age	Power	Prop. com-pleted
Benchmark model	-0.009	-0.005	0.212	0.231	0.206	0.231	0.206	0.951	0.973	0.352	100
Complete-case	-0.23	-0.218	0.396	0.398	0.389	0.46	0.446	0.913	0.936	0.071	100
Confounded model	-0.601	-0.599	0.219	0.219	0.212	0.64	0.635	0.210	0.209	0.162	100
IPW	-0.046	-0.047	0.408	0.38	0.393	0.383	0.396	0.951	0.939	0.168	100
Raking (vanilla)	-0.015	-0.017	0.274	0.264	0.267	0.264	0.268	0.950	0.944	0.298	100
MICE	0.128	0.127	0.262	0.256	0.248	0.286	0.278	0.921	0.914	0.511	100
MI-RF	-0.163	-0.163	0.226	0.243	0.219	0.293	0.273	0.889	0.918	0.131	100
IPCW-TMLE-M	-0.06	-0.063	0.422	0.39	0.409	0.395	0.414	0.944	0.936	0.154	100
IPCW-TMLE-MTO	-0.043	-0.050	0.418	0.362	0.411	0.364	0.414	0.946	0.920	0.203	100