

Supplementary material

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Biomarkers distribution

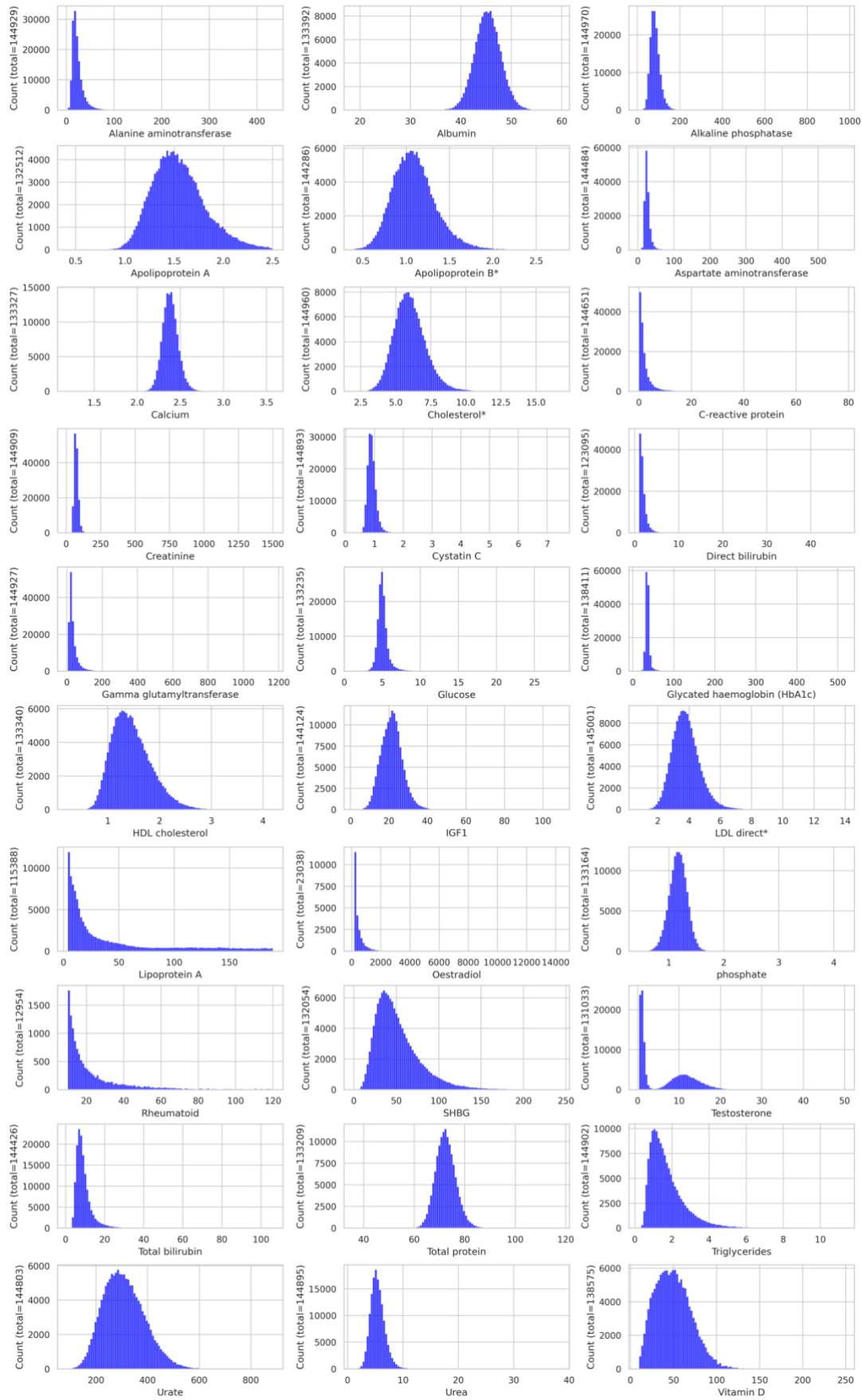


Figure S1 Distribution of samples across biomarkers.

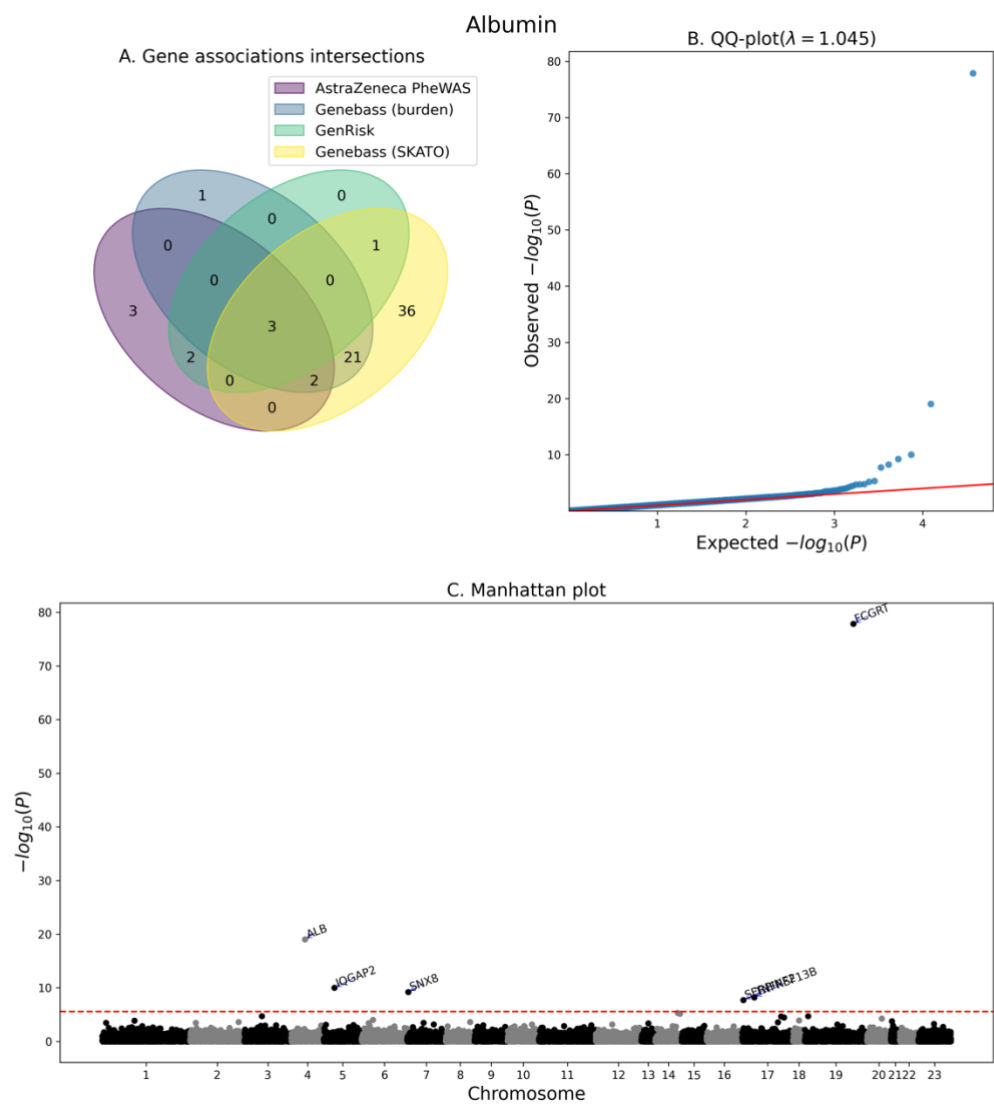


Figure S2 Association analysis summary for albumin.

A. Venn diagram of the number significantly associated genes as identified by GenRisk, AstraZeneca PheWAS and genebass. B. QQ-plot of the P-values of GenRisk pipeline results. C. Manhattan plot of GenRisk pipeline results.

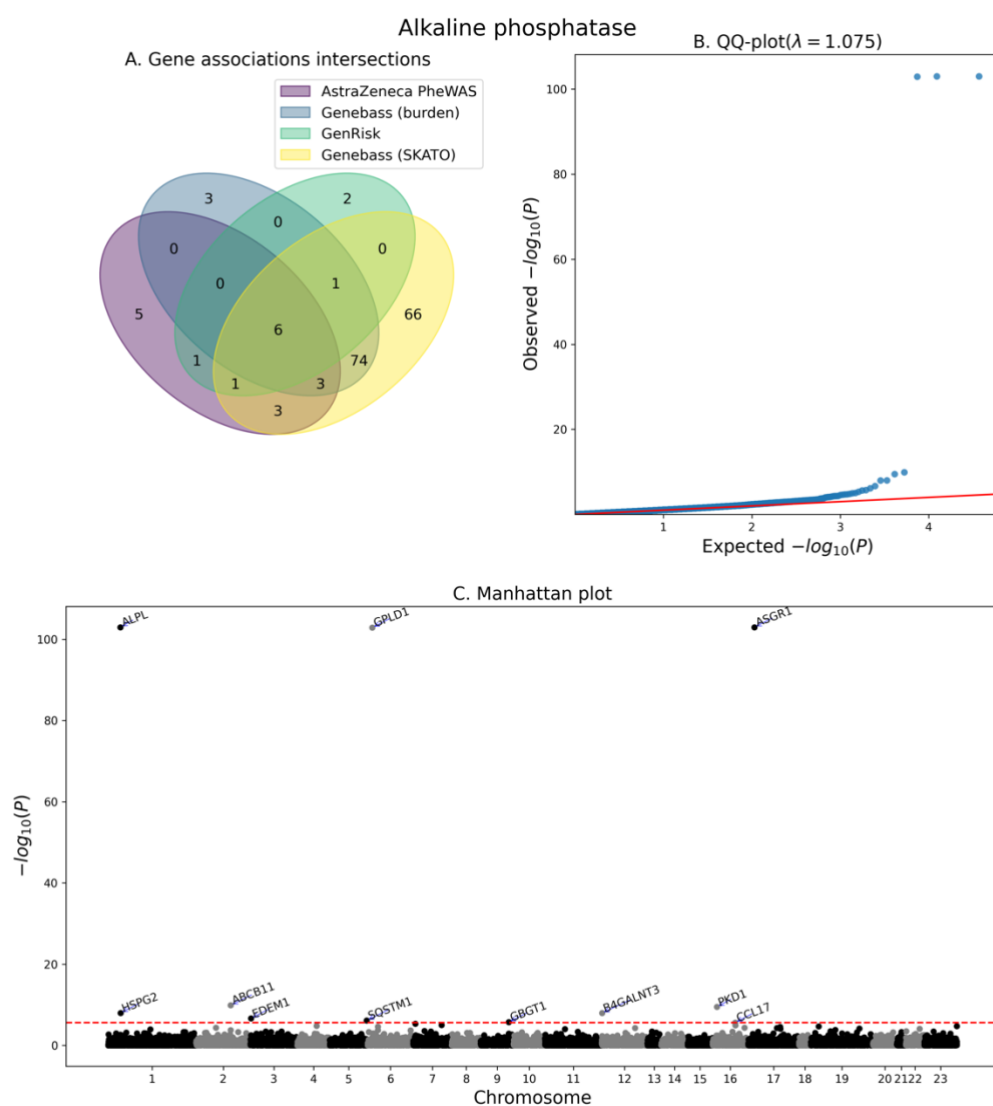


Figure S3 Association analysis summary for alkaline phosphatase.

A. Venn diagram of the number significantly associated genes as identified by GenRisk, AstraZeneca PheWAS and genebass. B. QQ-plot of the P-values of GenRisk pipeline results. C. Manhattan plot of GenRisk pipeline results.

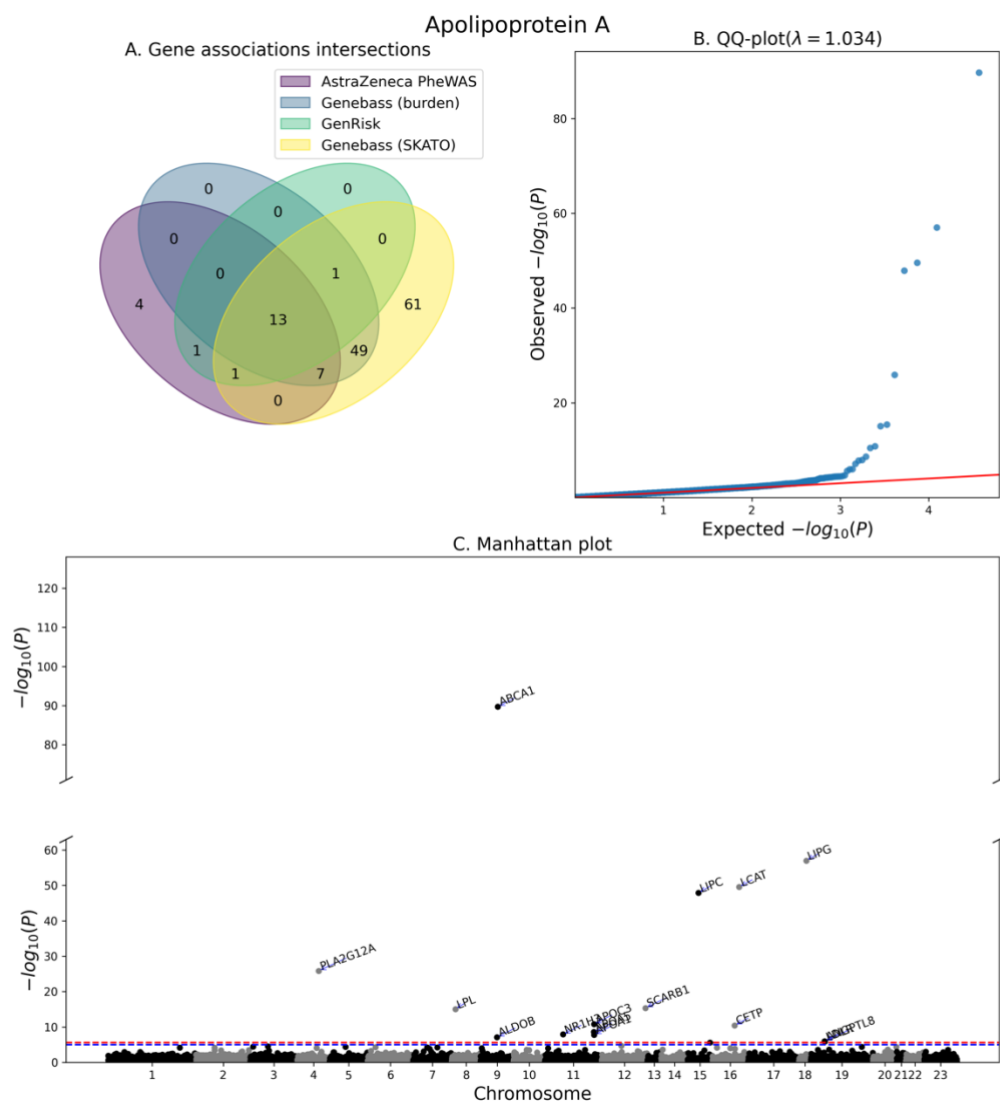


Figure S4 Association analysis summary for apolipoprotein A.

A. Venn diagram of the number significantly associated genes as identified by GenRisk, AstraZeneca PheWAS and genebass. B. QQ-plot of the P-values of GenRisk pipeline results. C. Manhattan plot of GenRisk pipeline results.

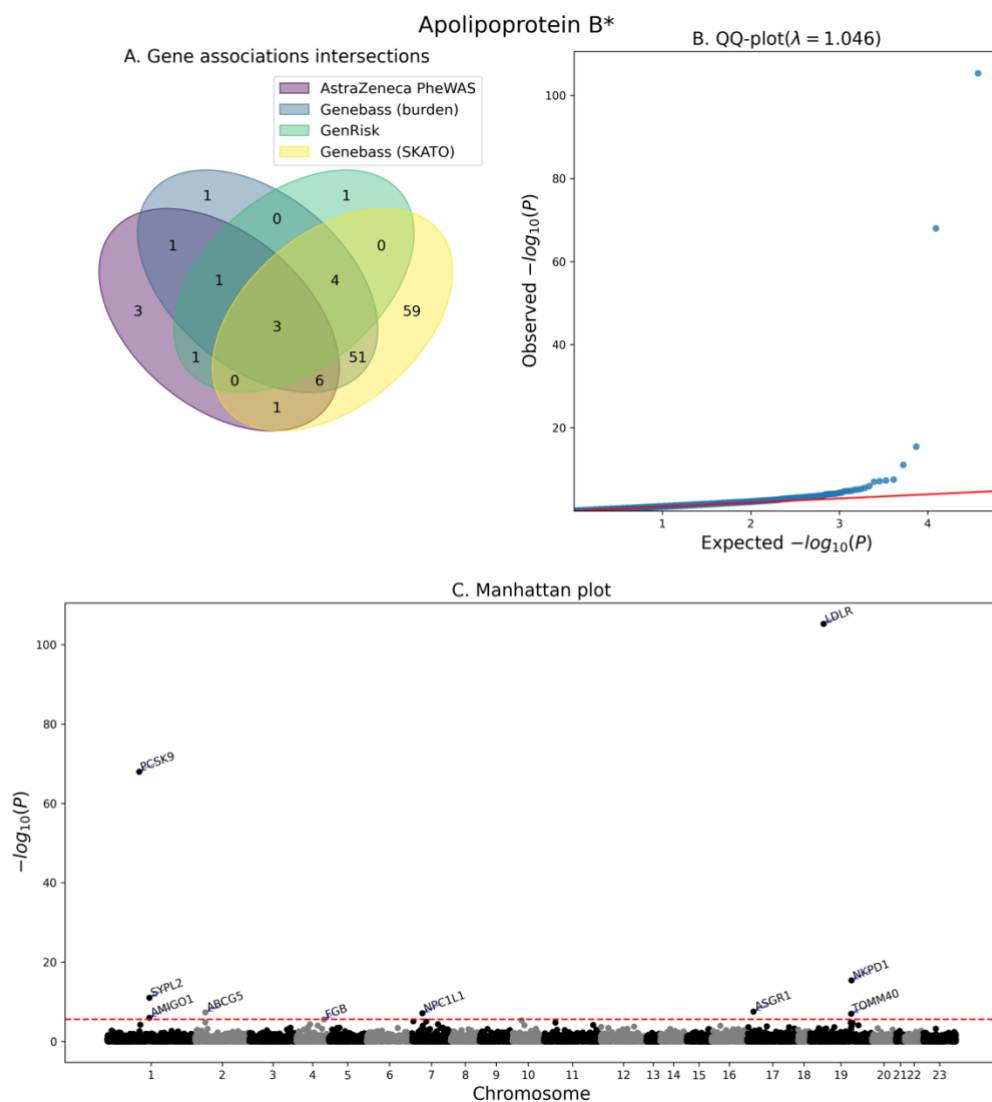


Figure S5 Association analysis summary for apolipoprotein B*.

