

# simulation summary

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## Simulation study

Investigate bias from model misspecification when estimating NDE and NIE.

## Simulation scenarios

Table 1: Variables used for simulations:

variable	type	true model
X(additional covariate)	continous	$X \sim \text{gamma}(8, 4.5)$
Z(exposure)	binary	$Z = I(Y^* > 0)$ where $Z^* \sim U_0 + U_1X + N(0, 1)$
M(mediator)	continous	$M \sim B_0 + B_1Z + B_2X + N(0, 1)$
Y(outcome)	continous	$Y \sim \theta_0 + \theta_1Z + \theta_2M + \theta_3ZM + \theta_4X + N(0, 1)$

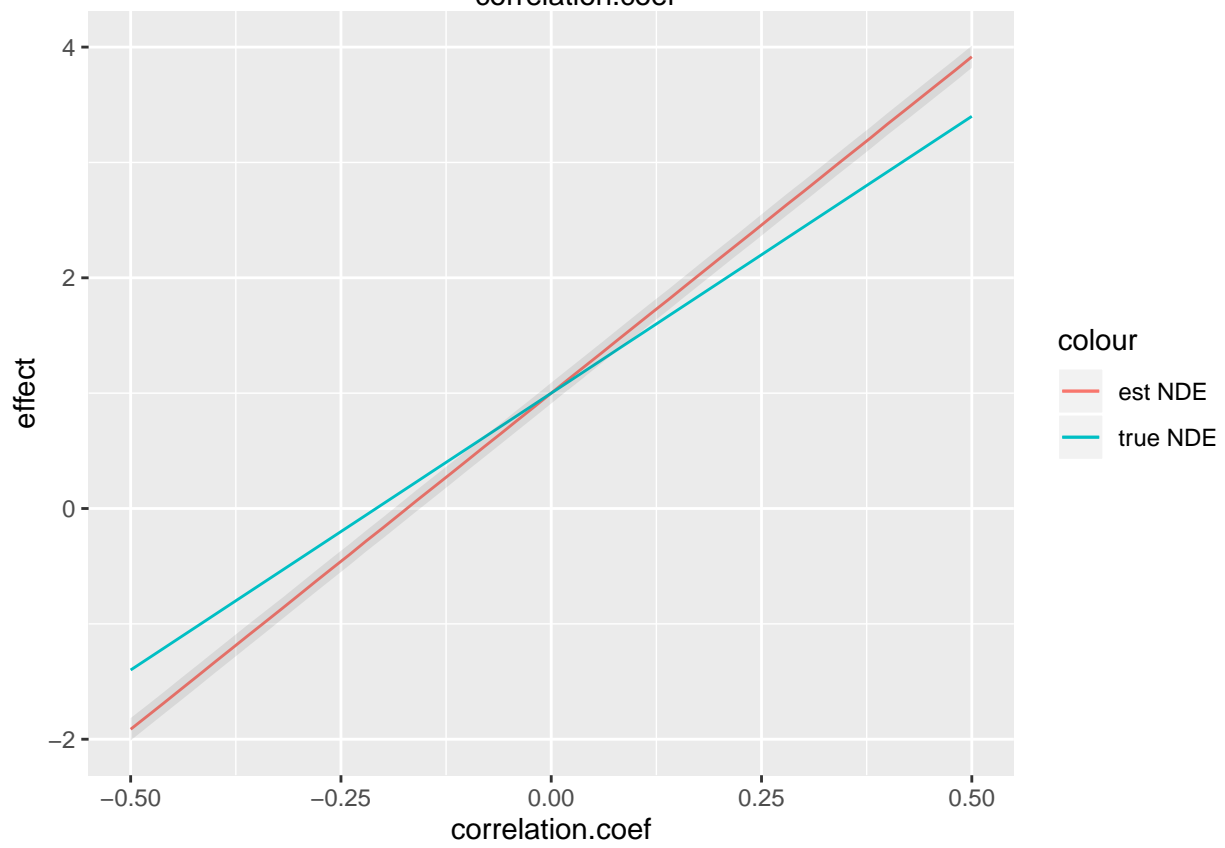
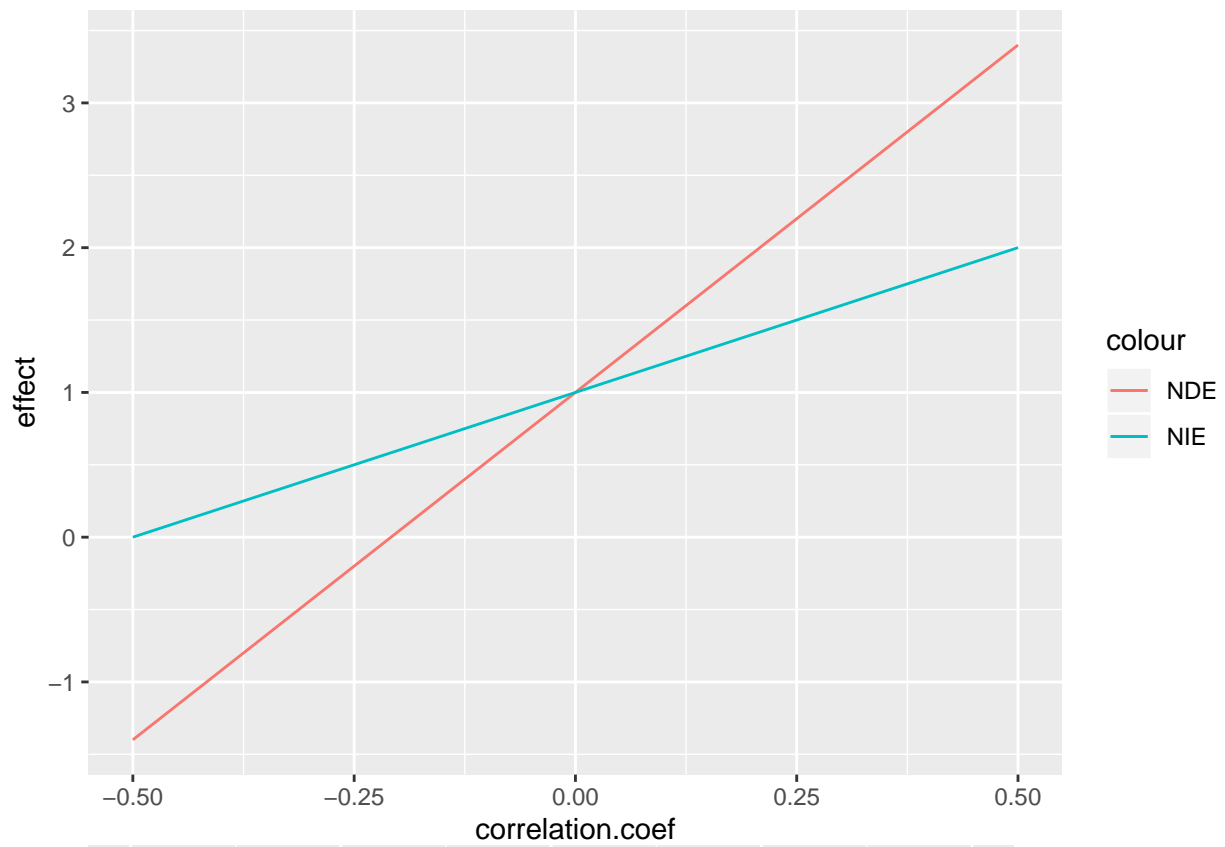
- $U_0 = -0.4$
- $U_1 = 0.01$
- $B_0 = 3$
- $B_1 = 2$
- $B_2 = 0.05$
- $\theta_0 = 5$
- $\theta_1 = 1$
- $\theta_2 = 0.5$
- $\theta_3 = \text{varied}[-0.5, 0.5]$
- $\theta_4 = 0.05$

