Tables and Figures

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December 13, 2019

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## [1] "multinom_hcsb_1000_count"
## [1] "multinom_hcsb_1000"
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1 Power

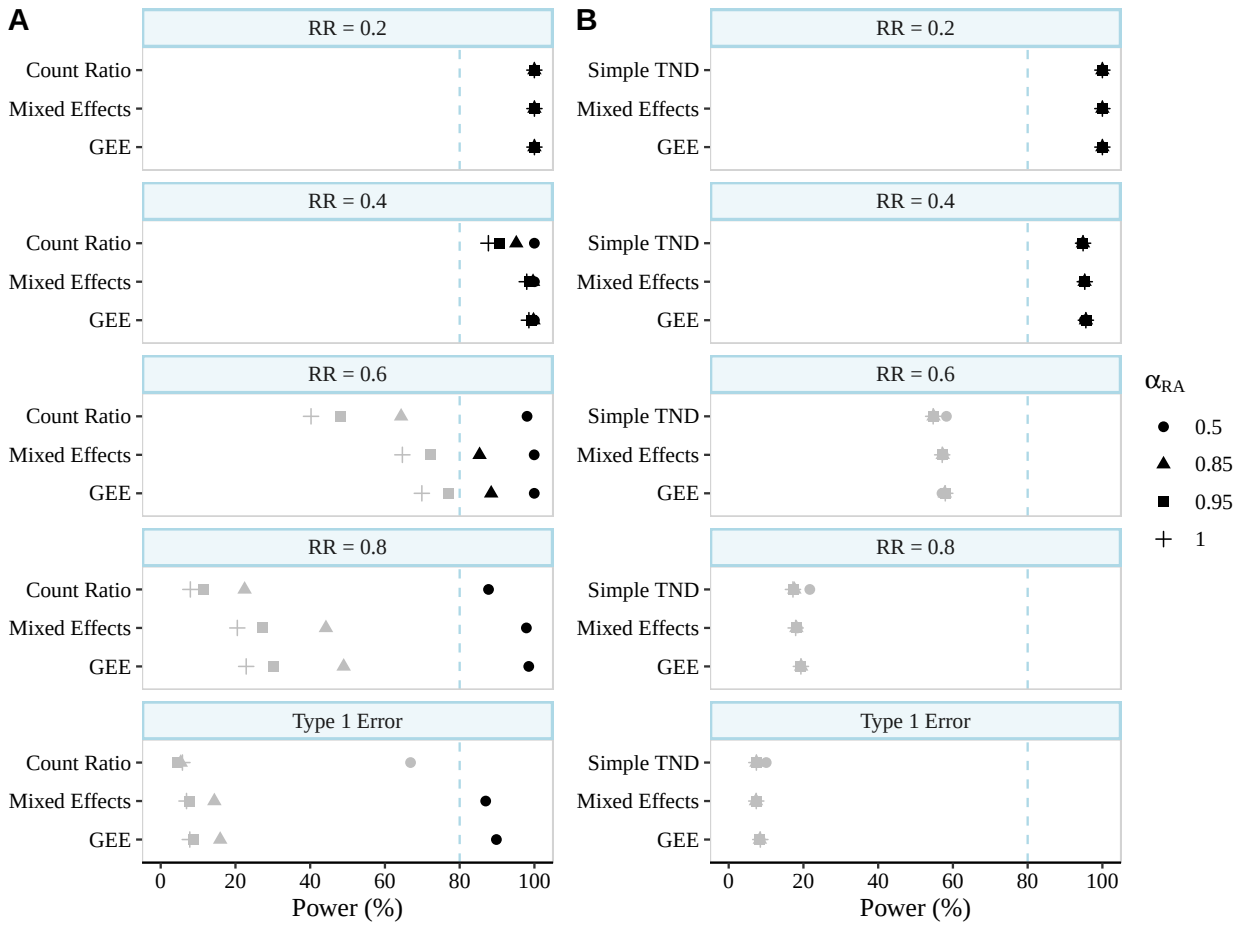

Table 1: The power, and Type I error rates, in testing departure from the null of no intervention effect based on estimation methods with and without debiasing by negative control counts for a range of Relative Risks (λ), over 10,000 intervention allocations applied to each of 9 historical time periods with 1,000 cases and 4,000 negative controls (when applicable). Differential ascertainment (α_{RA}) is allowed to increase in severity.