A. Venn diagram of the number significantly associated genes as identified by GenRisk, AstraZeneca PheWAS and genebass. B. QQ-plot of the P-values of GenRisk pipeline results. C. Manhattan plot of GenRisk pipeline results.

* statin adjusted values

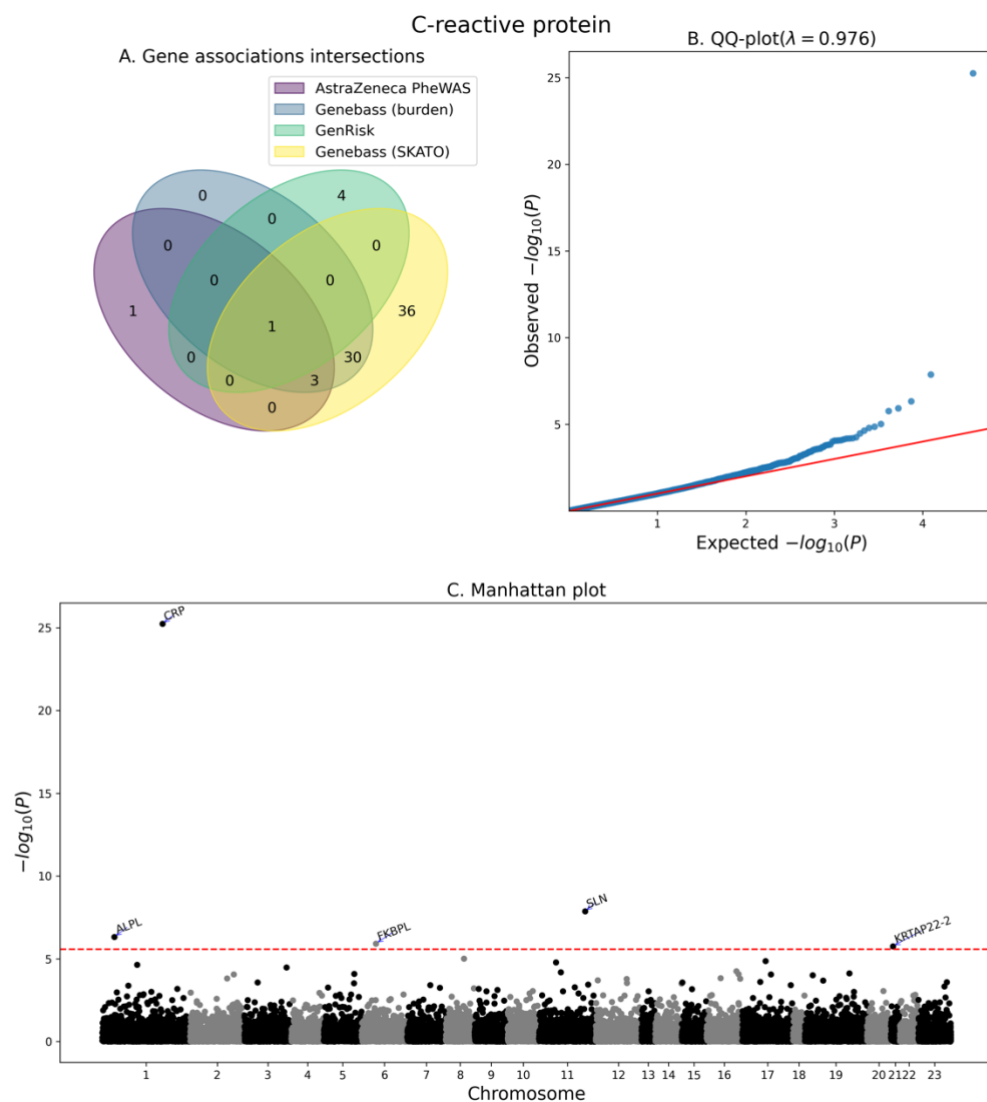


Figure S6 Association analysis summary for C-reactive protein.

A. Venn diagram of the number significantly associated genes as identified by GenRisk, AstraZeneca PheWAS and genebass. B. QQ-plot of the P-values of GenRisk pipeline results. C. Manhattan plot of GenRisk pipeline results.

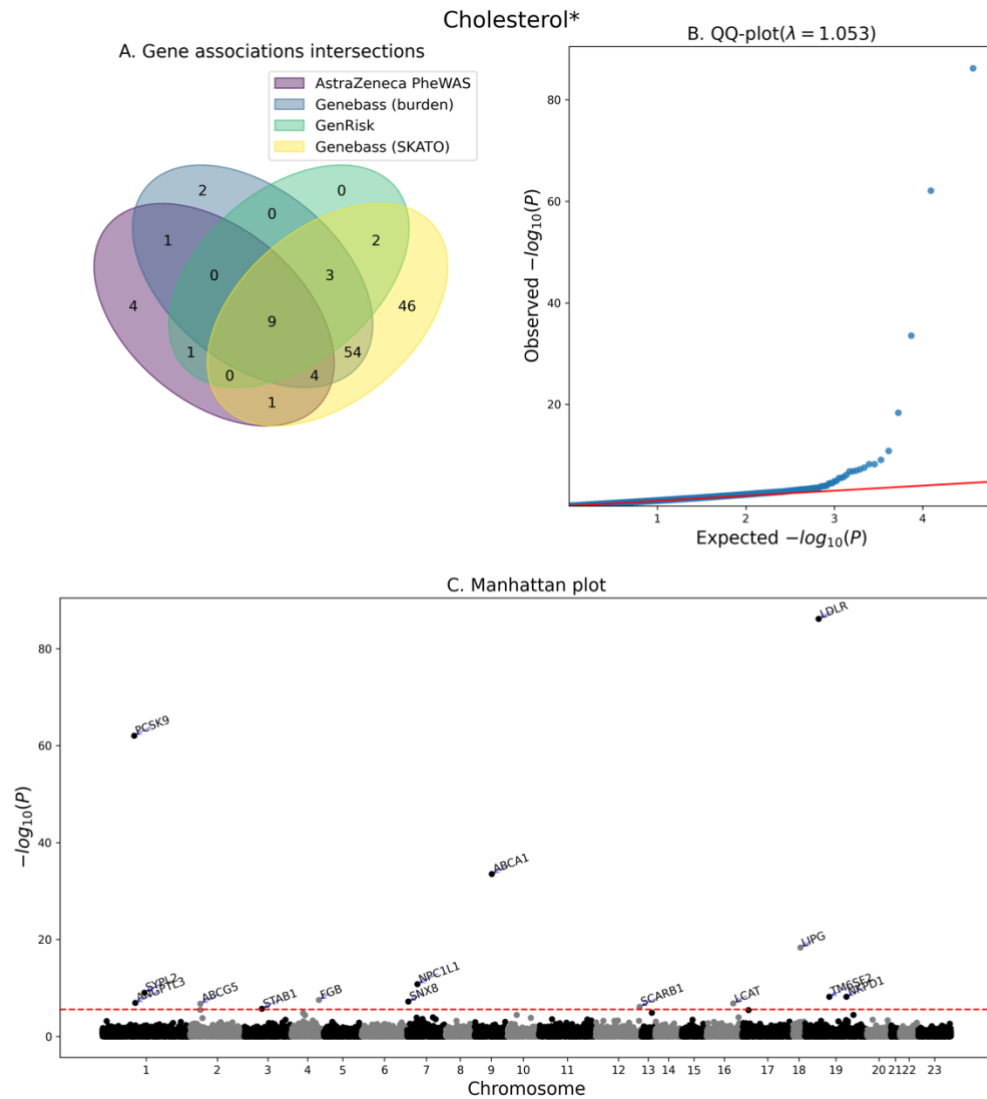


Figure S8 Association analysis summary for cholesterol*.

A. Venn diagram of the number significantly associated genes as identified by GenRisk, AstraZeneca PheWAS and genebass. B. QQ-plot of the P-values of GenRisk pipeline results. C. Manhattan plot of GenRisk pipeline results.

* statin adjusted values

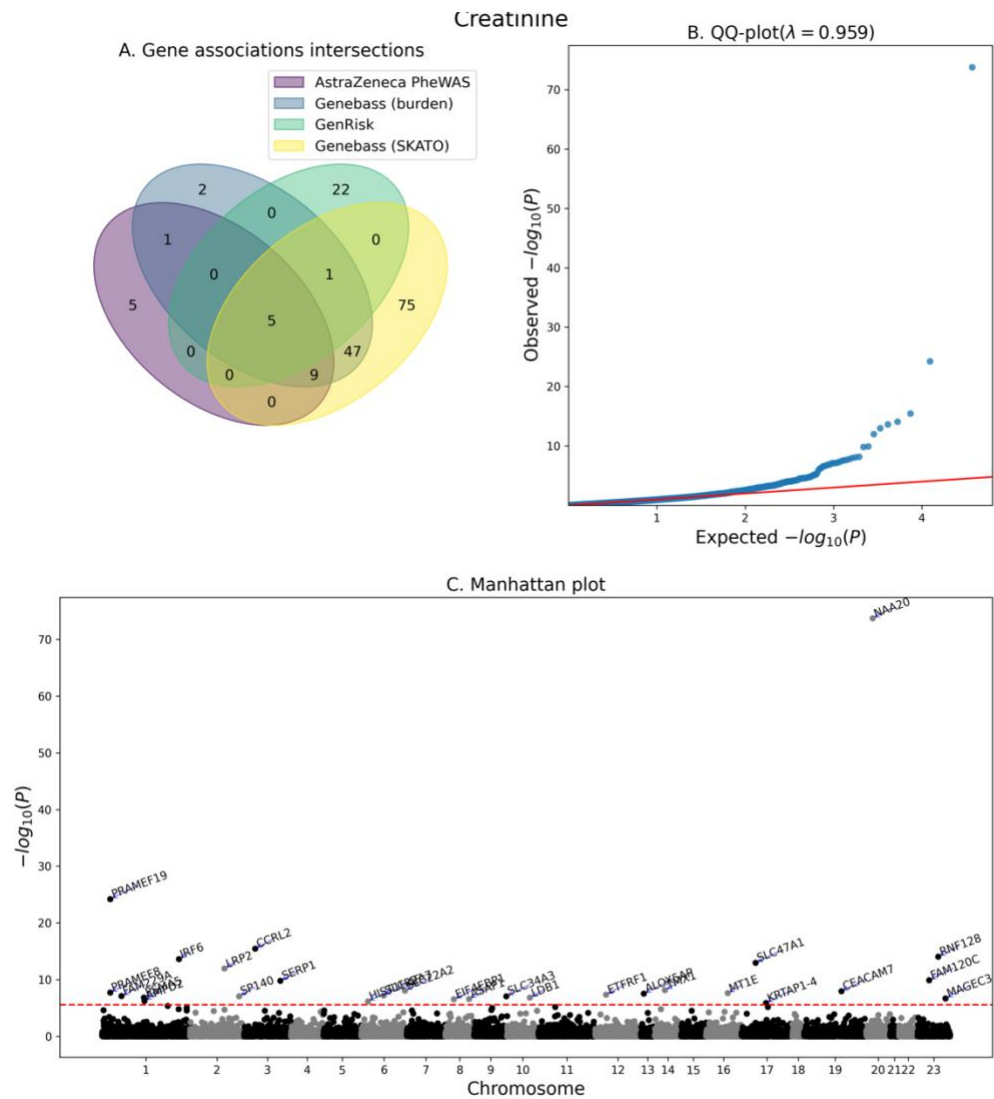


Figure S9 Association analysis summary for creatinine.

A. Venn diagram of the number significantly associated genes as identified by GenRisk, AstraZeneca PheWAS and genebass. B. QQ-plot of the P-values of GenRisk pipeline results. C. Manhattan plot of GenRisk pipeline results.

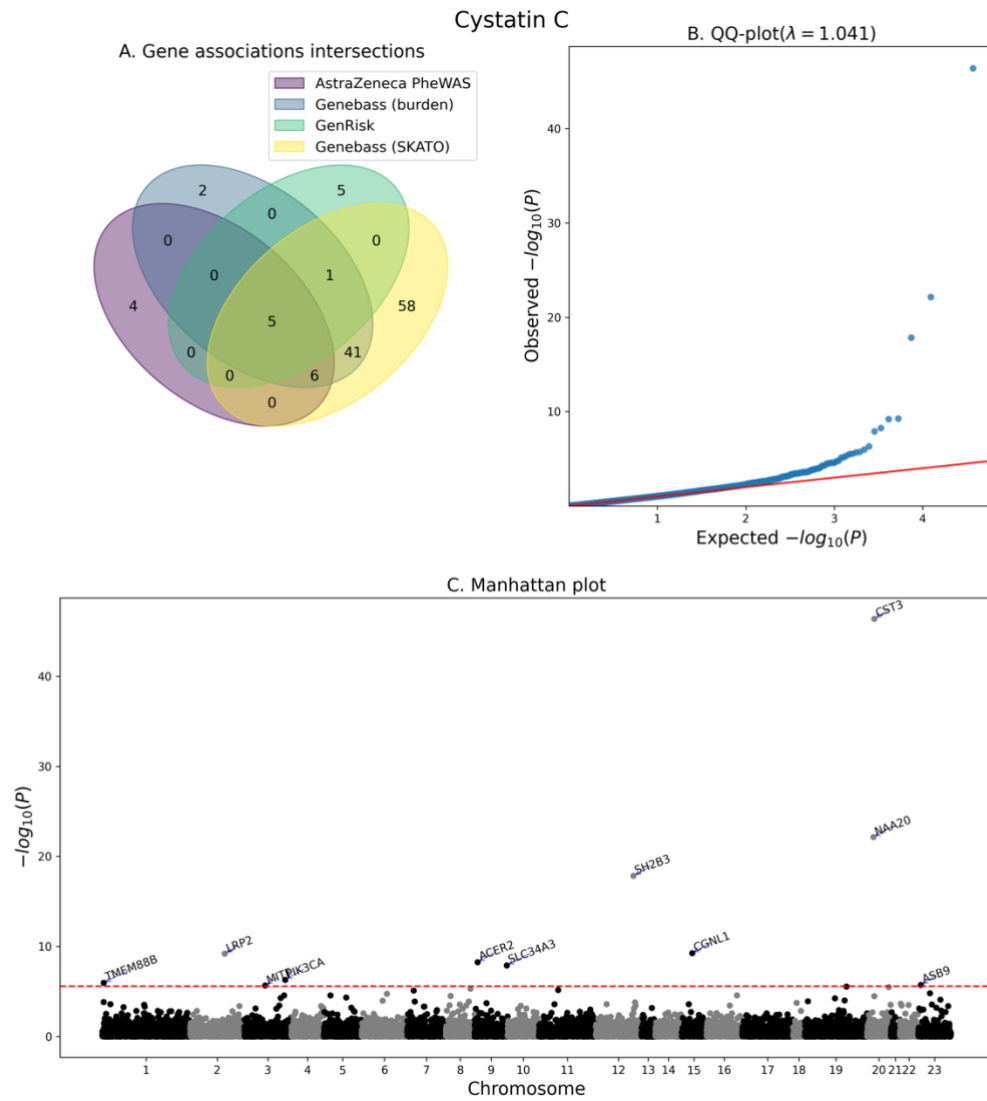


Figure S10 Association analysis summary for cystatin C.

A. Venn diagram of the number significantly associated genes as identified by GenRisk, AstraZeneca PheWAS and genebass. B. QQ-plot of the P-values of GenRisk pipeline results. C. Manhattan plot of GenRisk pipeline results.

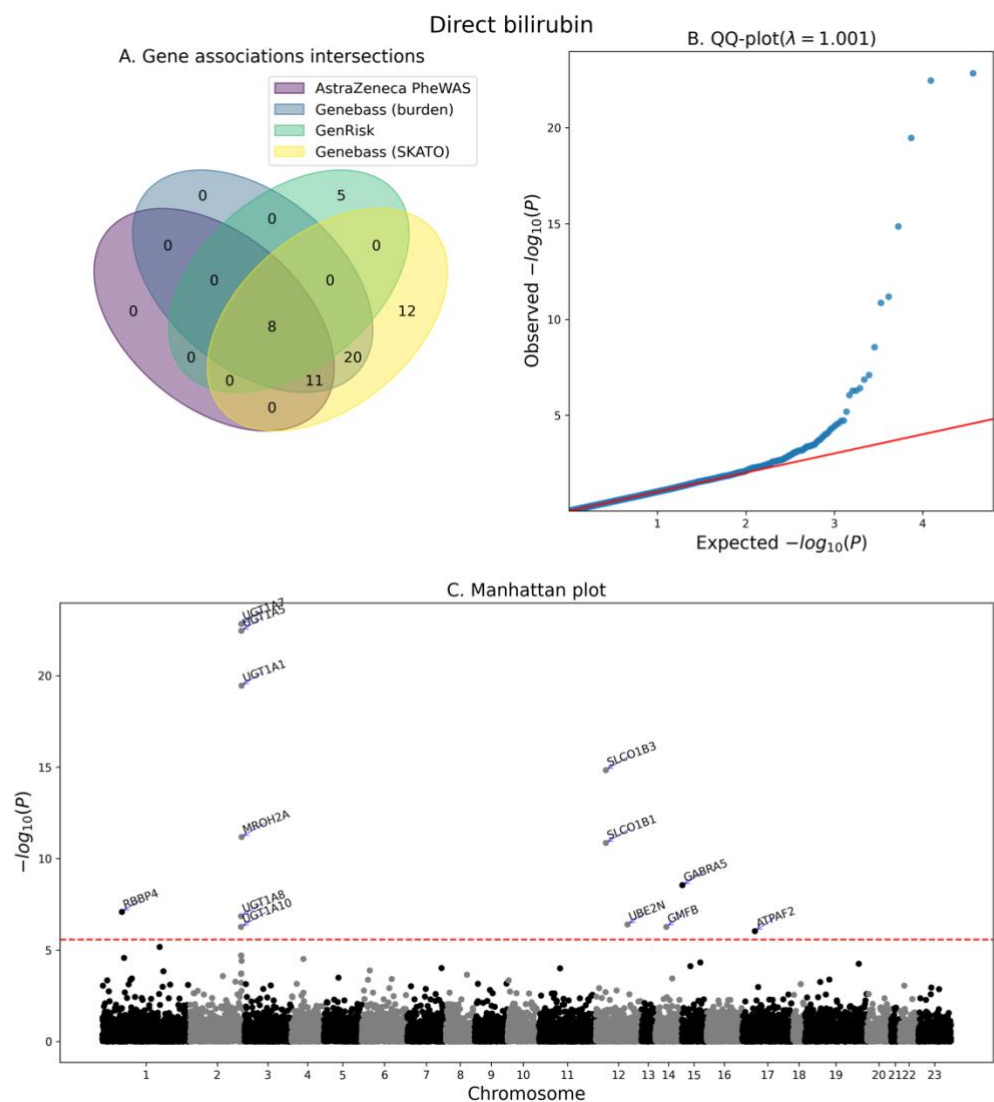


Figure S11 Association analysis summary for direct bilirubin.