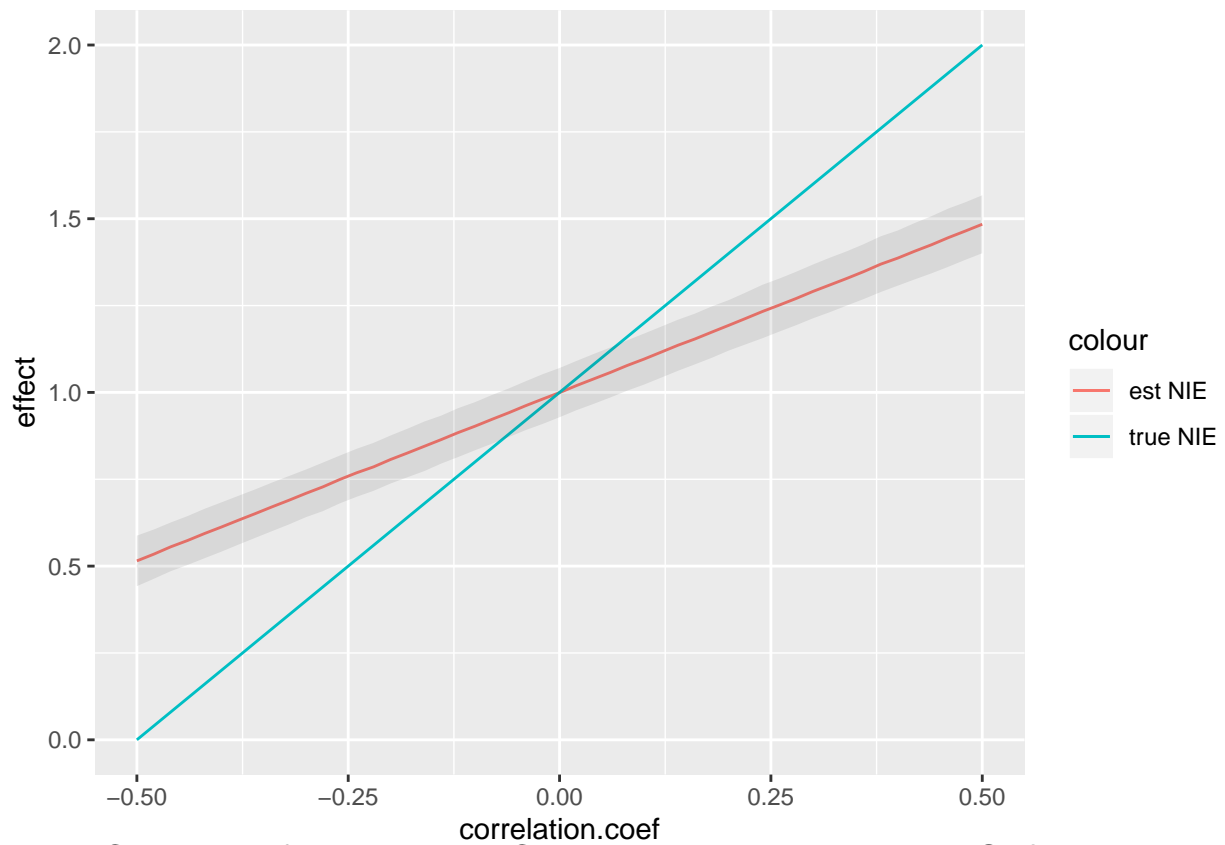
Estimated mediator model was set to the correct one. Estimated outcome model was linear but misspecified without  $ZM$  interaction:  $Y \sim Z + M + X$ .

