

**Supplementary materials for “An improved multiply robust estimator for the average treatment effect”**

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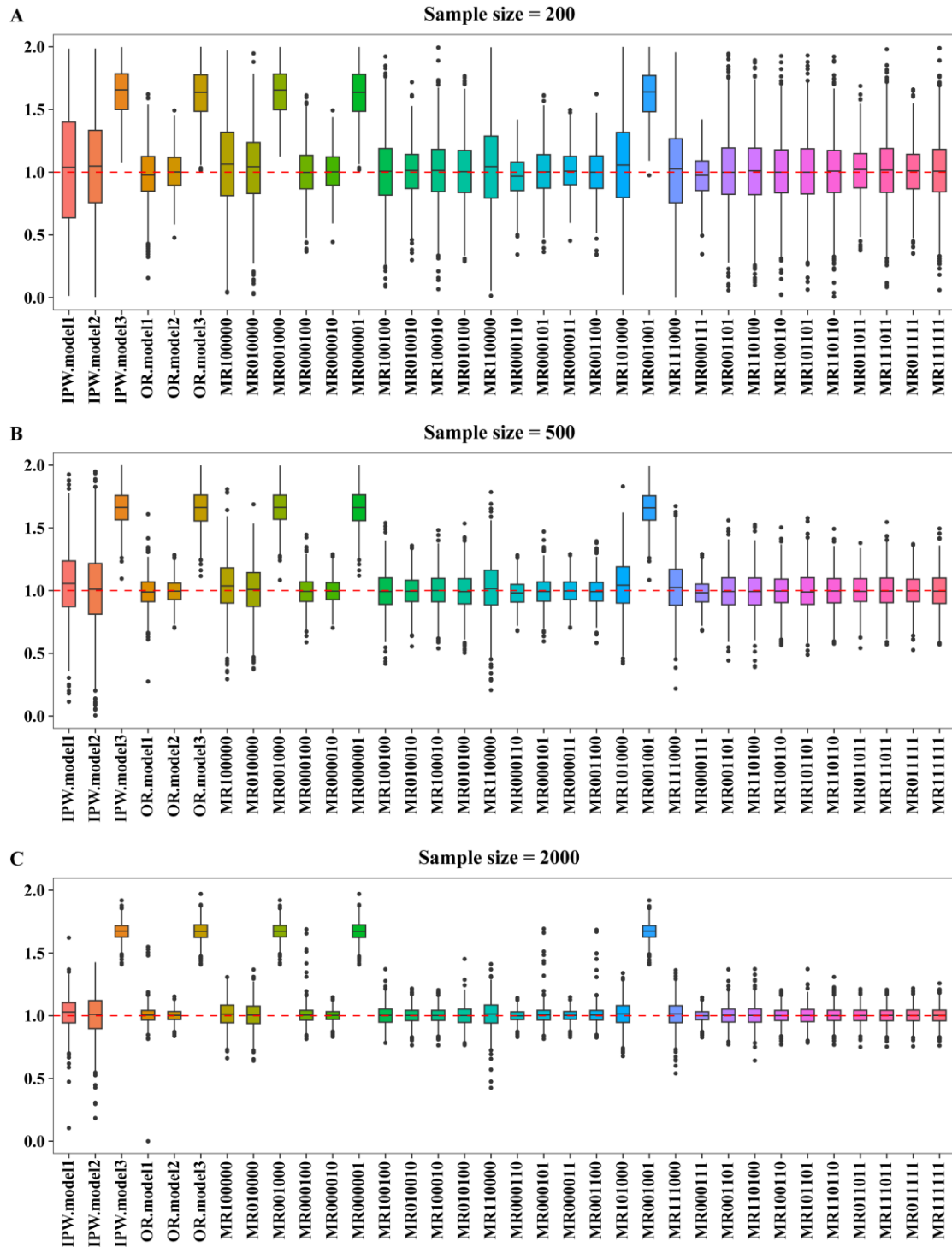