A. Venn diagram of the number significantly associated genes as identified by GenRisk, AstraZeneca PheWAS and genebass. B. QQ-plot of the P-values of GenRisk pipeline results. C. Manhattan plot of GenRisk pipeline results.

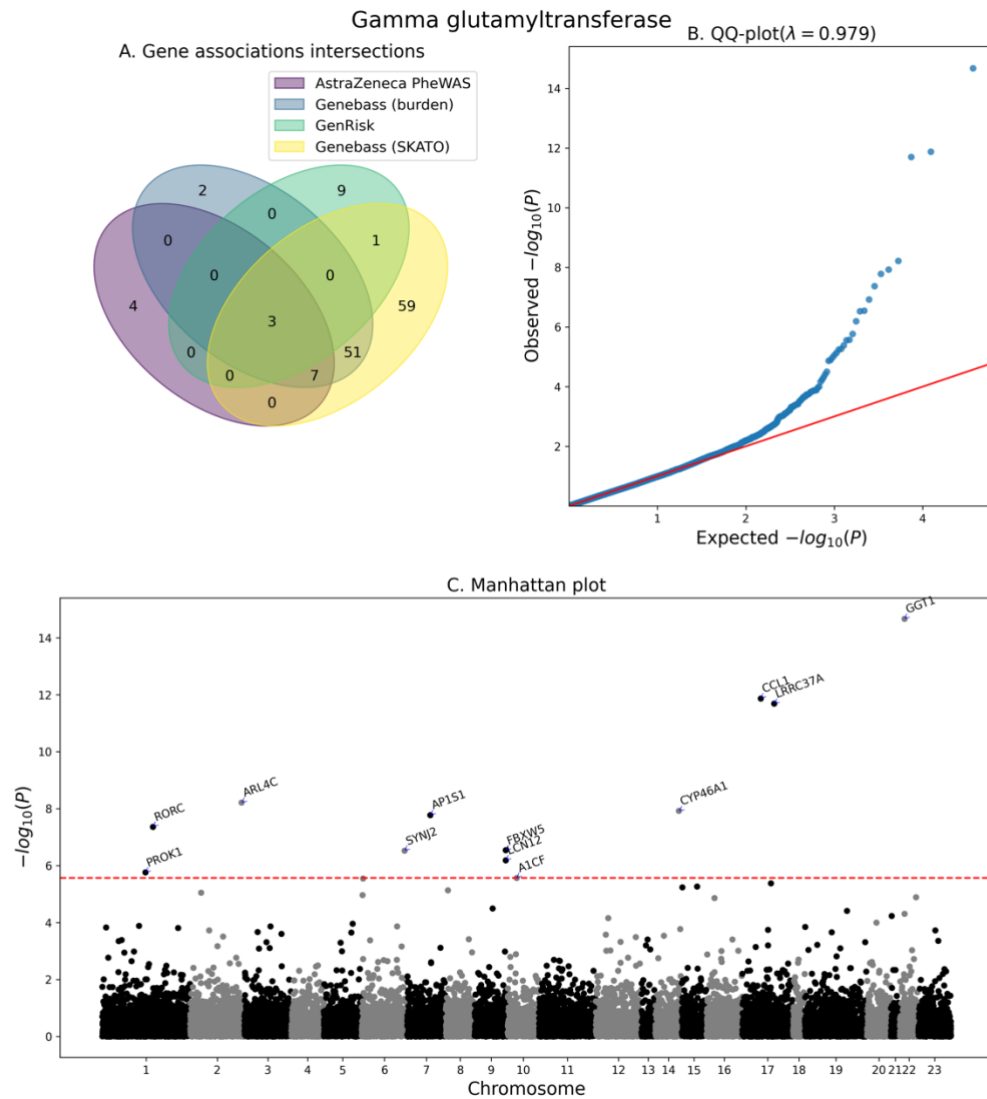


Figure S12 Association analysis summary for gamma glutamyltransferase.

A. Venn diagram of the number significantly associated genes as identified by GenRisk, AstraZeneca PheWAS and genebass. B. QQ-plot of the P-values of GenRisk pipeline results. C. Manhattan plot of GenRisk pipeline results.

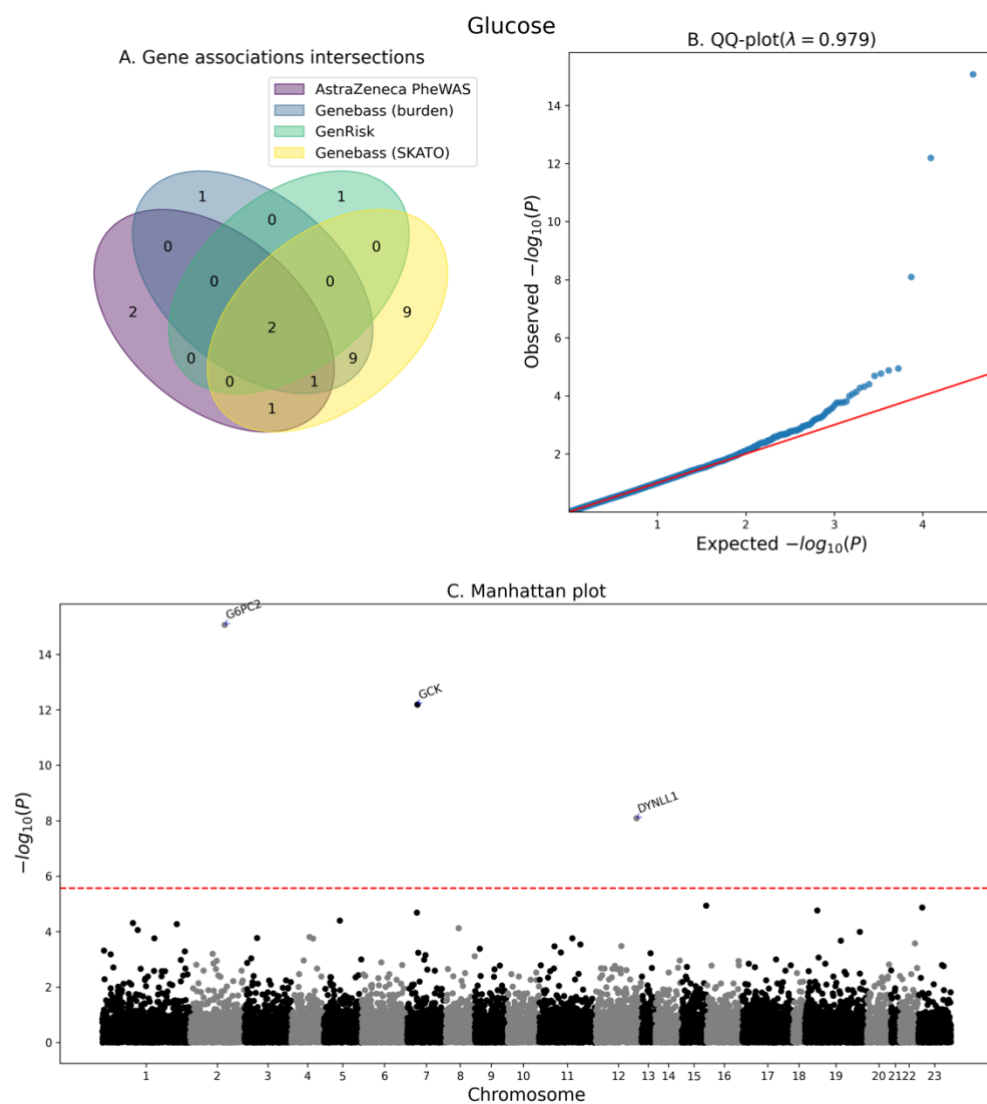


Figure S13 Association analysis summary for glucose.

A. Venn diagram of the number significantly associated genes as identified by GenRisk, AstraZeneca PheWAS and genebass. B. QQ-plot of the P-values of GenRisk pipeline results. C. Manhattan plot of GenRisk pipeline results.

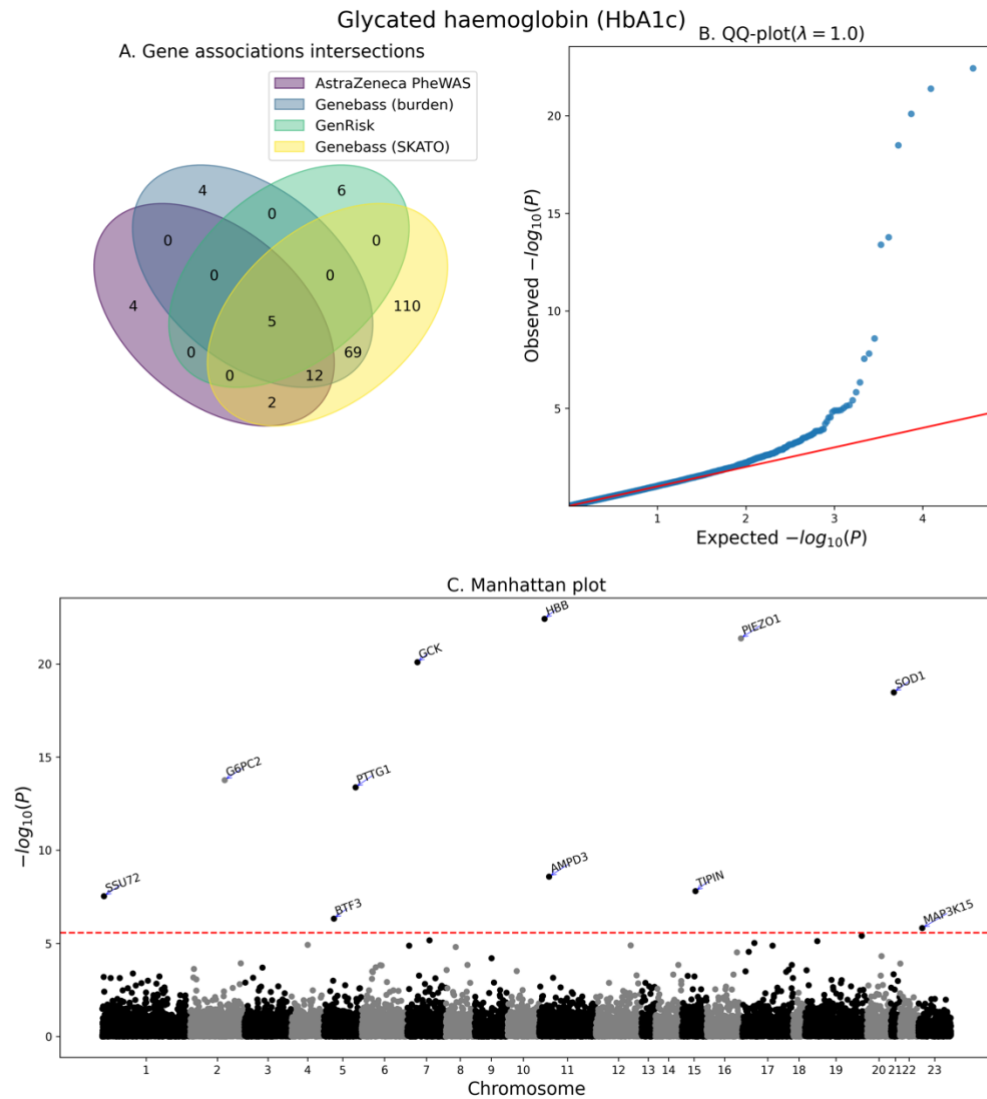


Figure S14 Association analysis summary for glycated haemoglobin (HbA1c).
A. Venn diagram of the number significantly associated genes as identified by GenRisk, AstraZeneca PheWAS and genebass. B. QQ-plot of the P-values of GenRisk pipeline results. C. Manhattan plot of GenRisk pipeline results.

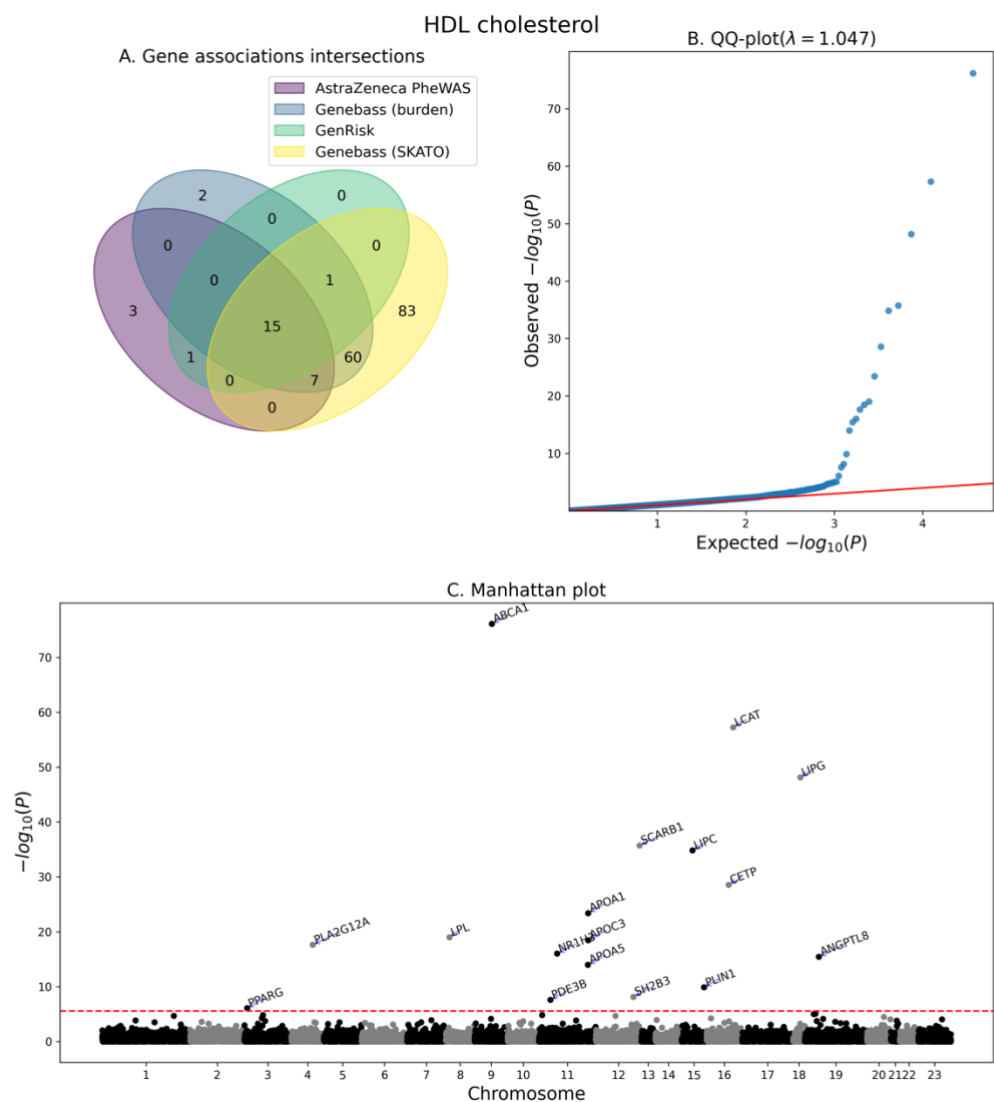


Figure S15 Association analysis summary for HDL cholesterol.

A. Venn diagram of the number significantly associated genes as identified by GenRisk, AstraZeneca PheWAS and genebass. B. QQ-plot of the P-values of GenRisk pipeline results. C. Manhattan plot of GenRisk pipeline results.

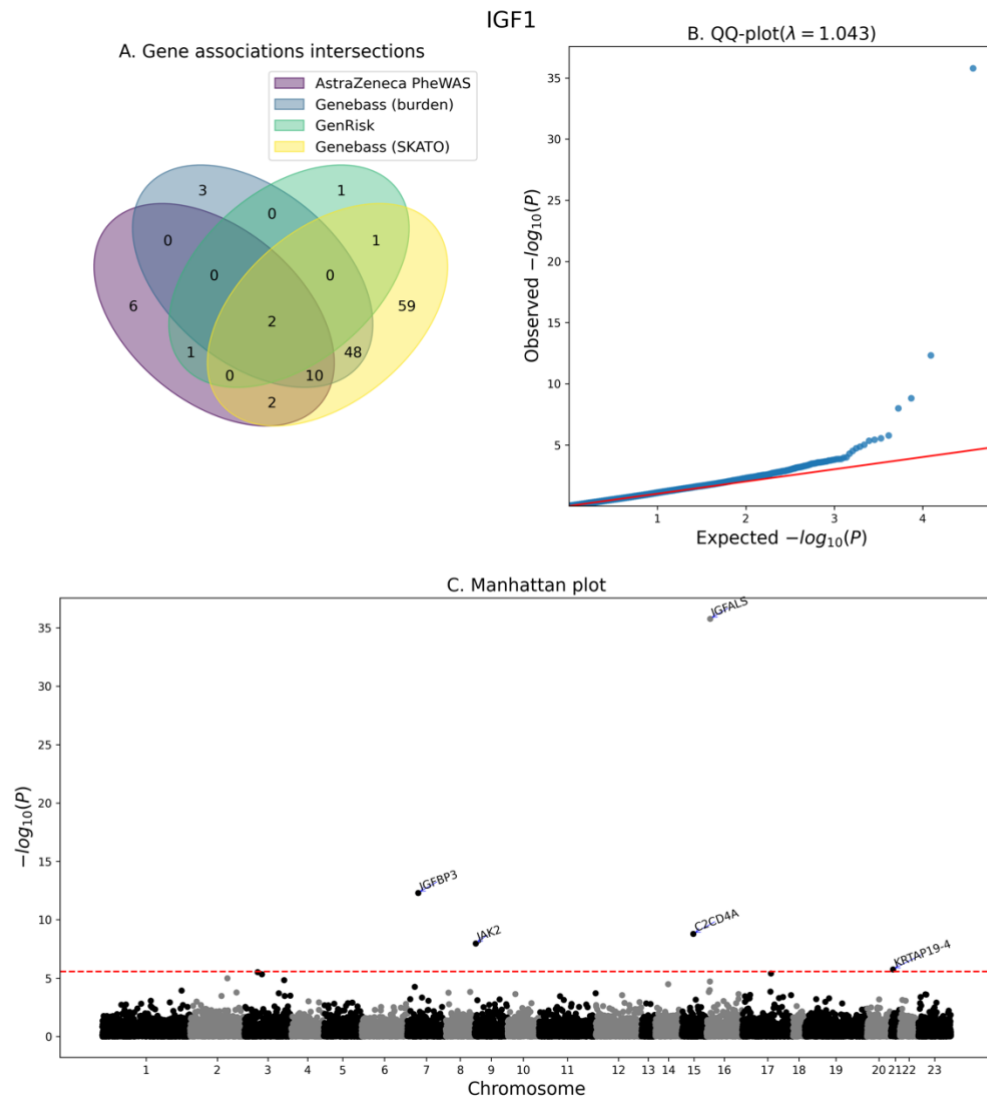


Figure S16 Association analysis summary for IGF1.