## Results

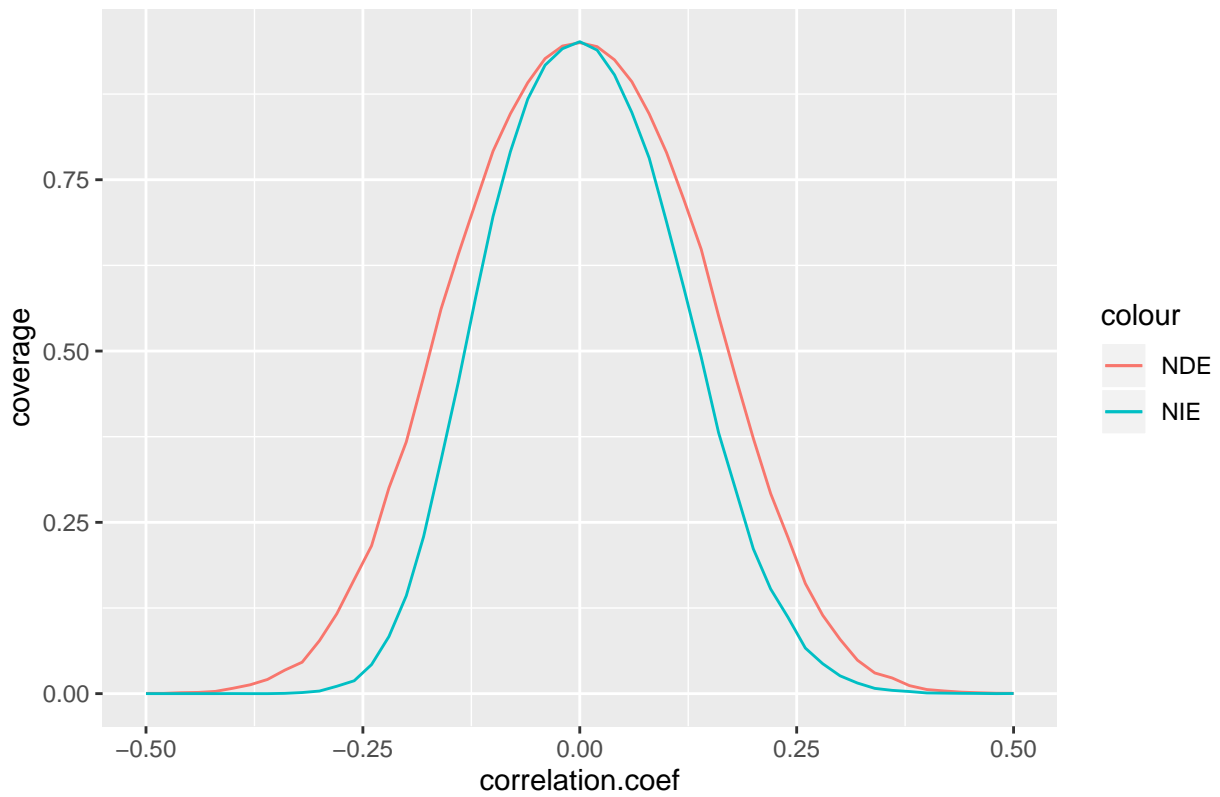
interaction.coefficient	true.nde	true.nie	est.nde	est.nie	nde.emp.SE	nie.emp.SE	nde.mean.delta.SE	r
-0.50	-1.3999687	0.00	-1.9137301	0.5150536	0.0972484	0.0728114	0.0936557	
-0.48	-1.3039799	0.04	-1.7984363	0.5344076	0.0951960	0.0709141	0.0933157	
-0.46	-1.2080985	0.08	-1.6825757	0.5554978	0.0947963	0.0701300	0.0931183	
-0.44	-1.1120050	0.12	-1.5655974	0.5737749	0.0957115	0.0703547	0.0928156	
-0.42	-1.0161317	0.16	-1.4494332	0.5938159	0.0951801	0.0711335	0.0925279	
-0.40	-0.9200497	0.20	-1.3316123	0.6125727	0.0943890	0.0709144	0.0923003	
-0.38	-0.8239437	0.24	-1.2155229	0.6320201	0.0947466	0.0702829	0.0920017	
-0.36	-0.7280290	0.28	-1.0984201	0.6511054	0.0943696	0.0698322	0.0918062	
-0.34	-0.6320130	0.32	-0.9832550	0.6707396	0.0935066	0.0699271	0.0916534	
-0.32	-0.5359864	0.36	-0.8674014	0.6897274	0.0914608	0.0696564	0.0913910	
-0.30	-0.4400434	0.40	-0.7499259	0.7094867	0.0914868	0.0685375	0.0912127	
-0.28	-0.3440628	0.44	-0.6320965	0.7280897	0.0917982	0.0698884	0.0910394	
-0.26	-0.2479304	0.48	-0.5159922	0.7493190	0.0920307	0.0687931	0.0909347	
-0.24	-0.1519789	0.52	-0.4007917	0.7686738	0.0912458	0.0690938	0.0907439	
-0.22	-0.0560352	0.56	-0.2815994	0.7857398	0.0905047	0.0690269	0.0905758	

