

Description of Additional Supplementary Files

File Name: Supplementary Data 1

Description: Characteristics of replication cohorts.

File Name: Supplementary Data 2

Description: Genetic variants associated with ALP within the UKB based on BOLT LMM and GCTA at $P < 1 \times 10^{-8}$.

File Name: Supplementary Data 3

Description: Genetic variants associated with ALT within the UKB based on BOLT LMM and GCTA at $P < 1 \times 10^{-8}$.

File Name: Supplementary Data 4

Description: Genetic variants associated with GGT within the UKB based on BOLT LMM and GCTA at $P < 1 \times 10^{-8}$.

File Name: Supplementary Data 5

Description: Known and novel genetic variants associated with ALP within the meta-analysis of UKB and replication cohorts at $P < 1 \times 10^{-9}$.

File Name: Supplementary Data 6

Description: Known and novel genetic variants associated with ALT within the meta-analysis of UKB and replication cohorts at $P < 1 \times 10^{-9}$.

File Name: Supplementary Data 7

Description: Known and novel genetic variants associated with GGT within the meta-analysis of UKB and replication cohorts at $P < 1 \times 10^{-9}$.

File Name: Supplementary Data 8

Description: Overview of LD score regression between liver enzymes and other traits.

File Name: Supplementary Data 9

Description: Overview of association results for liver enzymes genetic loci and genetically correlated traits in previously published genome-wide association studies.

File Name: Supplementary Data 10

Description: Overview of metabolites associated with liver enzyme SNPs in Airwave.

File Name: Supplementary Data 11.

Description: Overview of liver enzyme SNP cis- eQTL effects in liver

File Name: Supplementary Data 12.

Description: Overview of enriched mammalian phenotypes using DEPICT at False discovery rate $< 5\%$ for ALT, ALP, and GGT loci.

File Name: Supplementary Data 13.

Description: Overview of Mendelian randomization analysis for liver enzymes against coronary heart disease and stroke.

File Name: Supplementary Data 14.

Description: Overview of the liver enzyme genetic risk score analysis in the UKB at $P < 0.05$.

File Name: Supplementary Data 15.

Description: Overview of the impact of adjustment for metabolic factors on the association between liver enzyme GRS and CVD.