		Count Only Methods*			Negative Control Debiased Methods†		
λ	α_{RA}	GEE	Mixed Effects	Count Ratio	GEE	Mixed Effects	Simple TND
Type 1 Error: 1.0	1.00	0.078	0.069	0.058	0.085	0.074	0.074
	0.95	0.086	0.078	0.045	0.084	0.073	0.073
	0.85	0.159	0.144	0.054	0.084	0.073	0.074
	0.50	0.898	0.870	0.669	0.084	0.074	0.100
0.8	1.00	0.229	0.205	0.079	0.193	0.179	0.172
	0.95	0.302	0.271	0.113	0.193	0.181	0.172
	0.85	0.490	0.442	0.224	0.194	0.181	0.176
	0.50	0.985	0.979	0.877	0.193	0.184	0.217
0.6	1.00	0.699	0.647	0.402	0.580	0.571	0.547
	0.95	0.769	0.722	0.481	0.580	0.573	0.549
	0.85	0.884	0.853	0.643	0.578	0.573	0.548
	0.50	1.000	0.999	0.980	0.571	0.574	0.583
0.5	1.00	0.900	0.871	0.668	0.813	0.808	0.791
	0.95	0.931	0.909	0.731	0.813	0.806	0.790
	0.85	0.973	0.964	0.835	0.812	0.807	0.791
	0.50	1.000	1.000	0.997	0.804	0.808	0.797
0.4	1.00	0.985	0.979	0.877	0.956	0.953	0.948
	0.95	0.991	0.988	0.907	0.956	0.953	0.948
	0.85	0.998	0.996	0.951	0.956	0.952	0.948
	0.50	1.000	1.000	1.000	0.952	0.951	0.945
0.3	1.00	1.000	0.999	0.980	0.997	0.997	0.997
	0.95	1.000	1.000	0.987	0.997	0.997	0.996
	0.85	1.000	1.000	0.996	0.997	0.997	0.996
	0.50	1.000	1.000	1.000	0.996	0.996	0.996
0.2	1.00	1.000	1.000	1.000	1.000	1.000	1.000
	0.95	1.000	1.000	1.000	1.000	1.000	1.000
	0.85	1.000	1.000	1.000	1.000	1.000	1.000
	0.50	1.000	1.000	1.000	1.000	1.000	1.000

* GEE and mixed effects count only models assume Poisson distributed counts and use the canonical log link.

† GEE and mixed effects negative control de-biased models assume binomially distributed counts and use the canonical logit link.