interaction.coefficient	true.nde	true.nie	est.nde	est.nie	nde.emp.SE	nie.emp.SE	nde.mean.delta.SE	r
-0.20	0.0400014	0.60	-0.1670287	0.8067938	0.0909126	0.0691130	0.0904004	
-0.18	0.1359322	0.64	-0.0493490	0.8255944	0.0911630	0.0698563	0.0903555	
-0.16	0.2320231	0.68	0.0686301	0.8448901	0.0916871	0.0713151	0.0902484	
-0.14	0.3280086	0.72	0.1837688	0.8642317	0.0911900	0.0690422	0.0901122	
-0.12	0.4240023	0.76	0.2994306	0.8843265	0.0904095	0.0703240	0.0900560	
-0.10	0.5199996	0.80	0.4162563	0.9027602	0.0892460	0.0693292	0.0899760	
-0.08	0.6160063	0.84	0.5336003	0.9224792	0.0908340	0.0700936	0.0899355	
-0.06	0.7119907	0.88	0.6490572	0.9415881	0.0898267	0.0699002	0.0898831	
-0.04	0.8080023	0.92	0.7665822	0.9619084	0.0903208	0.0703357	0.0898585	
-0.02	0.9039983	0.96	0.8824060	0.9808894	0.0897155	0.0715835	0.0897840	
0.00	1.0000000	1.00	1.0002698	0.9994417	0.0903126	0.0708482	0.0898344	
0.02	1.0959953	1.04	1.1176802	1.0197109	0.0891669	0.0709040	0.0898541	
0.04	1.1919831	1.08	1.2334870	1.0385390	0.0894503	0.0717838	0.0898956	
0.06	1.2879836	1.12	1.3494096	1.0573349	0.0898034	0.0719925	0.0898728	
0.08	1.3839910	1.16	1.4671600	1.0775319	0.0897481	0.0724871	0.0899016	
0.10	1.4799757	1.20	1.5834923	1.0960197	0.0906156	0.0734491	0.0899911	
0.12	1.5759998	1.24	1.7000426	1.1157623	0.0899380	0.0734057	0.0900236	
0.14	1.6720136	1.28	1.8147213	1.1357509	0.0895460	0.0735058	0.0901643	
0.16	1.7679868	1.32	1.9328200	1.1536747	0.0895287	0.0730639	0.0902186	
0.18	1.8640142	1.36	2.0498524	1.1734959	0.0903687	0.0739834	0.0902928	
0.20	1.9599359	1.40	2.1667343	1.1930094	0.0905791	0.0726147	0.0904409	
0.22	2.0560570	1.44	2.2826019	1.2127907	0.0898537	0.0745851	0.0905974	
0.24	2.1519222	1.48	2.3985443	1.2329175	0.0919248	0.0769087	0.0906947	
0.26	2.2480337	1.52	2.5166364	1.2514877	0.0922198	0.0763285	0.0908911	
0.28	2.3440360	1.56	2.6337914	1.2705146	0.0926386	0.0769305	0.0910504	
0.30	2.4401444	1.60	2.7482404	1.2909287	0.0921373	0.0774389	0.0912266	
0.32	2.5360126	1.64	2.8654043	1.3096321	0.0921316	0.0784352	0.0914200	
0.34	2.6319537	1.68	2.9833792	1.3283603	0.0926090	0.0780868	0.0916168	
0.36	2.7279861	1.72	3.0992607	1.3479603	0.0939171	0.0790131	0.0918049	
0.38	2.8241733	1.76	3.2147746	1.3692399	0.0935586	0.0802170	0.0920513	
0.40	2.9199727	1.80	3.3344251	1.3866007	0.0939740	0.0794042	0.0923575	
0.42	3.0159251	1.84	3.4494769	1.4064069	0.0953062	0.0812035	0.0924815	
0.44	3.1119678	1.88	3.5656928	1.4250656	0.0960821	0.0823038	0.0928282	
0.46	3.2079675	1.92	3.6819816	1.4455886	0.0961072	0.0838853	0.0930666	
0.48	3.3039411	1.96	3.7974782	1.4645434	0.0960012	0.0828972	0.0933544	
0.50	3.3999945	2.00	3.9164679	1.4840494	0.0959023	0.0834990	0.0936808	

