Supplemental material to the article

"Optimization of two-stage genetic designs where data are pooled using an accurate and efficient approximation for Pearson's statistic"

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Average power of probability tables vs. power of the average probability table

To calculate the PTD in our paper we focus on the power for an average probability table (=average effect size) and do not take into account that these probability tables will vary across markers (=distribution of the effect sizes). To study the impact of the distribution of effect sizes we compared the average of the power for each of the individual probability tables (AVE POW IND TABLE) to the power of the average probability table (POW. AVR. TABLE). For this purpose we randomly generated hundred odds ratios (o) according to a lognormal distribution with mean 1.3 and range 1.2-1.41. A control allele frequency (q_1), or more precisely an entry in the probability table, was randomly generated to each odds ratio according to a lognormal distribution with mean 0.2 and range 0.1-0.47. From the odds ratio and control allele frequency (o, q_1), we calculated the allele frequencies in the cases (p_1) by

$$p_1 = \frac{oq_1}{1 - q_1 + oq_1}.$$

to obtain the 2×2 probability table. The 2×3 tables were obtained from the 2×2 probability tables by assuming Hardy-Weinberg equilibrium.

Results for different critical value c and sample size n are shown in Tables 1 and 2.

Table 1. 2×2 probability table

c	n	AVE POW IND TABLE	POW. AVR. TABLE
0.5	1000	0.9122533	0.9165234
1	1000	0.8539016	0.8589993
2	1000	0.7397831	0.7443431
4	1000	0.5269881	0.5275279
1	2000	0.9677274	0.9732342
2	2000	0.9264927	0.9350992
4	2000	0.812797	0.8232412
6	2000	0.6762068	0.683437
8	2000	0.5372975	0.5388673
3	3000	0.9590546	0.968222
6	3000	0.8567323	0.8720848
9	3000	0.7083085	0.7205948
12	3000	0.5447208	0.5475649
13	3000	0.4917864	0.4911275

Table 2. 2×3 probability table

c	n	AVE POW IND TABLE	POW. AVR. TABLE
0.2	500	0.9746089	0.9754613
0.8	500	0.8951623	0.8973246
1.5	500	0.8000982	0.8020889
3.0	500	0.6055429	0.6043045
0.4	1000	0.9838379	0.9865156
1.6	1000	0.9156056	0.9235265
3.0	1000	0.810451	0.8190479
6.0	1000	0.5594791	0.5580665
0.6	1500	0.990786	0.9938375
2.4	1500	0.9356714	0.9474424
4.5	1500	0.8286528	0.8435775
6.0	1500	0.7350583	0.7467517
9.0	1500	0.5384353	0.5362445

The tables demonstrate that there is only a slight difference between the average of the powers of the individual probability tables and the power of the average probability table. This suggests that using an average probability table, as we did in our article, can be expected to produce reasonably accurate results.