A. Venn diagram of the number significantly associated genes as identified by GenRisk, AstraZeneca PheWAS and genebass. B. QQ-plot of the P-values of GenRisk pipeline results. C. Manhattan plot of GenRisk pipeline results.

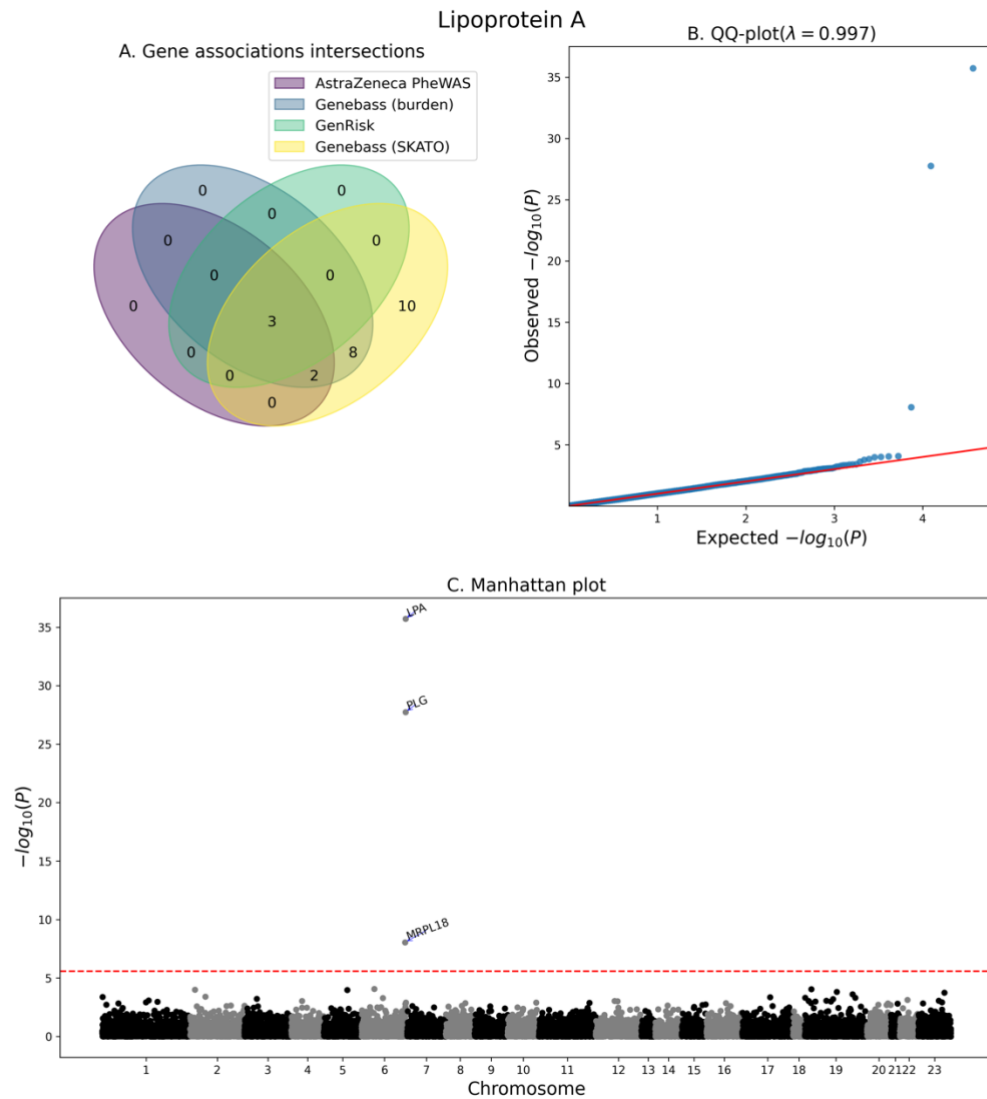


Figure S17 Association analysis summary for lipoprotein A.

A. Venn diagram of the number significantly associated genes as identified by GenRisk, AstraZeneca PheWAS and genebass. B. QQ-plot of the P-values of GenRisk pipeline results. C. Manhattan plot of GenRisk pipeline results.

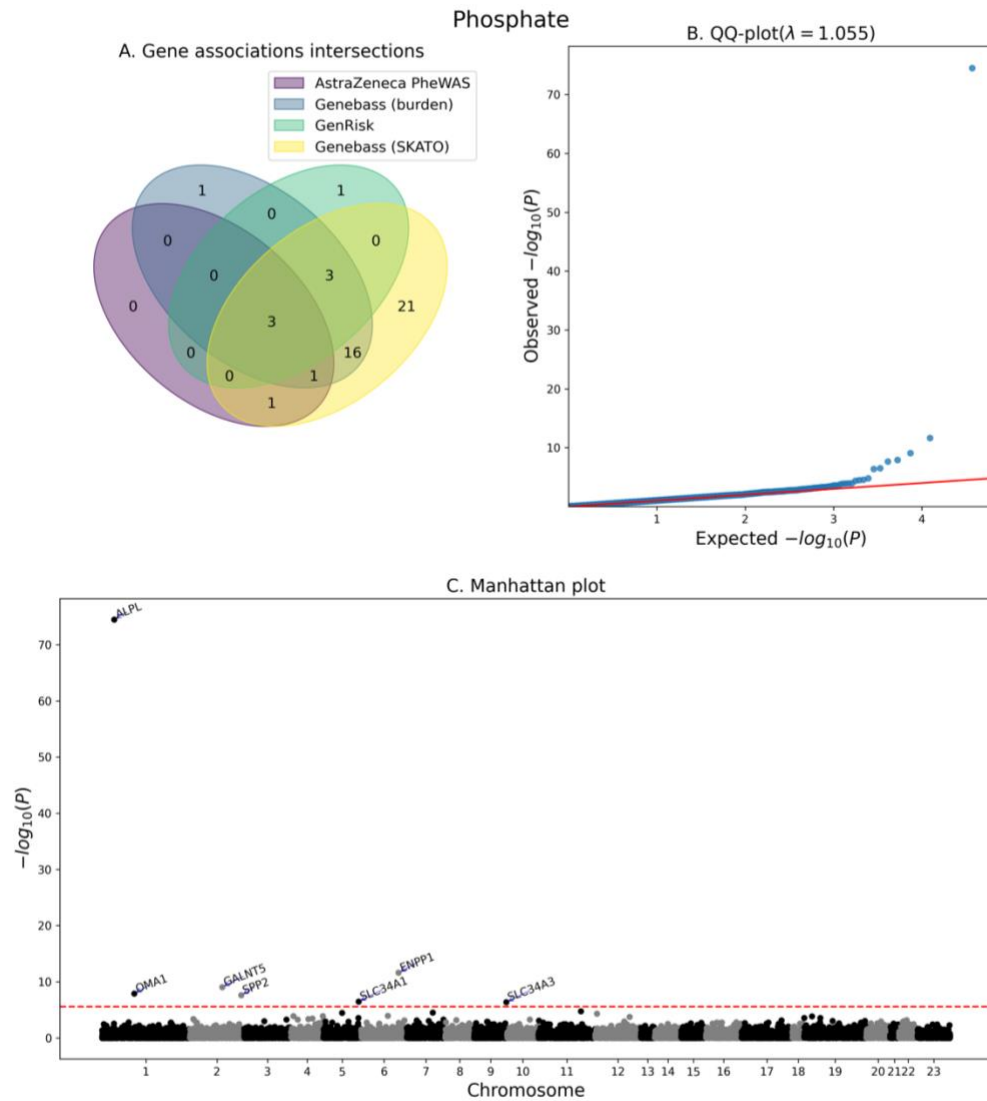


Figure S18 Association analysis summary for phosphate.

A. Venn diagram of the number significantly associated genes as identified by GenRisk, AstraZeneca PheWAS and genebass. B. QQ-plot of the P-values of GenRisk pipeline results. C. Manhattan plot of GenRisk pipeline results.

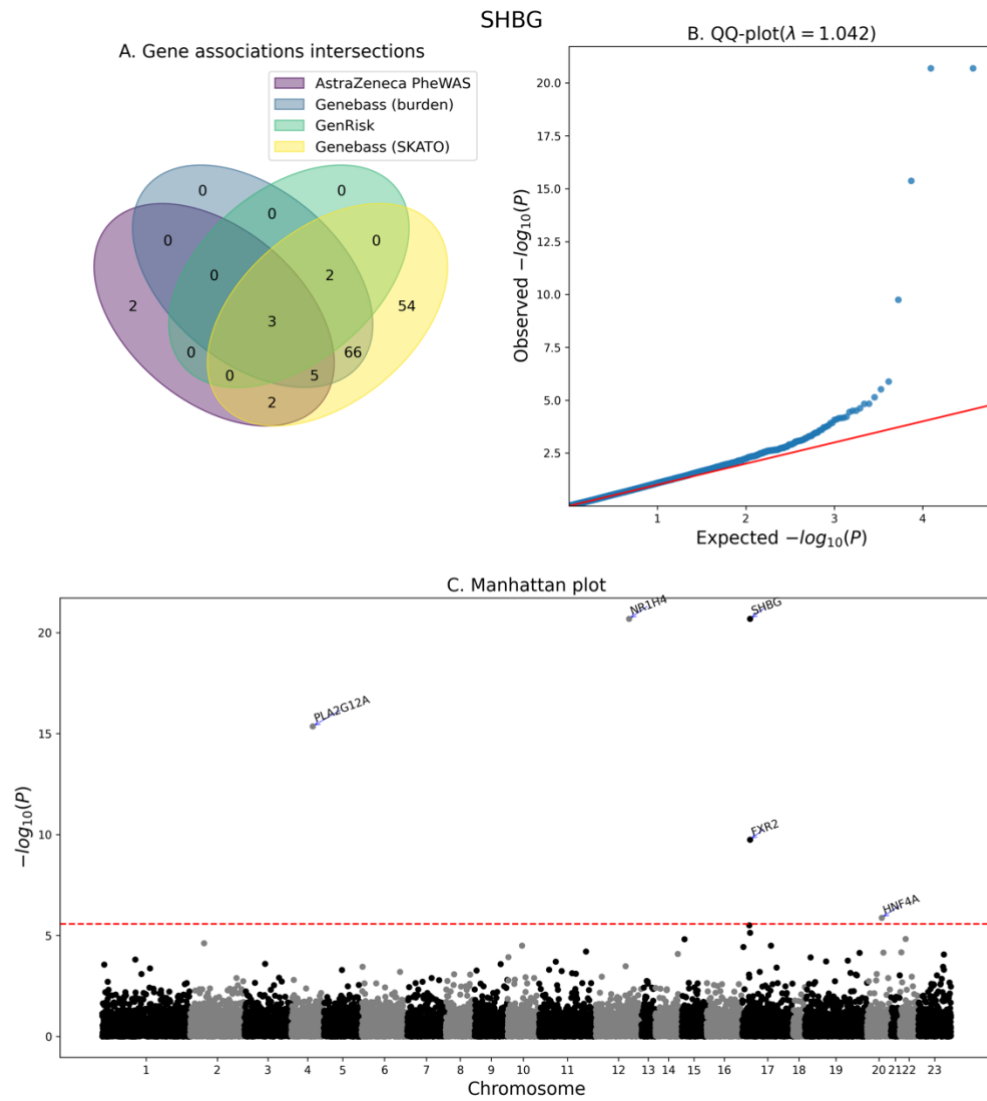


Figure S19 Association analysis summary for SHBG.

A. Venn diagram of the number significantly associated genes as identified by GenRisk, AstraZeneca PheWAS and genebass. B. QQ-plot of the P-values of GenRisk pipeline results. C. Manhattan plot of GenRisk pipeline results.

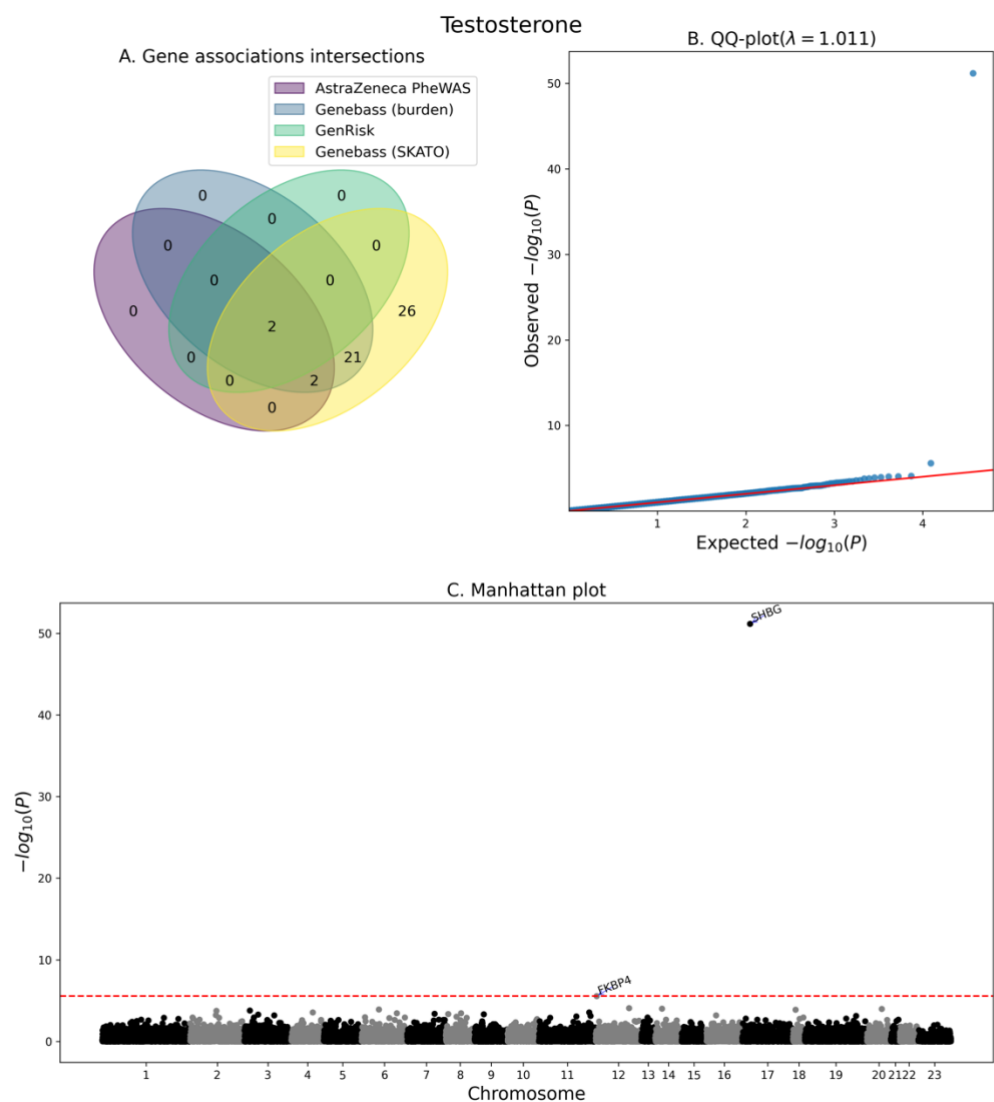


Figure S20 Association analysis summary for testosterone.

A. Venn diagram of the number significantly associated genes as identified by GenRisk, AstraZeneca PheWAS and genebass. B. QQ-plot of the P-values of GenRisk pipeline results. C. Manhattan plot of GenRisk pipeline results.

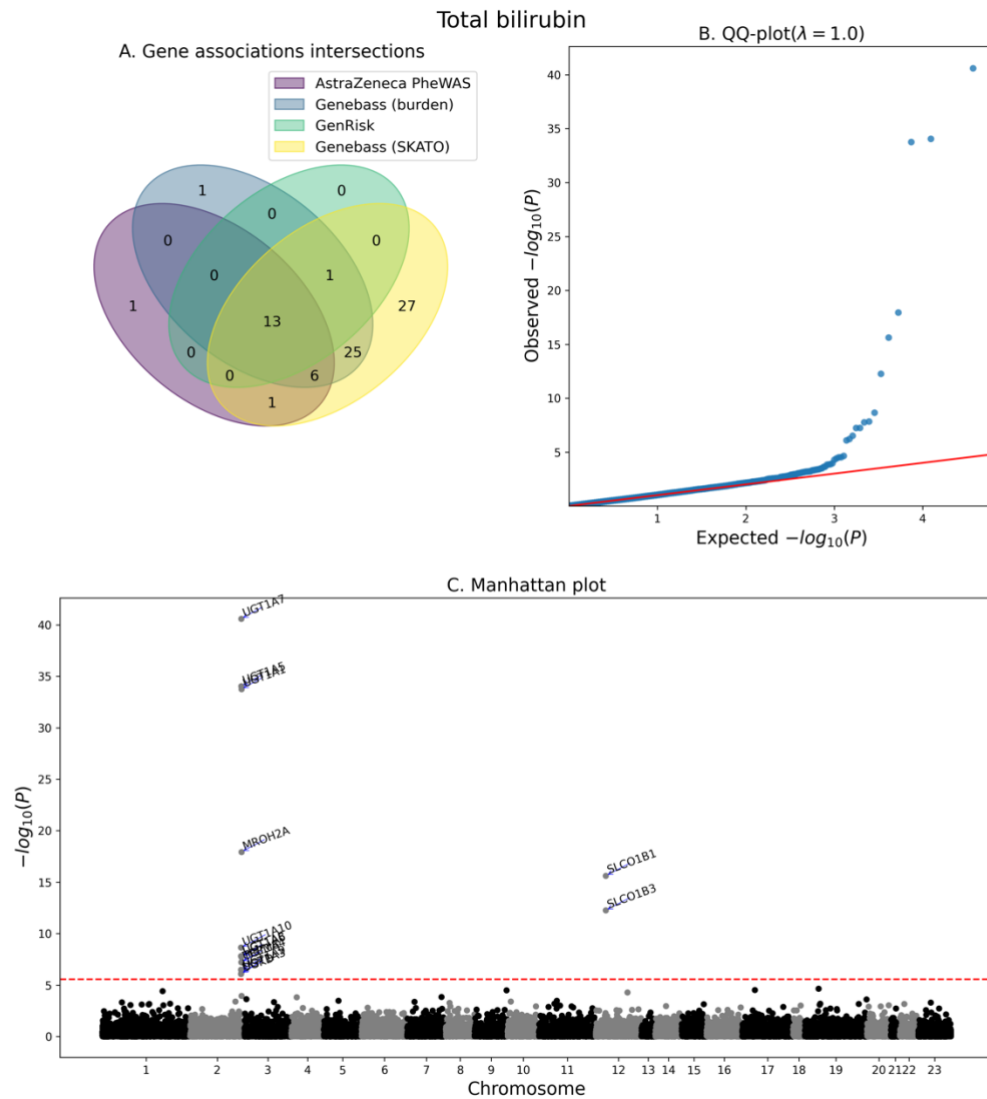


Figure S21 Association analysis summary for total bilirubin.