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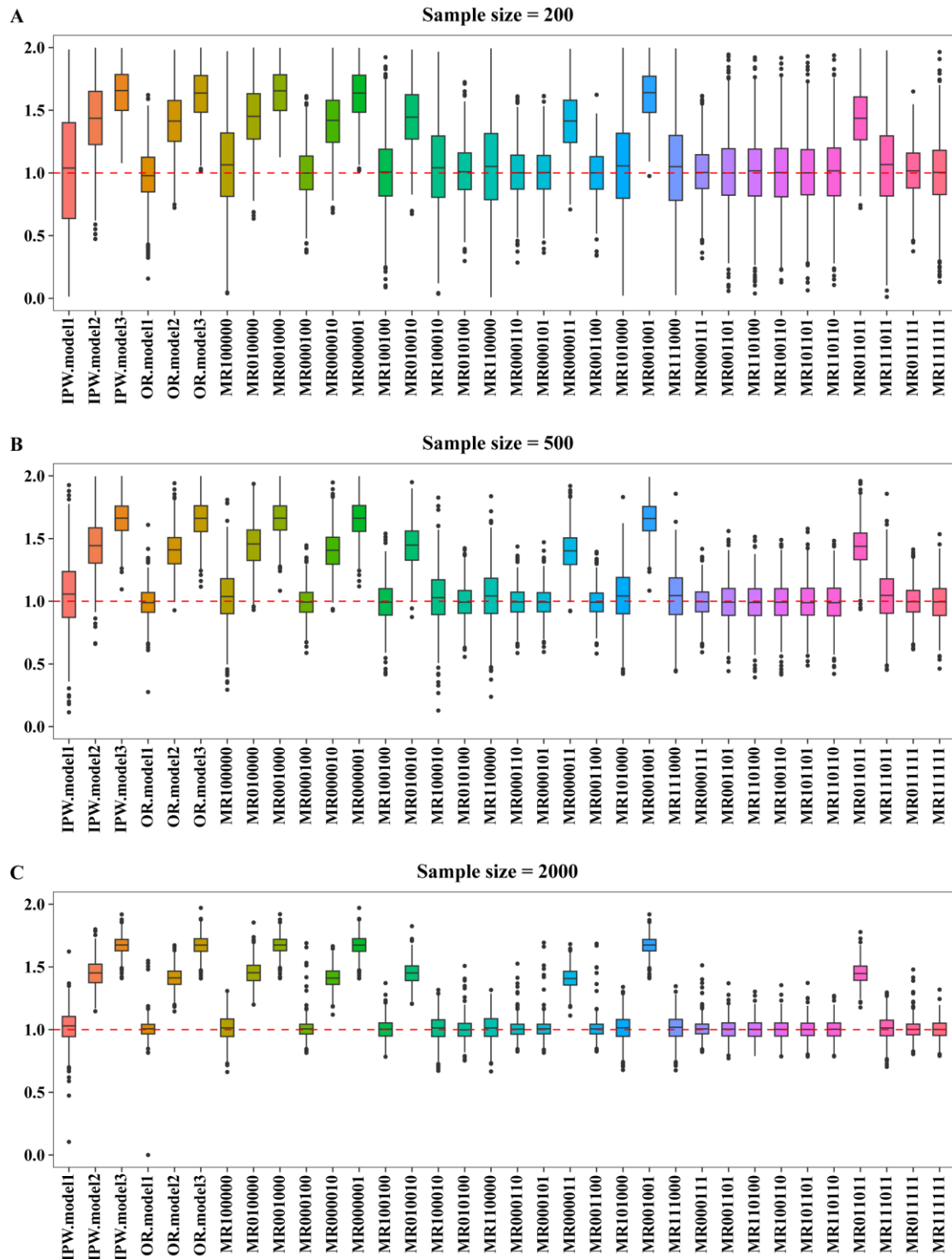
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**Table S1.** Baseline characteristics between chemotherapy and non-chemotherapy groups

