**APPENDIX**

**Performance of FB-GGRF for non-normally distributed quantitative phenotypes**

The FB-GGRF method provides a framework to account for various distributions of phenotypes by using appropriate link functions as in a generalized linear model (Equation 2). The link function should be selected based on the distribution of phenotypes. In this Appendix, we used phenotypes following a Poisson distribution as an example to evaluate the performance of FB-GGRF for non-normally distributed phenotypes. We simulated the phenotype by:



Similar to the main text,we let the effect sizes to be proportional to the negative logarithm of the minor allele frequencies: . The performance of FB-GGRF was evaluated using both log link and identity link. The current version of FB-SKAT did not provide an option for log link, and was directly applied assuming an identity link.

The simulation results are summarized in Figure A1. Both FB-GGRF and FB-SKAT were able to control type I errors properly. When identity link was used, FB-GGRF attained an improved power over FB-SKAT, consistent with the results for normally distributed phenotypes. FB-GGRF also attained an improved power when log link function was used. We expect that FB-SKAT may also incorporate other link functions to improve its statistical power for non-normally distributed phenotypes.

**Figure A1. The performance of FB-GGRF and FB-SKAT with phenotypes following Poisson distribution.**

From left to right: FB-GGRF with log link; FB-GGRF with identity link; FG-SKAT (identity link)