A. Venn diagram of the number significantly associated genes as identified by GenRisk, AstraZeneca PheWAS and genebass. B. QQ-plot of the P-values of GenRisk pipeline results. C. Manhattan plot of GenRisk pipeline results.

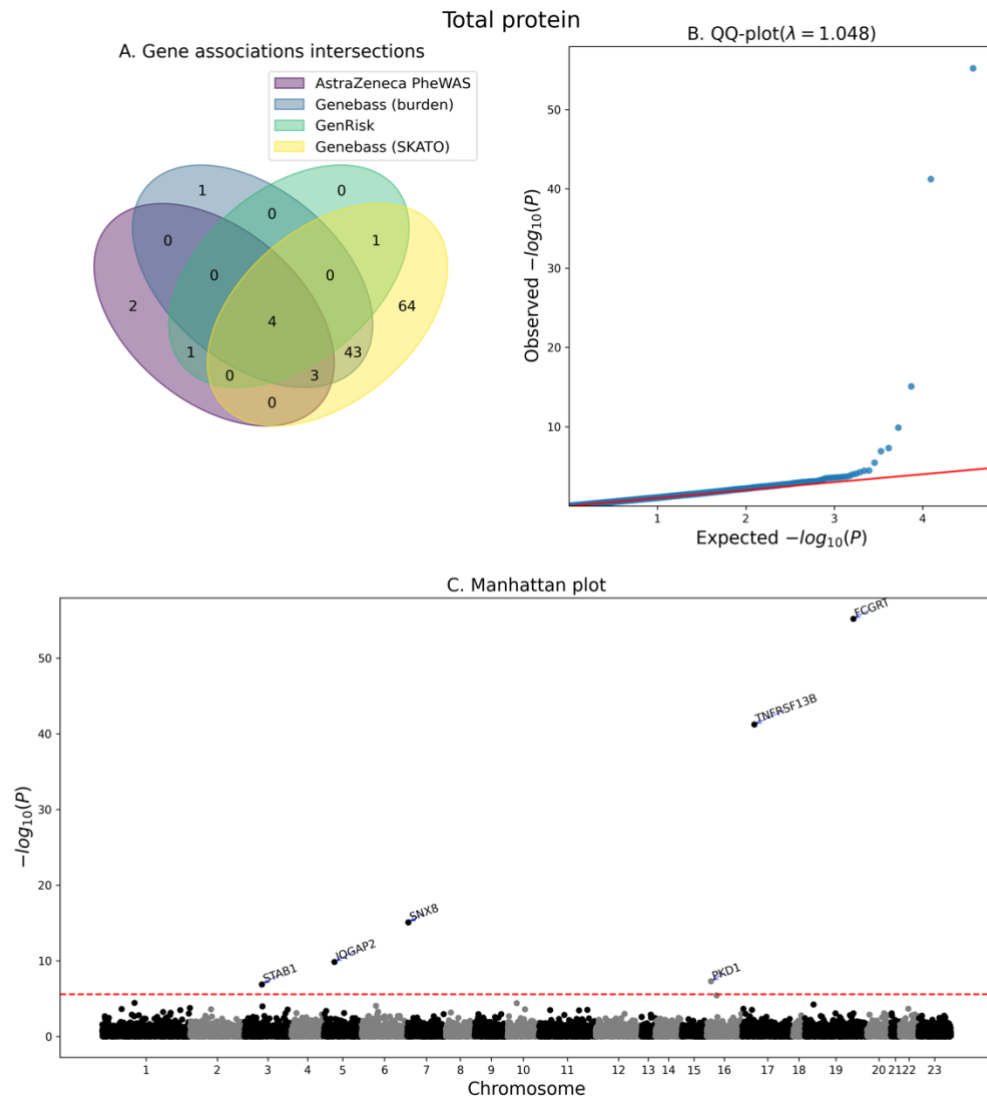


Figure S22 Association analysis summary for total protein.

A. Venn diagram of the number significantly associated genes as identified by GenRisk, AstraZeneca PheWAS and genebass. B. QQ-plot of the P-values of GenRisk pipeline results. C. Manhattan plot of GenRisk pipeline results.

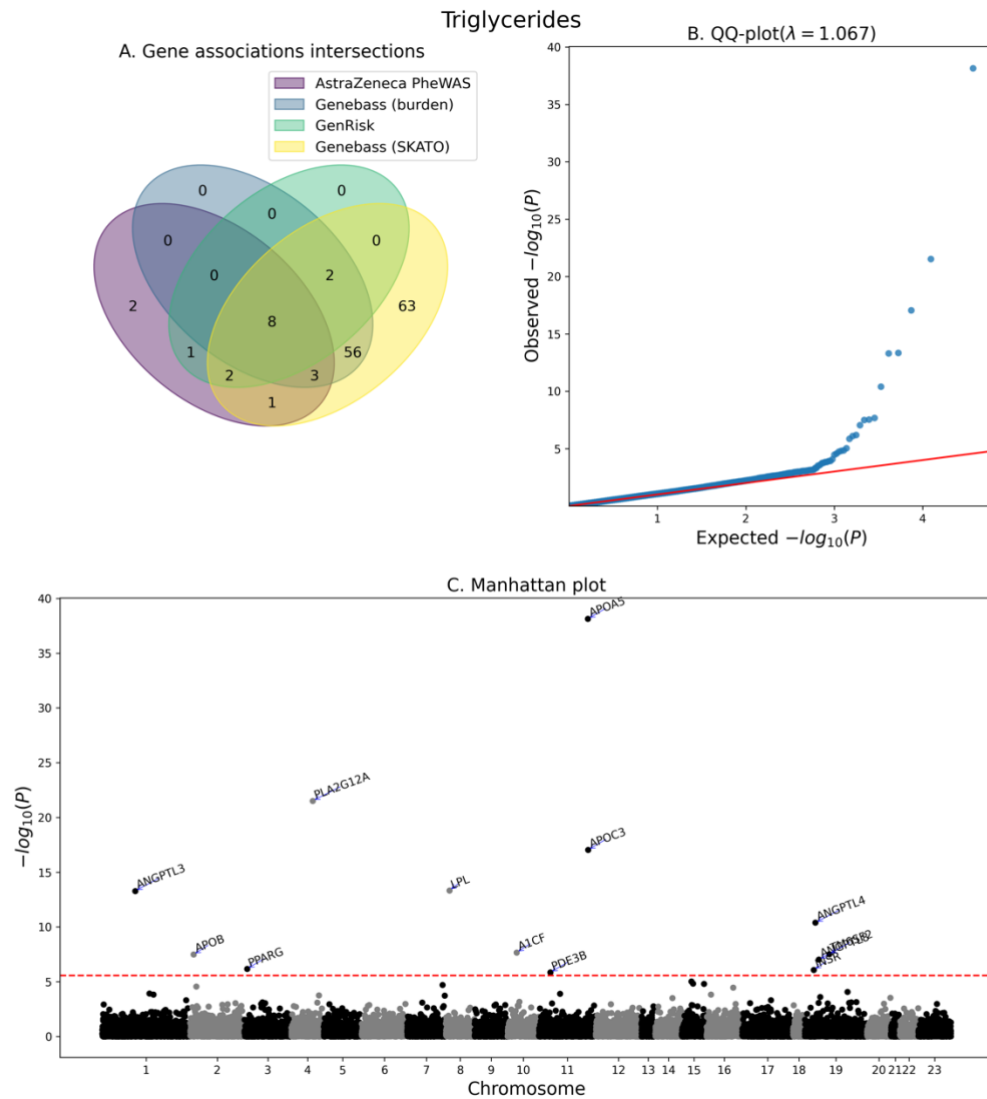


Figure S23 Association analysis summary for triglycerides.

A. Venn diagram of the number significantly associated genes as identified by GenRisk, AstraZeneca PheWAS and genebass. B. QQ-plot of the P-values of GenRisk pipeline results. C. Manhattan plot of GenRisk pipeline results.

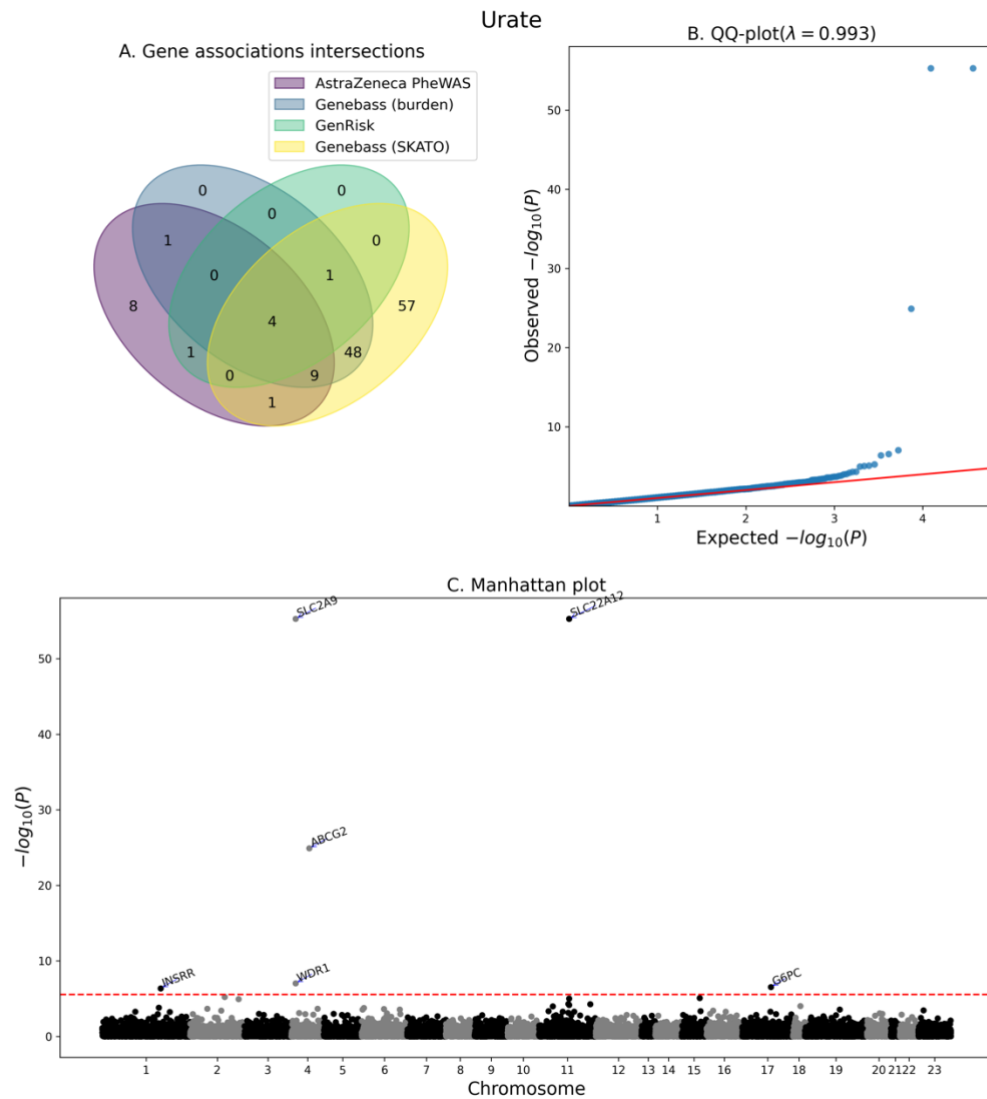


Figure S24 Association analysis summary for urate.

A. Venn diagram of the number significantly associated genes as identified by GenRisk, AstraZeneca PheWAS and genebass. B. QQ-plot of the P-values of GenRisk pipeline results. C. Manhattan plot of GenRisk pipeline results

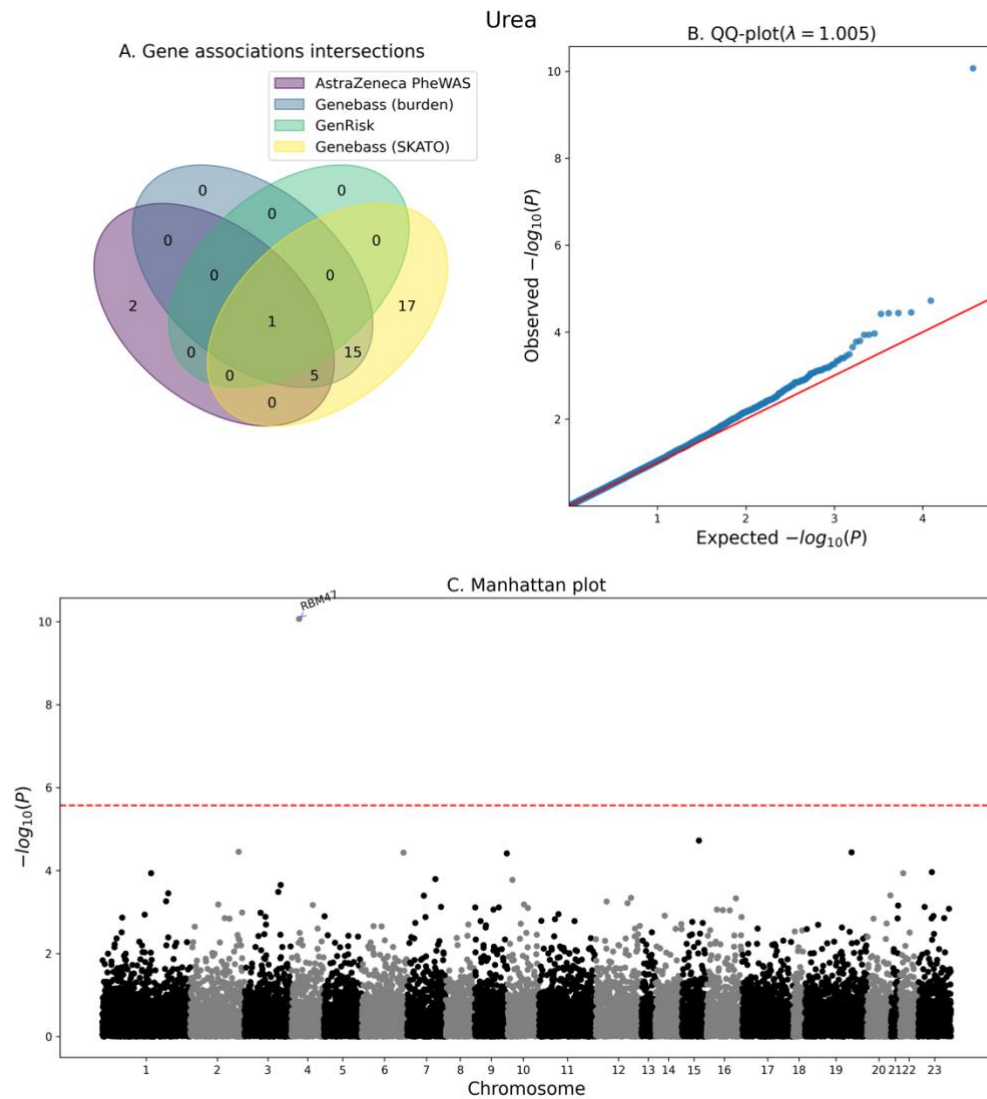


Figure S25 Association analysis summary for urea.