2 Bias

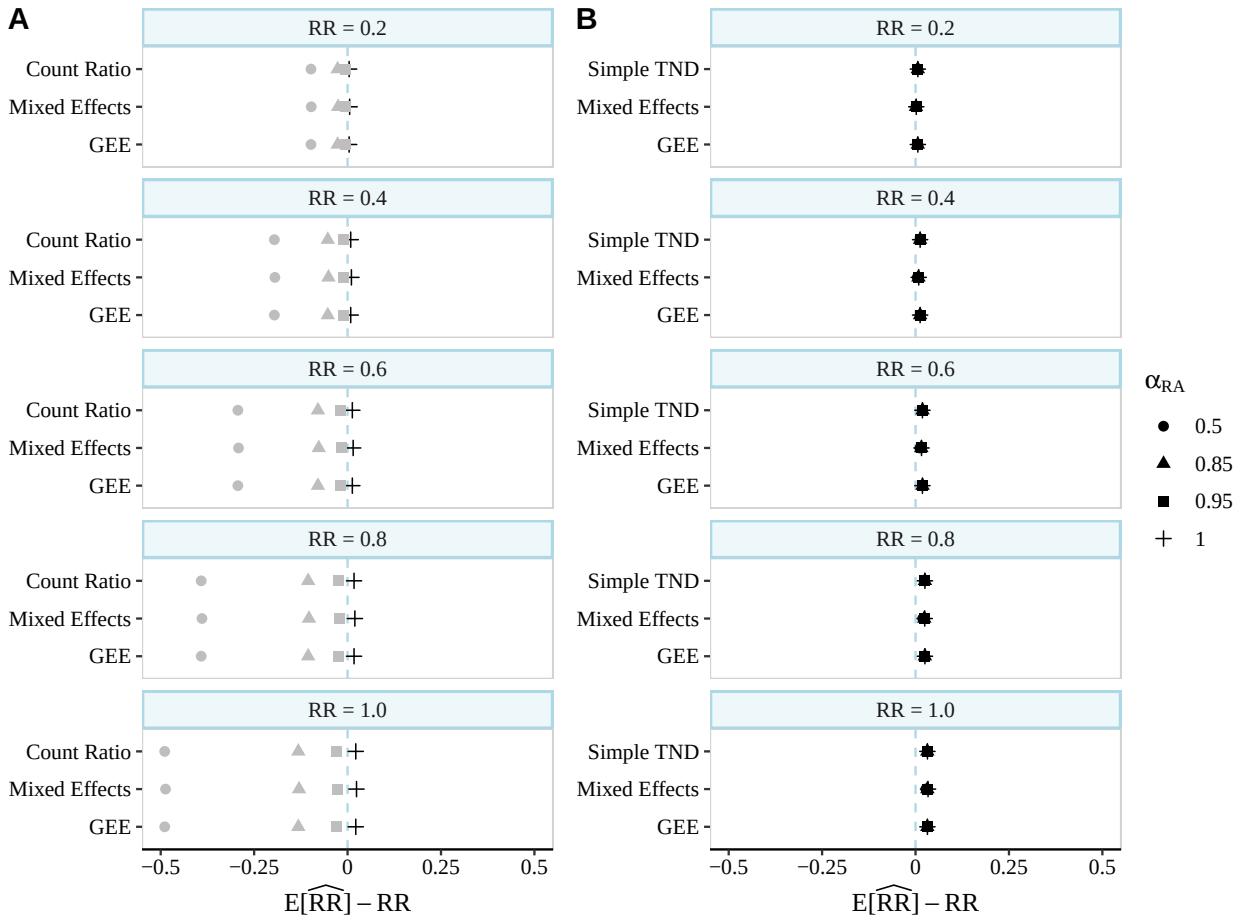
A
B
RR = 0.2
RR = 0.4
RR = 0.6
RR = 0.8
RR = 1.0
Count Ratio
Simple TND
Mixed Effects
GEE
−0.5
−0.25
0
0.25
0.5
$\widehat{E[RR]} - RR$
α_{RA}
0.5
0.85
0.95
1

Table 2: Bias in estimation of the intervention Relative Risk for estimation methods with and wihtout debiasing by negative control counts for a range of Relative Risks (λ), over 10,000 intervention allocations applied to each of 9 historical time periods with 1,000 cases and 4,000 controls (when applicable). Differential ascertainment(α_{RA}) is allowed to increase in severity.

		Count Only Methods*			Negative Control De-Biased Methods†		
λ	α_{RA}	GEE	Mixed Effects	Count Ratio	GEE	Mixed Effects	Simple TND
1.0	1.00	0.022	0.024	0.022	0.032	0.033	0.032
	0.95	-0.030	-0.027	-0.030	0.031	0.032	0.031
	0.85	-0.132	-0.130	-0.132	0.031	0.032	0.031
	0.50	-0.489	-0.487	-0.489	0.032	0.028	0.032
0.8	1.00	0.017	0.020	0.017	0.025	0.025	0.025
	0.95	-0.024	-0.021	-0.024	0.025	0.024	0.025
	0.85	-0.105	-0.103	-0.105	0.025	0.023	0.025
	0.50	-0.392	-0.390	-0.392	0.025	0.019	0.025
0.6	1.00	0.013	0.015	0.013	0.018	0.016	0.018
	0.95	-0.018	-0.016	-0.018	0.019	0.016	0.019
	0.85	-0.079	-0.077	-0.079	0.019	0.015	0.019
	0.50	-0.294	-0.292	-0.294	0.019	0.012	0.019
0.5	1.00	0.010	0.013	0.010	0.015	0.012	0.015
	0.95	-0.015	-0.013	-0.015	0.015	0.012	0.015
	0.85	-0.066	-0.064	-0.066	0.015	0.011	0.015
	0.50	-0.245	-0.243	-0.245	0.015	0.008	0.015
0.4	1.00	0.008	0.010	0.008	0.012	0.009	0.012
	0.95	-0.012	-0.010	-0.012	0.012	0.008	0.012
	0.85	-0.053	-0.051	-0.053	0.012	0.008	0.012
	0.50	-0.196	-0.195	-0.196	0.012	0.005	0.012
0.3	1.00	0.006	0.008	0.006	0.009	0.005	0.009
	0.95	-0.009	-0.007	-0.009	0.009	0.005	0.009
	0.85	-0.040	-0.038	-0.040	0.009	0.005	0.009
	0.50	-0.147	-0.146	-0.147	0.009	0.002	0.009
0.2	1.00	0.004	0.006	0.004	0.006	0.002	0.006
	0.95	-0.006	-0.005	-0.006	0.006	0.002	0.006
	0.85	-0.026	-0.025	-0.026	0.006	0.001	0.006
	0.50	-0.098	-0.097	-0.098	0.006	-0.001	0.006