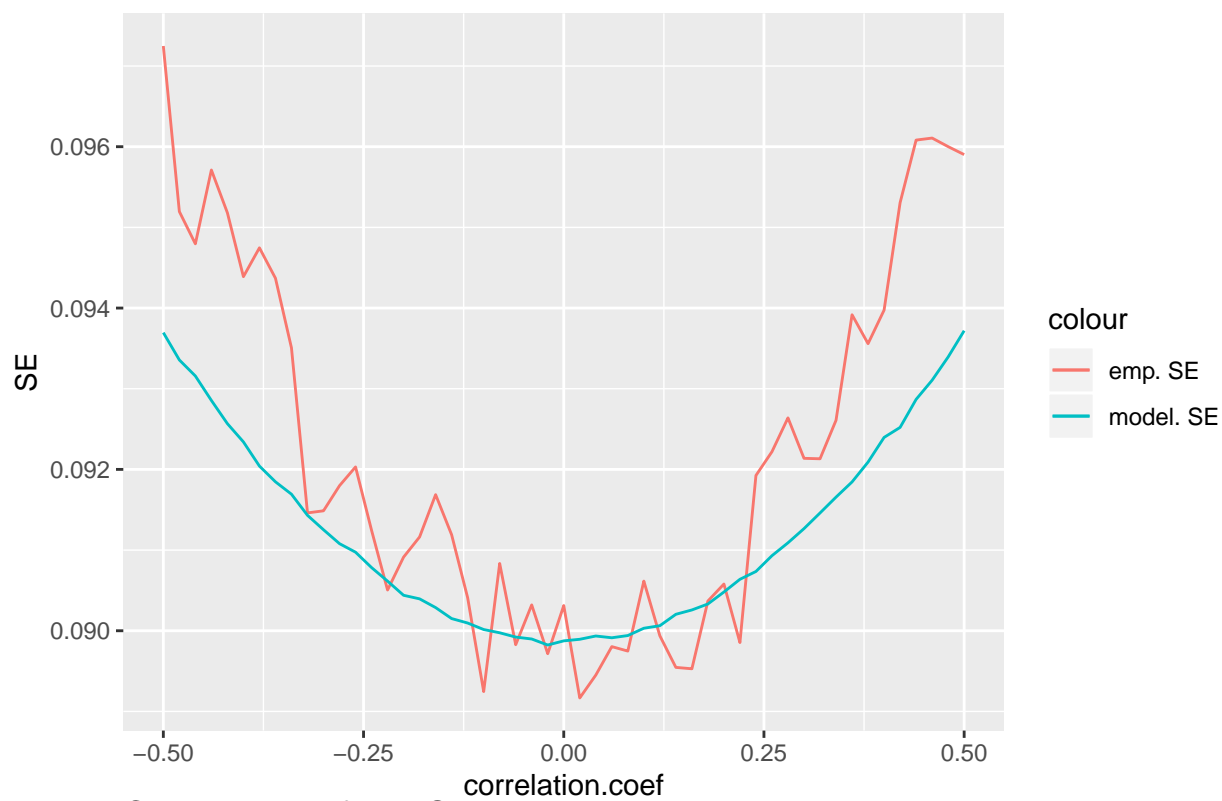




Coverage of nominal 95% CI. Nominal = based on delta-SE?



Comparison of NDE SE's



Comparison of NIE SE's