A. Venn diagram of the number significantly associated genes as identified by GenRisk, AstraZeneca PheWAS and genebass. B. QQ-plot of the P-values of GenRisk pipeline results. C. Manhattan plot of GenRisk pipeline results

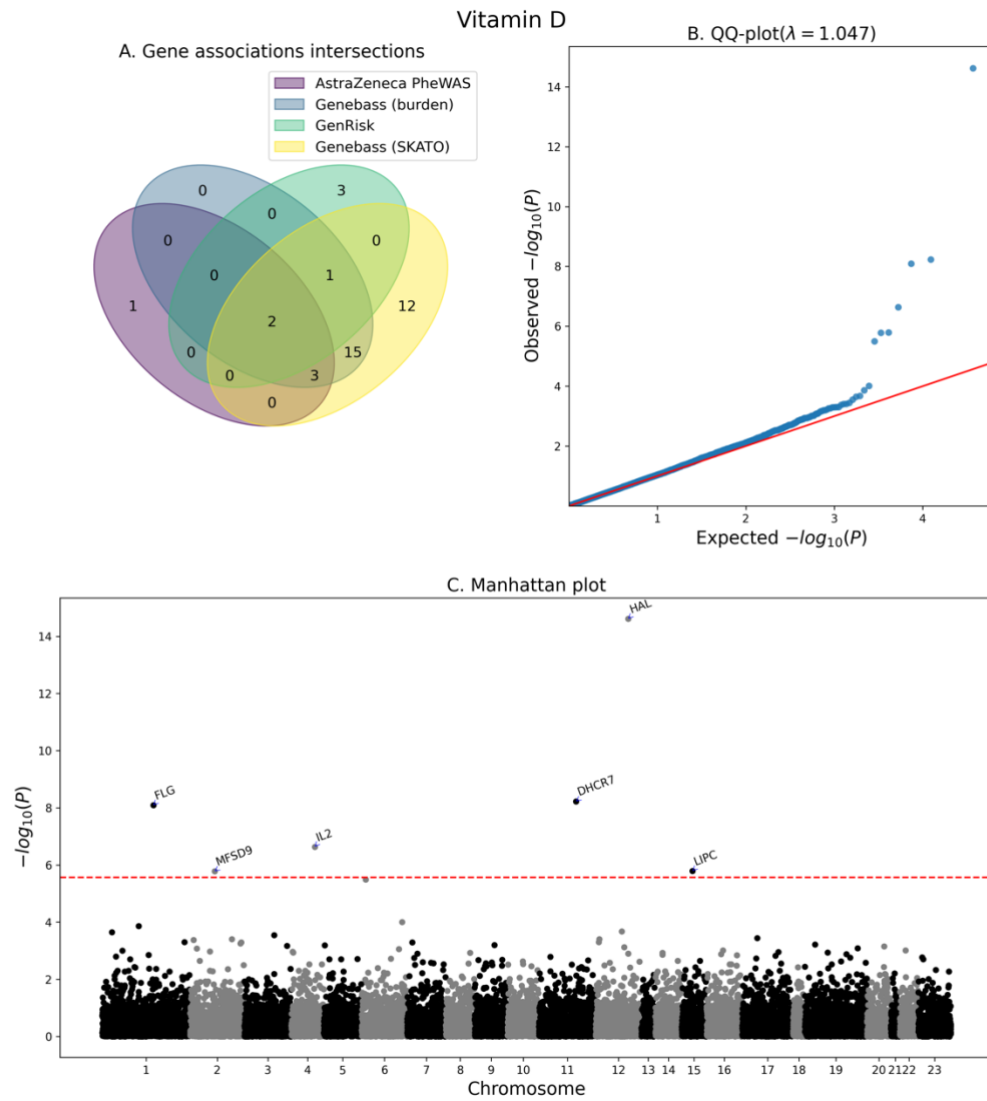
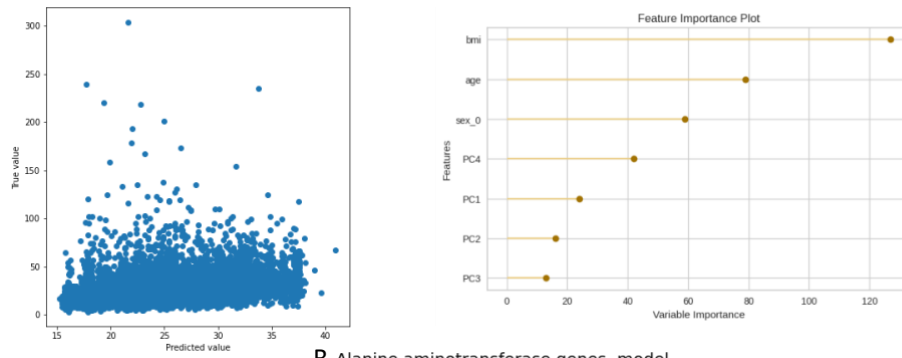


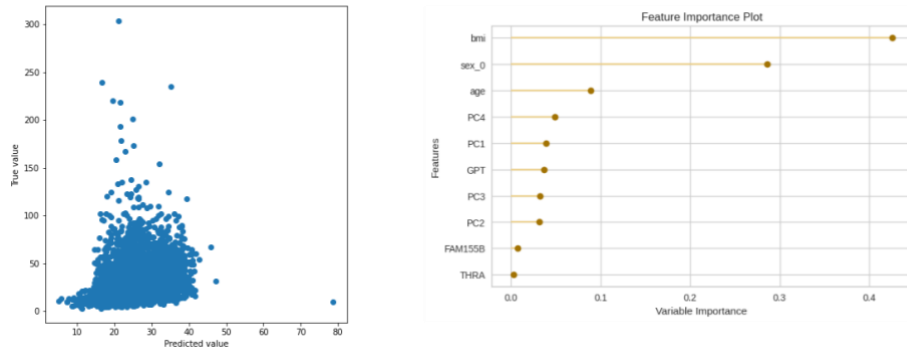
Figure S26 Association analysis summary for vitamin D.

A. Venn diagram of the number significantly associated genes as identified by GenRisk, AstraZeneca PheWAS and genebass. B. QQ-plot of the P-values of GenRisk pipeline results. C. Manhattan plot of GenRisk pipeline results.

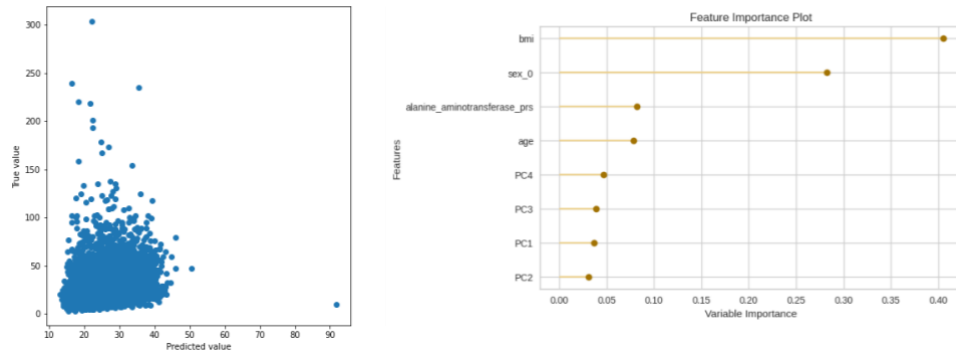
A. Alanine aminotransferase cov model



B. Alanine aminotransferase genes model



C. Alanine aminotransferase prs model



D. Alanine aminotransferase genes prs model

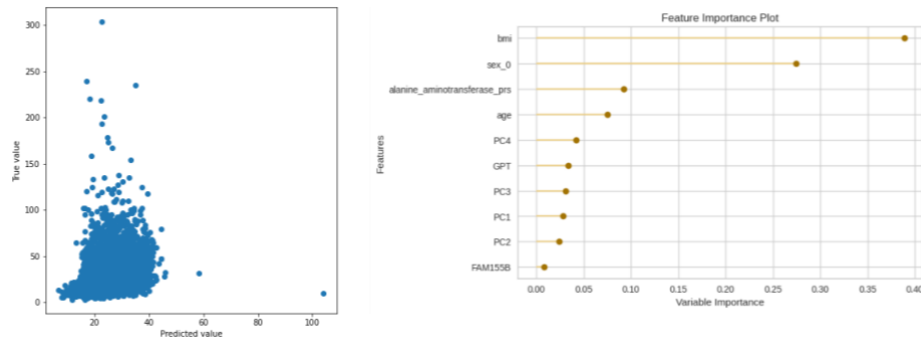
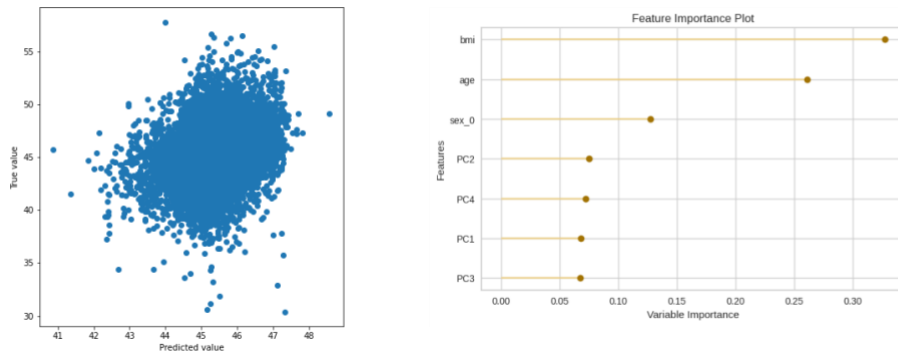
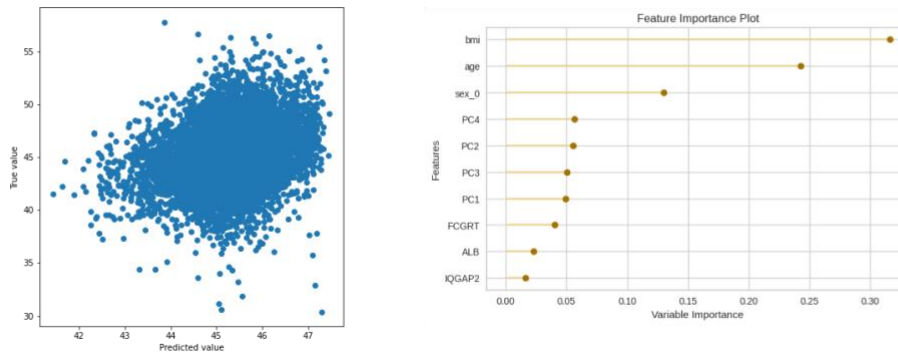


Figure S27 True vs. Predicted value plot (left) and top 10 features (right) for alanine aminotransferase A. covariates model B. genes model C. PRS model and D. combined model.

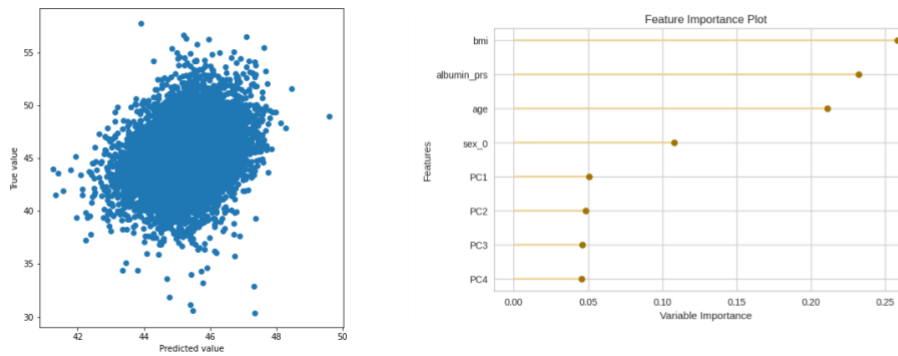
A. Albumin cov model



B. Albumin genes model



C. Albumin prs model



D. Albumin genes prs model

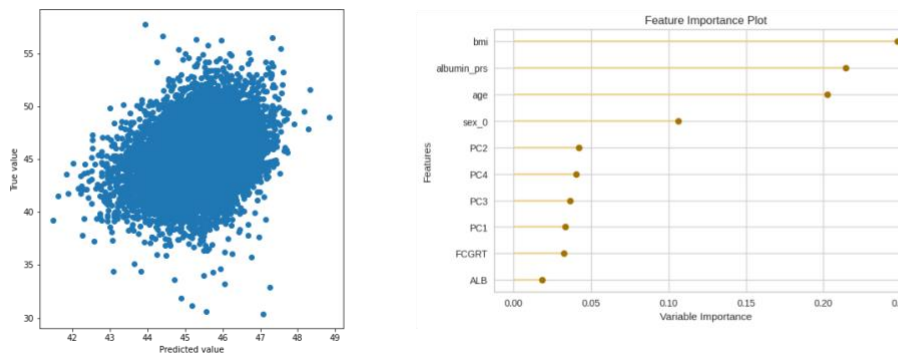
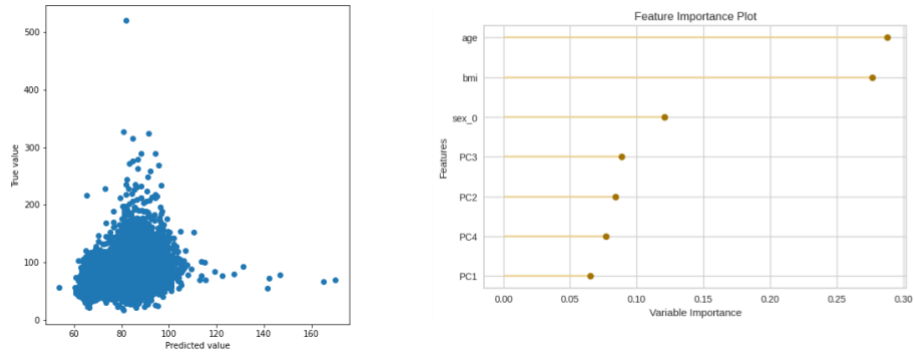
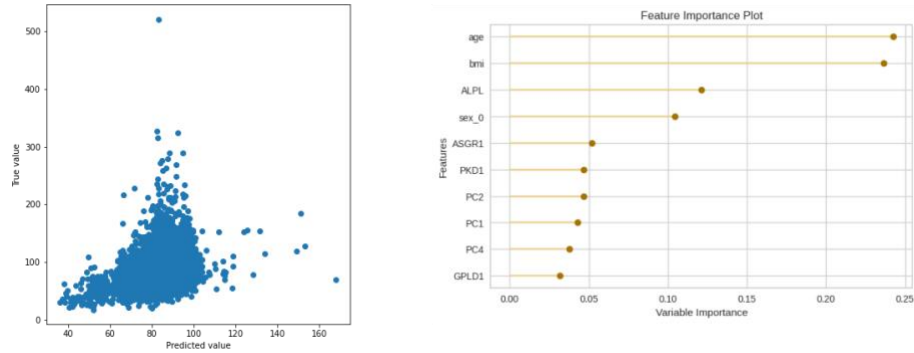


Figure S28 True vs. Predicted value plot (left) and top 10 features (right) for albumin A. covariates model B. genes model C. PRS model and D. combined model.

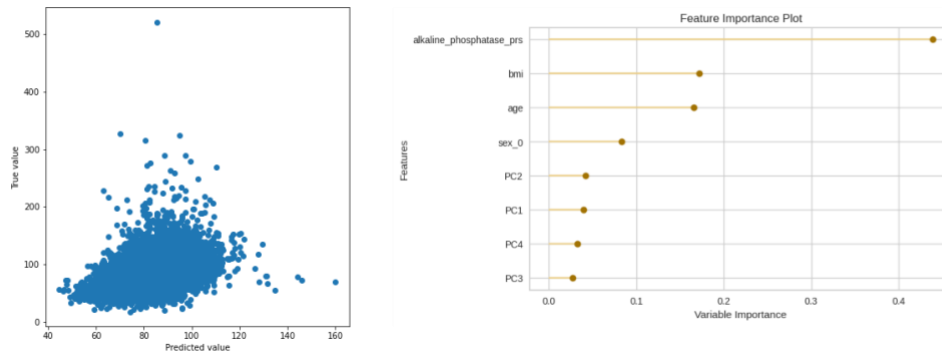
A. Alkaline phosphatase cov model



B. Alkaline phosphatase genes model



C. Alkaline phosphatase prs model



D. Alkaline phosphatase genes prs model

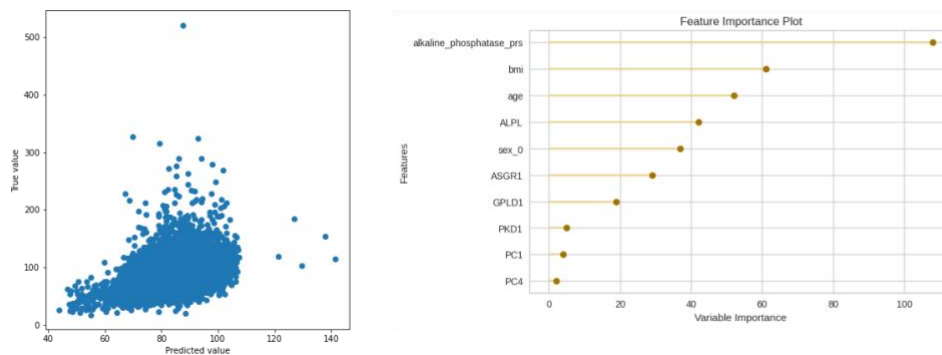
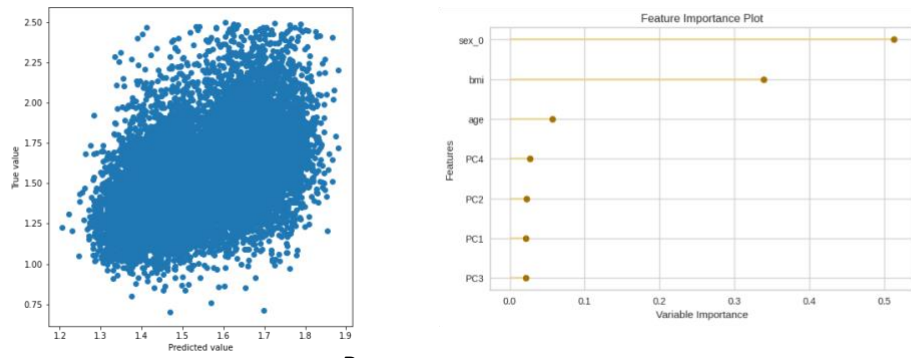
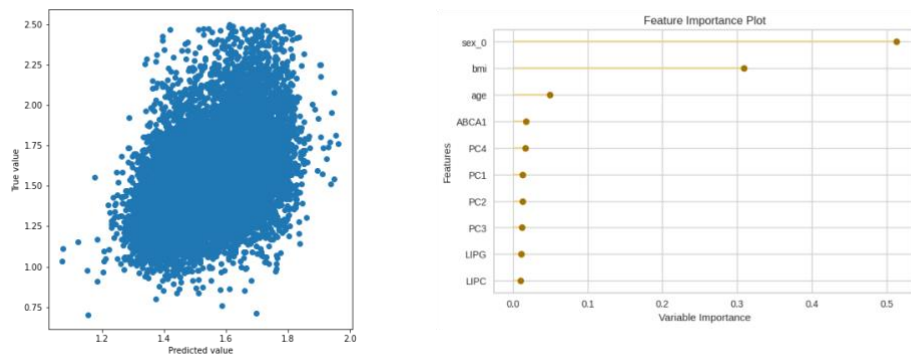


Figure S29 True vs. Predicted value plot (left) and top 10 features (right) for alkaline phosphatase A. covariates model B. genes model C. PRS model and D. combined model.