* GEE and mixed effects count only models assume Poisson distributed counts and use the canonical log link.
† GEE and mixed effects negative control de-biased models assume binomially distributed counts and use the canonical logit link.

3 Coverage

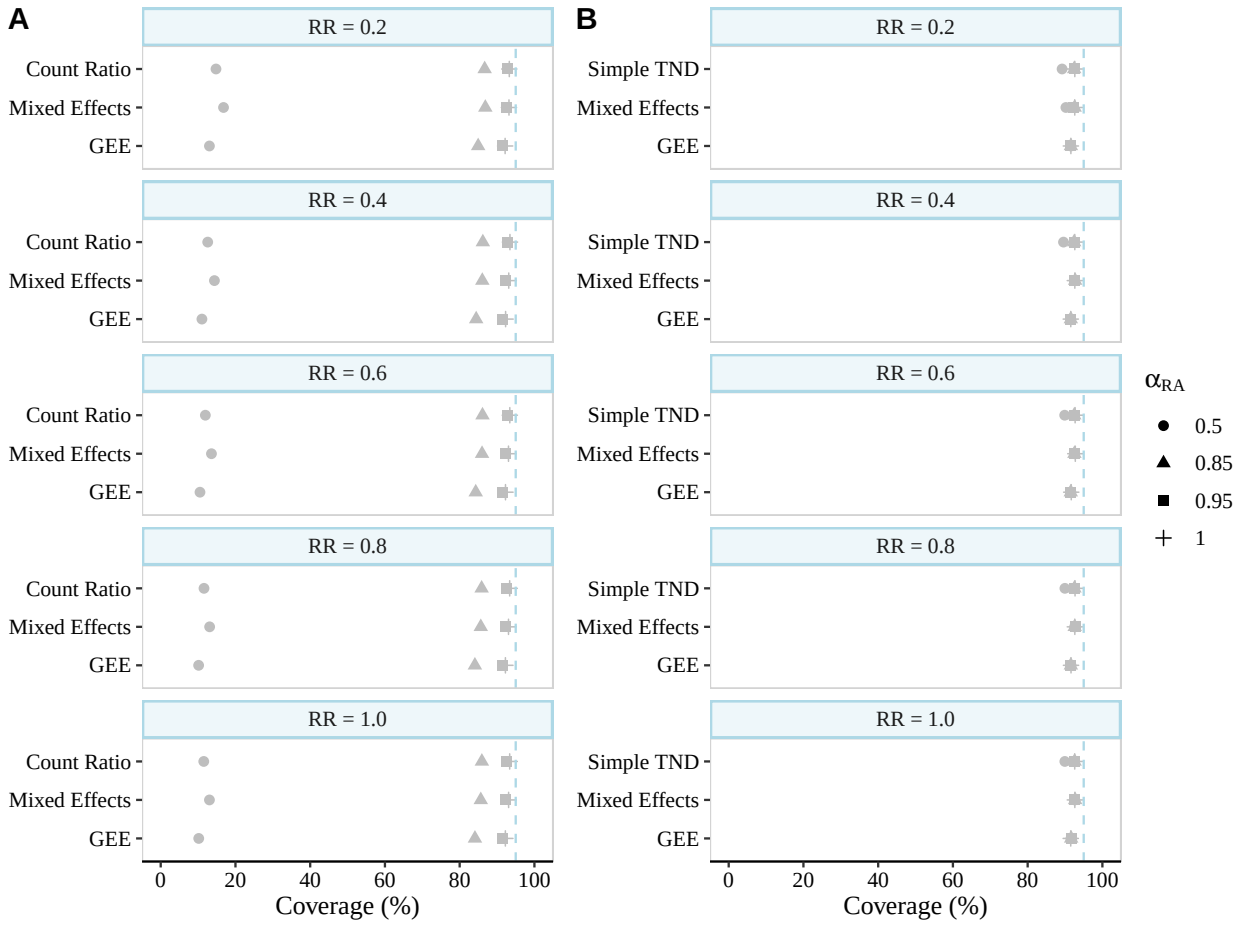
A
B
RR = 0.2
RR = 0.4
RR = 0.6
RR = 0.8
RR = 1.0
Count Ratio
Simple TND
Mixed Effects
GEE
0
20
40
60
80
100
Coverage (%)
α_{RA}
0.5
0.85
0.95
1

