

Estimator	Relationship					
	FS	HS	C1	C2	C3	IN
$\hat{\Phi}_D$	3.12	6.38	12.34	49.55	187.68	7.33
	3.12	6.38	12.34	47.90	144.48	7.33
$\hat{\Phi}_G$	3.00	4.85	8.32	30.83	116.22	5.92
	3.00	4.85	8.32	30.42	95.98	5.92
$\hat{\Phi}_R$	2.42	4.33	7.99	31.64	120.56	5.56
	2.42	4.33	7.99	31.19	99.20	5.56
$\hat{\Phi}_T$	2.19	4.26	7.96	30.84	116.24	5.50
	2.19	4.26	7.96	30.43	96.01	5.50
$\hat{\Phi}_N$	3.01	4.70	7.87	28.20	105.46	5.82
	3.01	4.70	7.87	27.98	88.58	5.82
$\hat{\Phi}_K$	2.64	4.10	7.21	23.74	85.57	6.31
	2.64	4.10	7.21	23.69	72.58	6.31
$\hat{\Phi}_W$	1.59	2.60	4.44	17.33	65.60	4.82
	1.59	2.60	4.44	17.33	56.70	4.82

**Table S6** Estimation accuracies from simulation study as measured by the ratio ( $\times 10^2$ ) of the square root of MSE and the average realized kinship. For each GRM estimator, the top row shows results from unconstrained estimates. The bottom row shows results from estimates constrained to the natural range of  $[0, 1]$ .