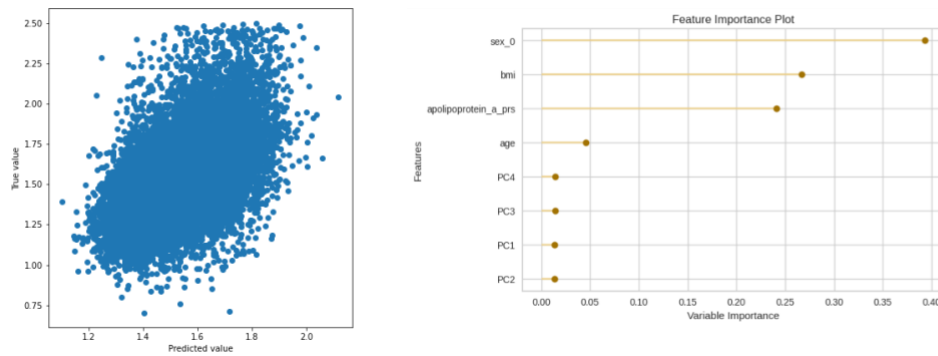
A. Apolipoprotein a cov model



B. Apolipoprotein a genes model



C. Apolipoprotein a prs model



D. Apolipoprotein a genes prs model

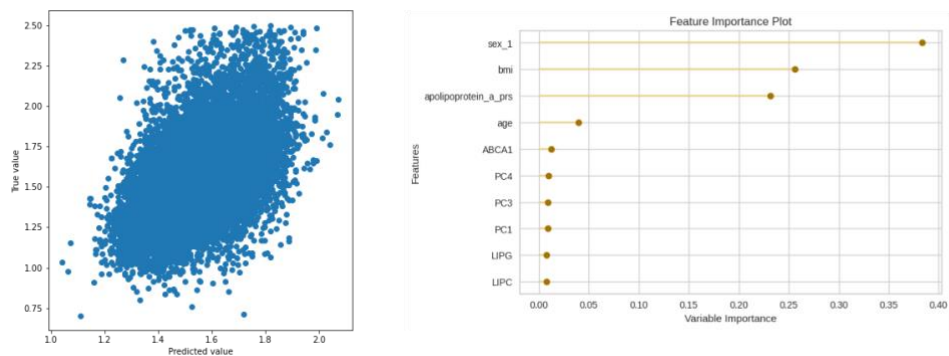
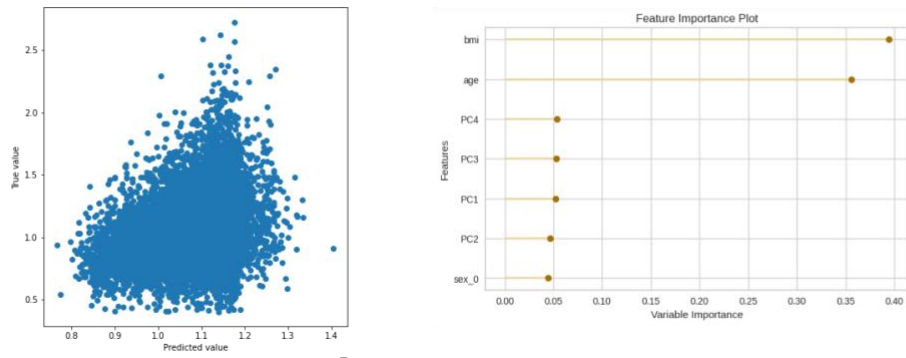
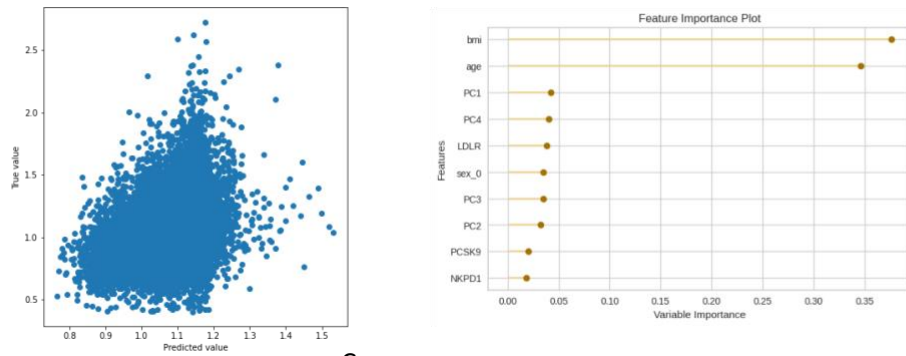


Figure S30 True vs. Predicted value plot (left) and top 10 features (right) for apolipoprotein A A. covariates model B. genes model C. PRS model and D. combined model.

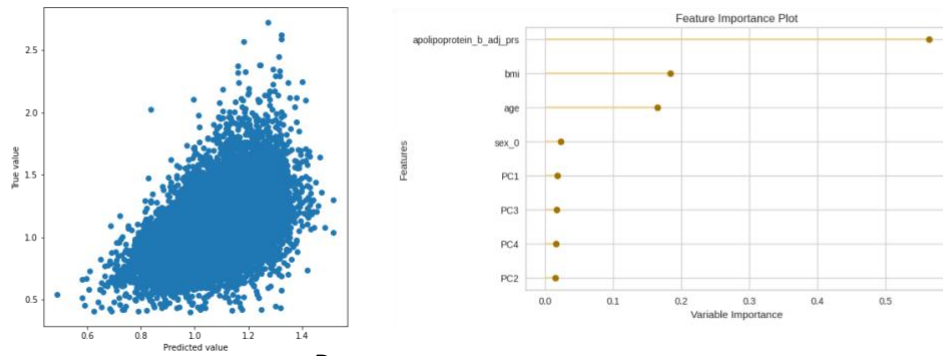
A. Apolipoprotein b * cov model



B. Apolipoprotein b * genes model



C. Apolipoprotein b * prs model



D. Apolipoprotein b * genes prs model

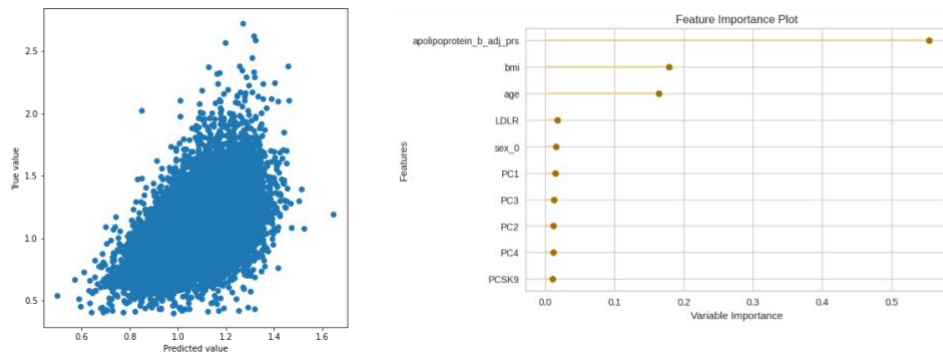
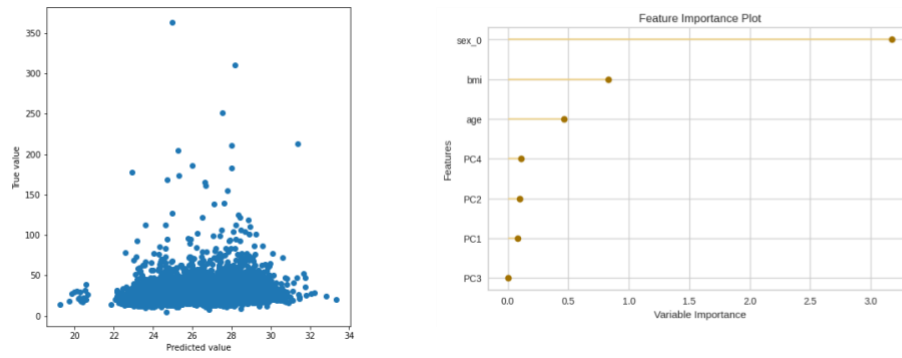


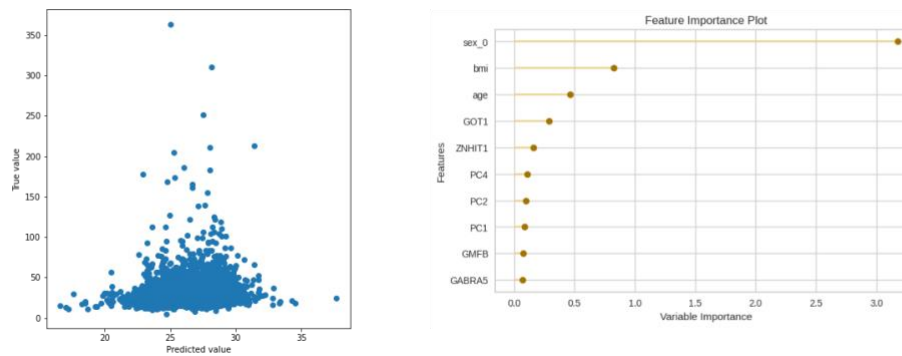
Figure S31 True vs. Predicted value plot (left) and top 10 features (right) for apolipoprotein B* A. covariates model B. genes model C. PRS model and D. combined model.

* statin adjusted values

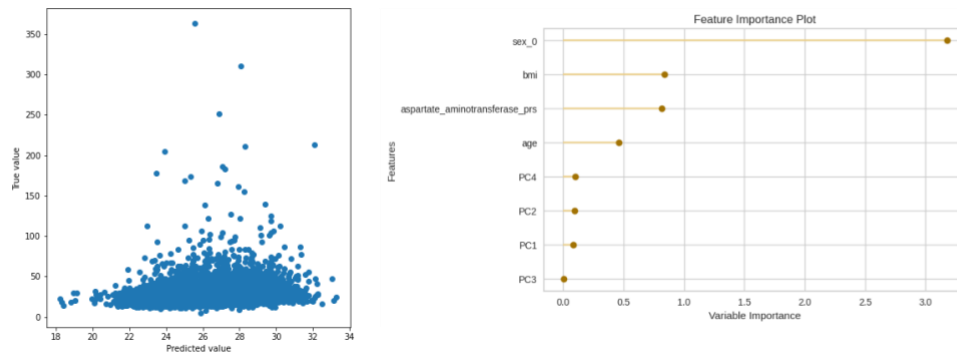
A. Aspartate aminotransferase cov model



B. Aspartate aminotransferase genes model



C. Aspartate aminotransferase prs model



D. Aspartate aminotransferase genes prs model

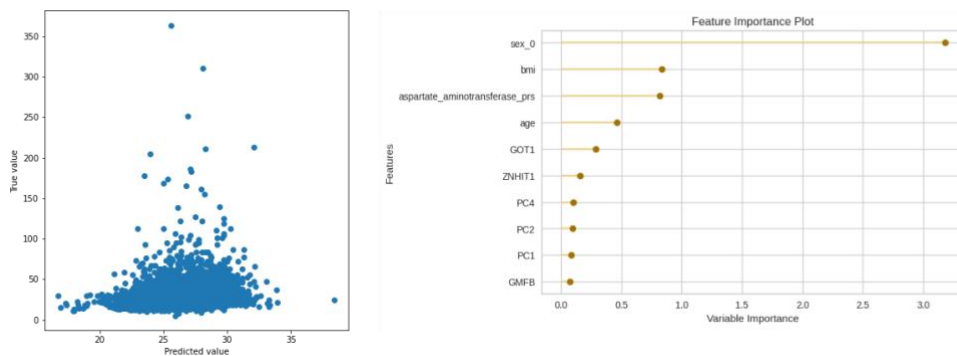
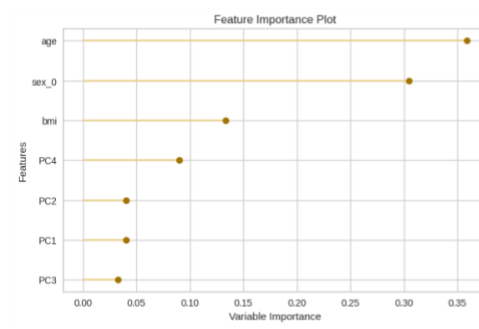
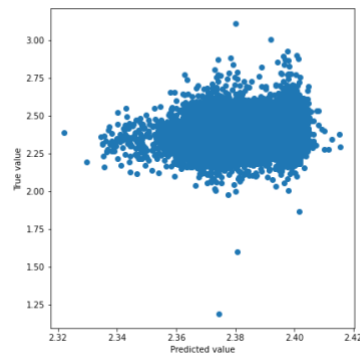
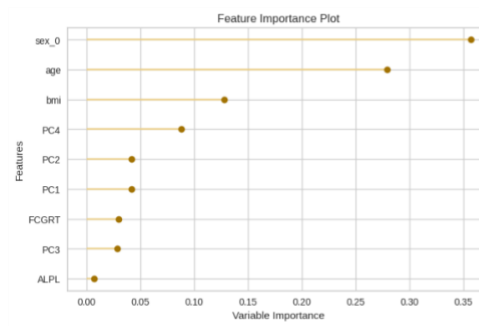
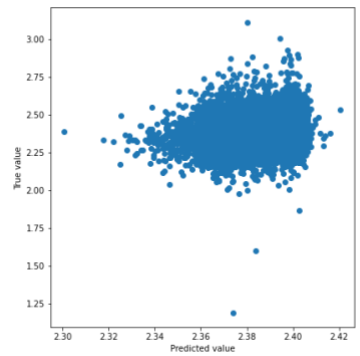


Figure S32 True vs. Predicted value plot (left) and top 10 features (right) for aspartate aminotransferase A. covariates model B. genes model C. PRS model and D. combined model.

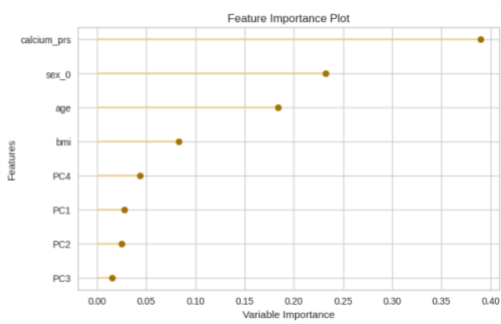
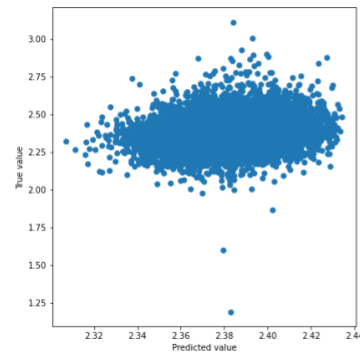
A. Calcium cov model



B. Calcium genes model



C. Calcium prs model



D. Calcium genes prs model

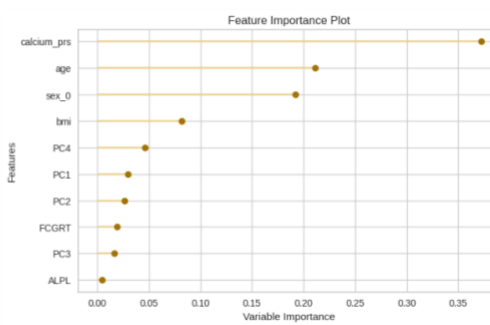
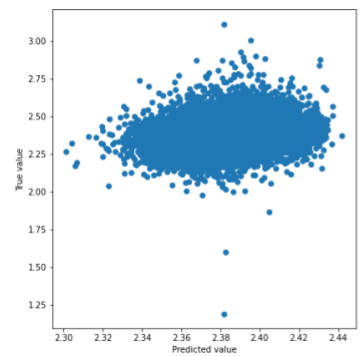
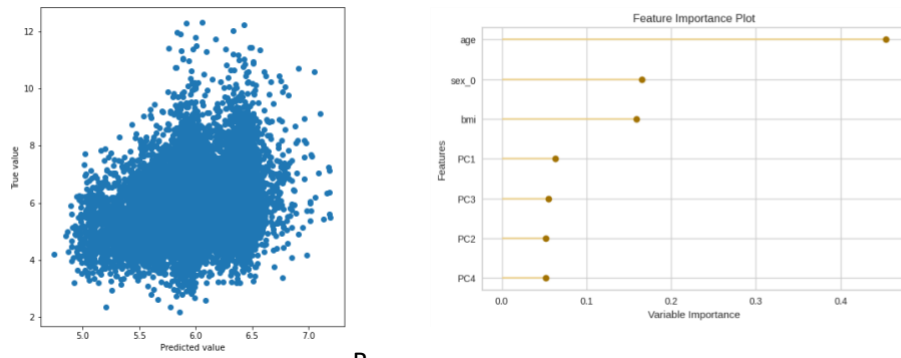
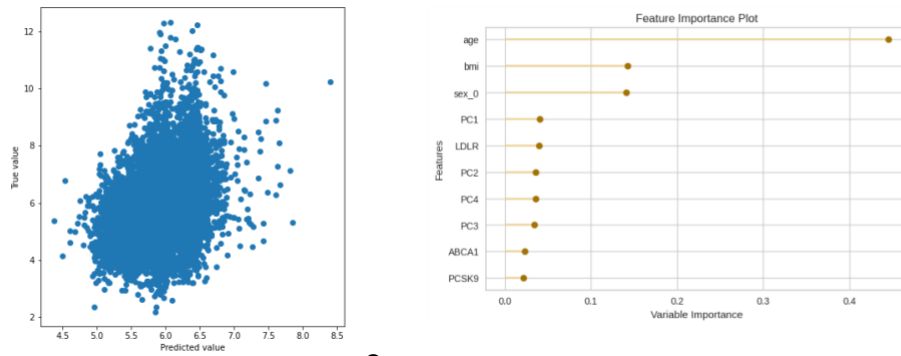


Figure S33 True vs. Predicted value plot (left) and top 10 features (right) for calcium A. covariates model B. genes model C. PRS model and D. combined model.

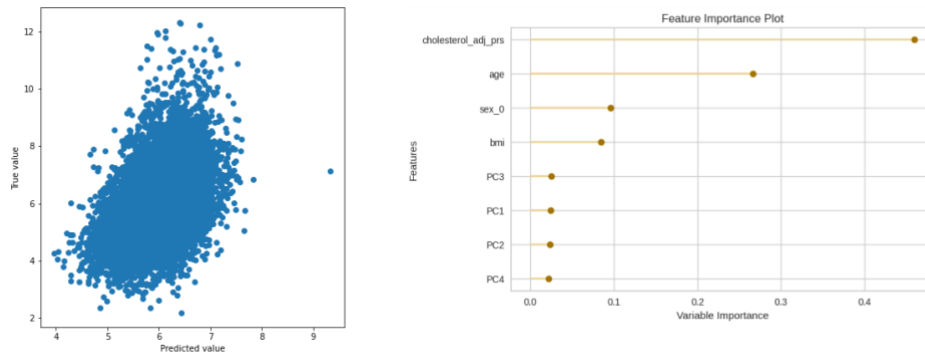
A. Cholesterol * cov model



B. cholesterol * genes model



C. cholesterol * prs model



D. cholesterol * genes prs model

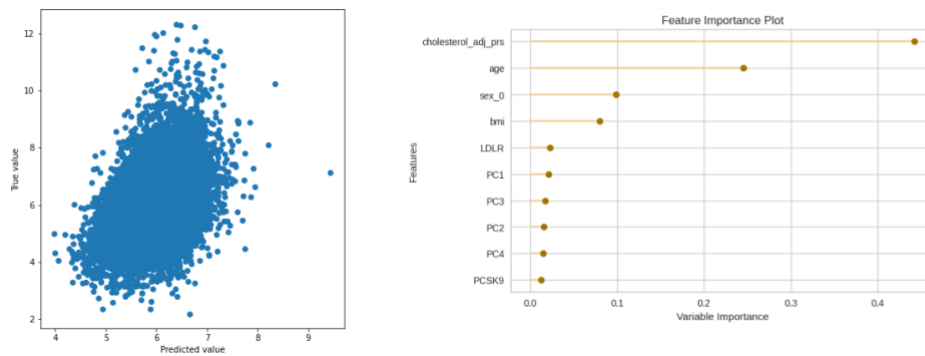
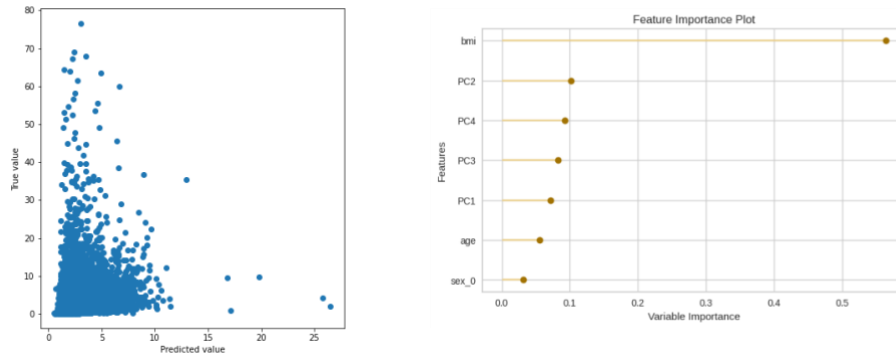


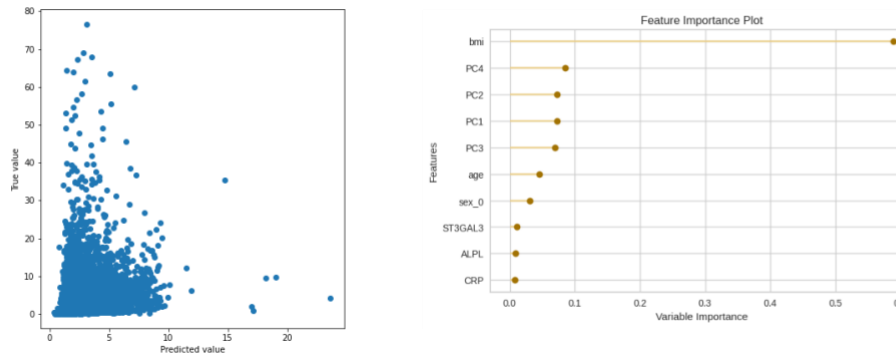
Figure S 34 True vs. Predicted value plot (left) and top 10 features (right) for cholesterol* A. covariates model B. genes model C. PRS model and D. combined model.