Table 3: 95% confidence interval coverage based on estimation of the intervention Relative Risk for estimation methods with and without debiasing by negative control counts for a range of Relative Risks (λ), over 10,000 intervention allocations applied to each of 9 historical time periods with 1,000 cases and 4,000 negative controls (when applicable). Differential ascertainment (α_{RA}) is allowed to increase in severity.

		Count Only Methods*			Negative Control De-Biased Methods†		
λ	α_{RA}	GEE	Mixed Effects	Count Ratio	GEE	Mixed Effects	Simple TND
1.0	1.00	0.922	0.931	0.934	0.915	0.926	0.926
	0.95	0.914	0.922	0.926	0.916	0.927	0.927
	0.85	0.841	0.856	0.859	0.916	0.927	0.926
	0.50	0.102	0.130	0.115	0.916	0.926	0.900
0.8	1.00	0.922	0.931	0.934	0.916	0.926	0.927
	0.95	0.914	0.923	0.926	0.915	0.927	0.926
	0.85	0.841	0.856	0.859	0.916	0.926	0.925
	0.50	0.101	0.131	0.116	0.916	0.926	0.900
0.6	1.00	0.923	0.931	0.934	0.917	0.928	0.927
	0.95	0.915	0.923	0.927	0.915	0.926	0.925
	0.85	0.843	0.860	0.861	0.915	0.925	0.925
	0.50	0.105	0.136	0.119	0.916	0.926	0.899
0.5	1.00	0.922	0.931	0.934	0.916	0.926	0.926
	0.95	0.913	0.922	0.925	0.915	0.926	0.925
	0.85	0.843	0.859	0.860	0.917	0.926	0.926
	0.50	0.106	0.137	0.121	0.916	0.925	0.898
0.4	1.00	0.923	0.931	0.935	0.915	0.926	0.926
	0.95	0.916	0.923	0.927	0.916	0.925	0.926
	0.85	0.844	0.861	0.862	0.916	0.927	0.924
	0.50	0.110	0.144	0.126	0.915	0.925	0.896
0.3	1.00	0.922	0.931	0.934	0.917	0.927	0.927
	0.95	0.914	0.925	0.926	0.916	0.926	0.927
	0.85	0.846	0.864	0.864	0.916	0.927	0.925
	0.50	0.117	0.152	0.134	0.916	0.924	0.895
0.2	1.00	0.922	0.932	0.933	0.916	0.926	0.926
	0.95	0.915	0.926	0.927	0.915	0.924	0.926
	0.85	0.849	0.869	0.867	0.916	0.926	0.924
	0.50	0.130	0.168	0.148	0.916	0.902	0.892

* GEE and mixed effects count only models assume Poisson distributed counts and use the canonical log link.
† GEE and mixed effects negative control de-biased models assume binomially distributed counts and use the canonical logit link.