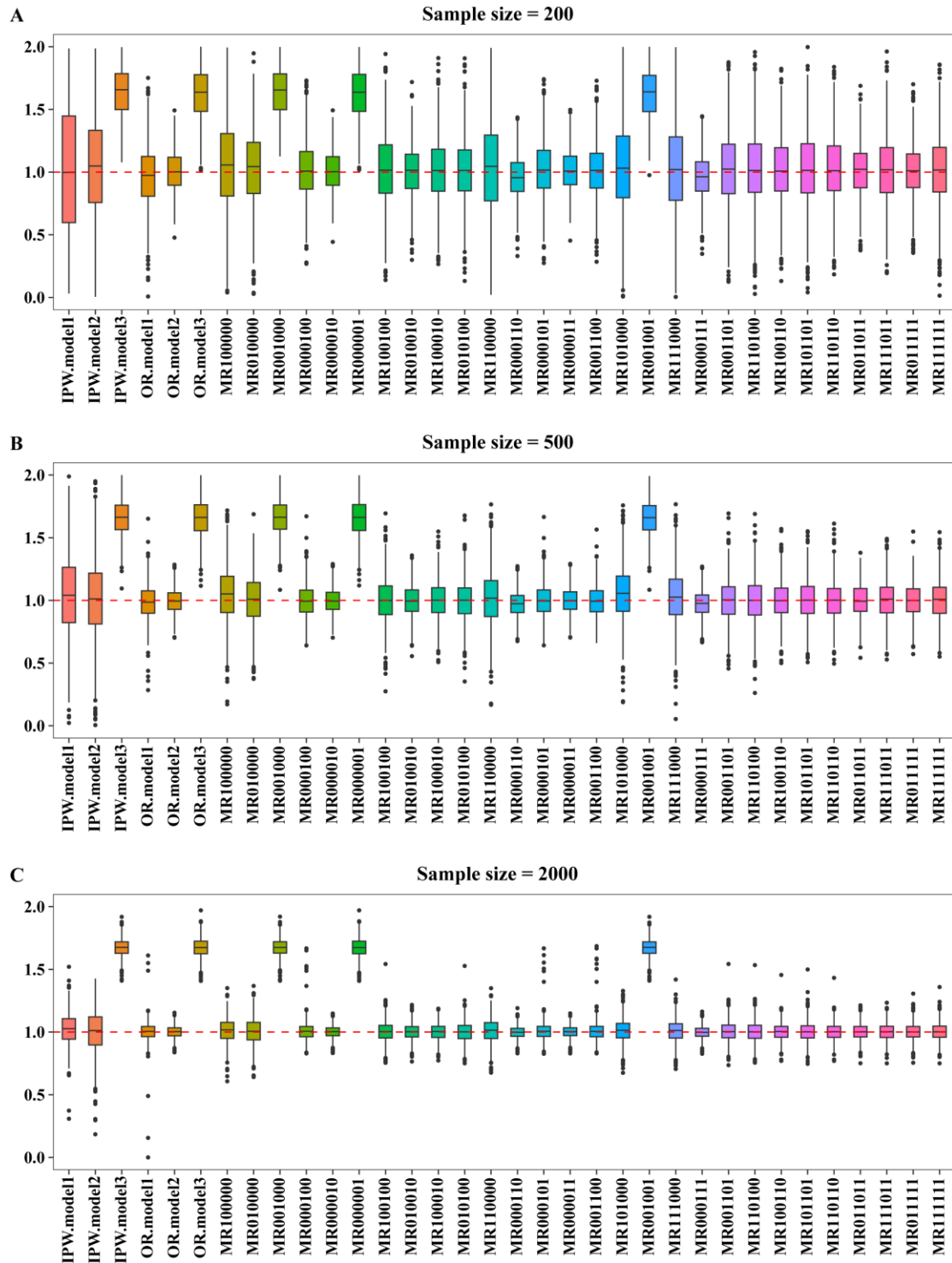
	Non-social activity group	Social activity group	
Marital			<0.001
Yes	3831 (77.5)	4203 (81.2)	
No	1111 (22.5)	974 (18.8)	
Sex			0.083
Male	2484 (50.3)	2512 (48.5)	
Female	2458 (49.7)	2665 (51.5)	
Urban			<0.001
Yes	960 (19.4)	1502 (29.0)	
No	3982 (80.6)	3675 (71.0)	
Smoke			0.728
Yes	2006 (40.6)	2120 (41.0)	
No	2936 (59.4)	3057 (59.0)	
Hypertension			0.185
Yes	1262 (25.5)	1383 (26.7)	
No	3680 (74.5)	3794 (73.3)	
Diabetes			0.002
Yes	255 ( 5.2)	343 ( 6.6)	
No	4687 (94.8)	4834 (93.4)	
Heart disease			0.619
Yes	659 (13.3)	672 (13.0)	
No	4283 (86.7)	4505 (87.0)	
Stroke			0.776
Yes	112 ( 2.3)	112 ( 2.2)	
No	4830 (97.7)	5065 (97.8)	
Depression level (mean±SD)	20.42 (5.22)	19.78 (4.72)	<0.001
Age (mean±SD)	60.74 (10.19)	58.99 (10.14)	<0.001



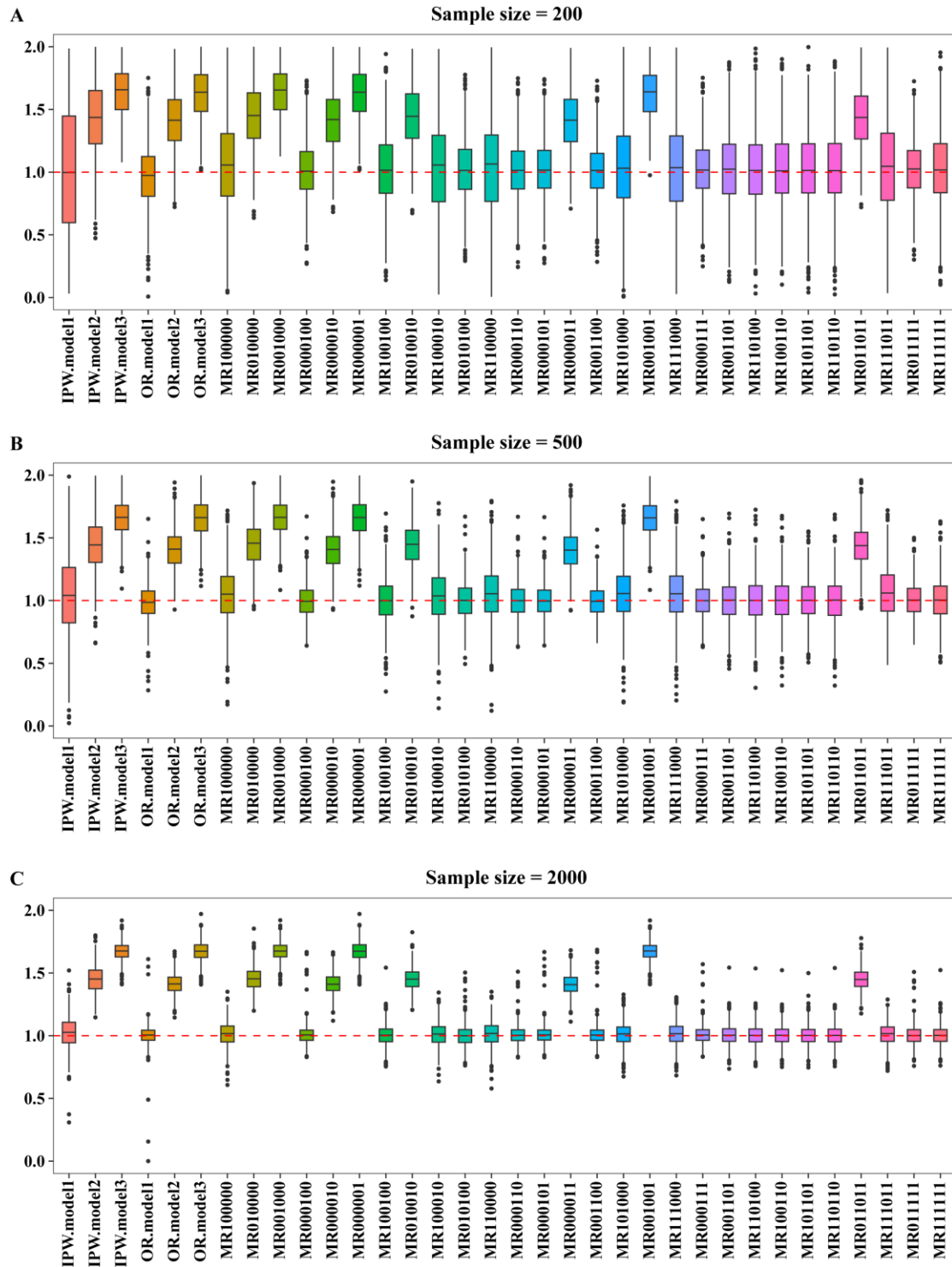
**Figure S1.** Simulation results with different sample sizes = 200, 500 or 2000 in the situation where the parametric models included the correct models and the neural network model included true covariates.



**Figure S2.** Simulation results with different sample sizes = 200, 500 or 2000 in the situation where the parametric models did not include the correct models and the neural network model included true covariates.



**Figure S3.** Simulation results with different sample sizes = 200, 500 or 2000 in the situation where the parametric models included the correct models and the neural network model included all covariates.



**Figure S4.** Simulation results with different sample sizes = 200, 500 or 2000 in the situation where the parametric models did not include the correct models and the neural network model included all covariates