* statin adjusted values

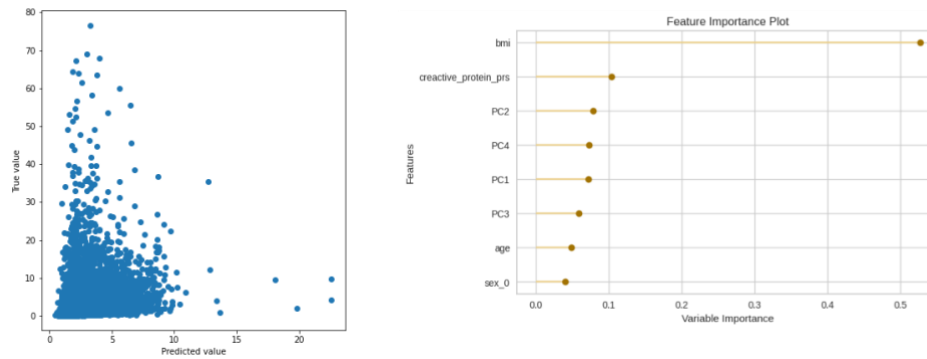
A. Creative protein cov model



B. Creative protein genes model



C. Creative protein prs model



D. Creative protein genes prs model

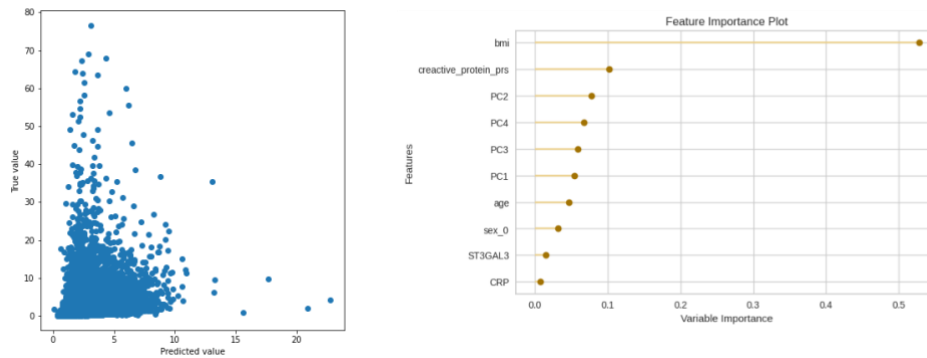
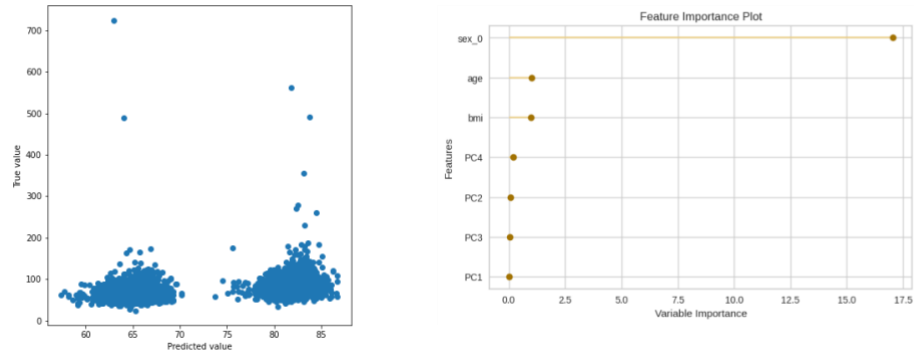
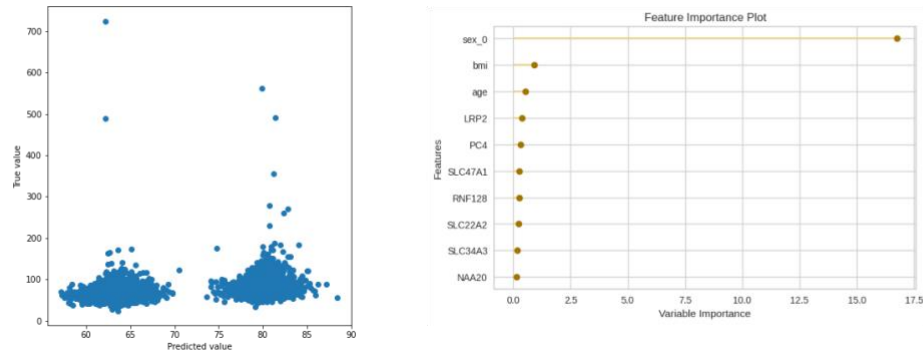


Figure S35 True vs. Predicted value plot (left) and top 10 features (right) for C reactive protein A. covariates model B. genes model C. PRS model and D. combined model.

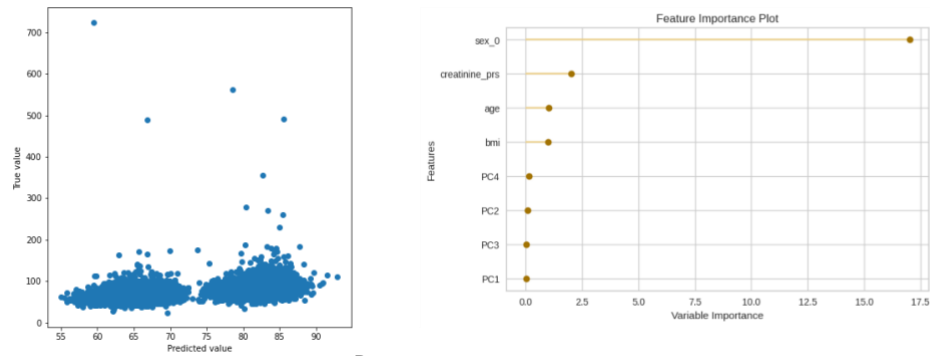
A. Creatinine cov model



B. Creatinine genes model



C. Creatinine prs model



D. Creatinine combined model

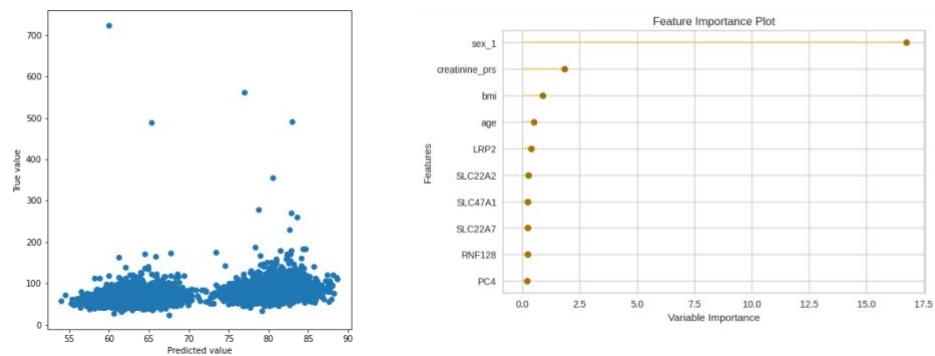
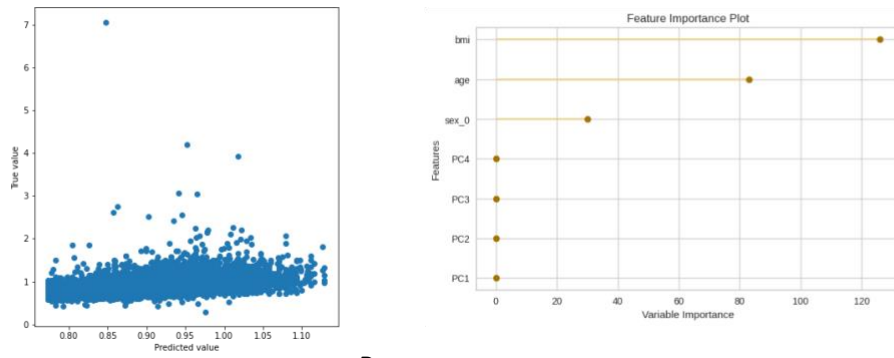
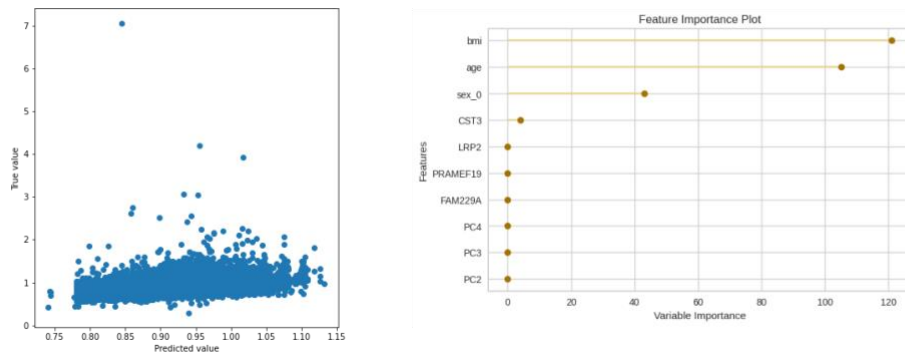


Figure S36 True vs. Predicted value plot (left) and top 10 features (right) for creatinine A. covariates model B. genes model C. PRS model and D. combined model.

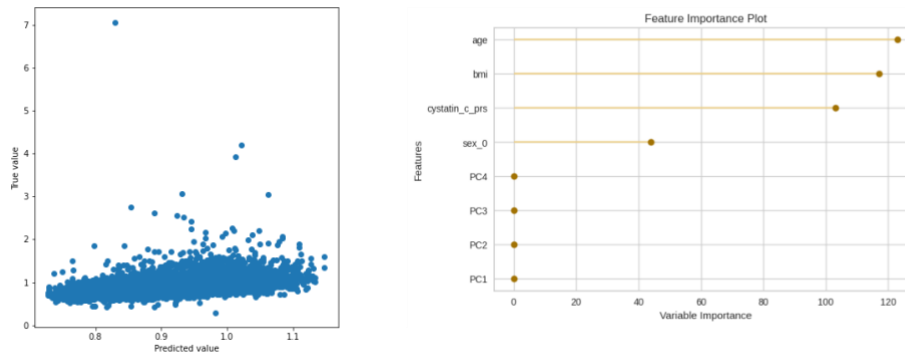
A. Cystatin c cov model



B. cystatin c genes model



C. Cystatin c prs model



D. cystatin c genes prs model

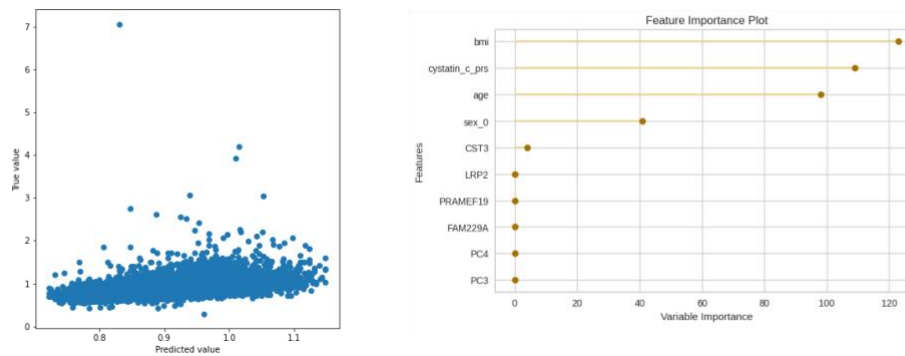
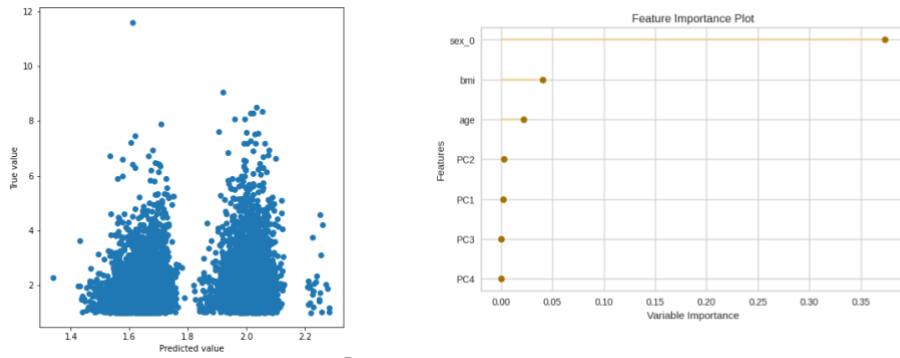
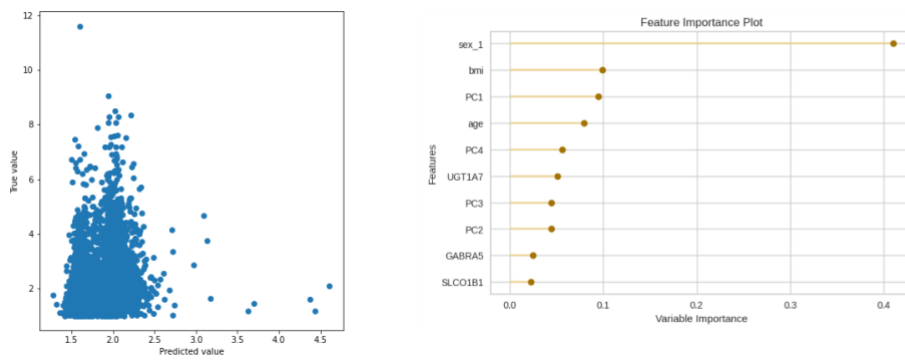


Figure S37 True vs. Predicted value plot (left) and top 10 features (right) for cystatin C A. covariates model B. genes model C. PRS model and D. combined model.

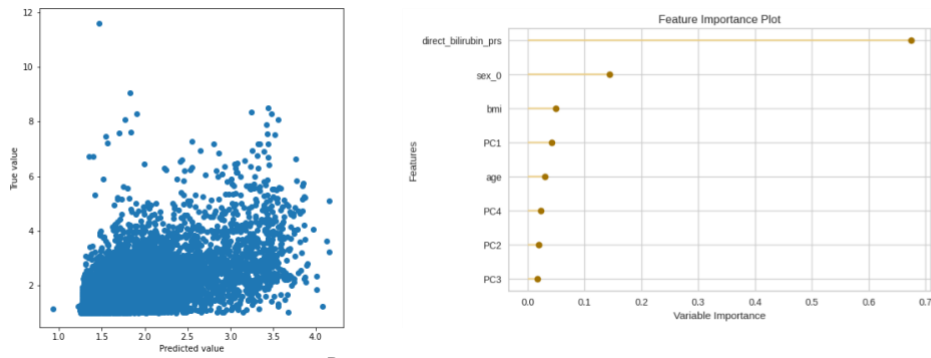
A. Direct bilirubin cov model



B. Direct bilirubin genes model



C. Direct bilirubin prs model



D. Direct bilirubin genes prs model

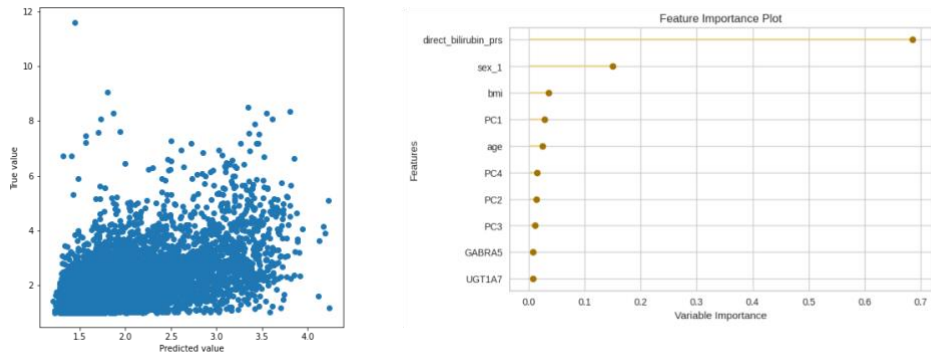
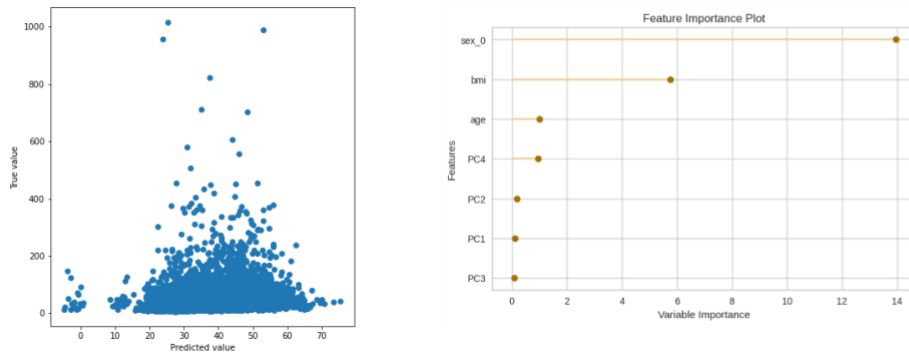
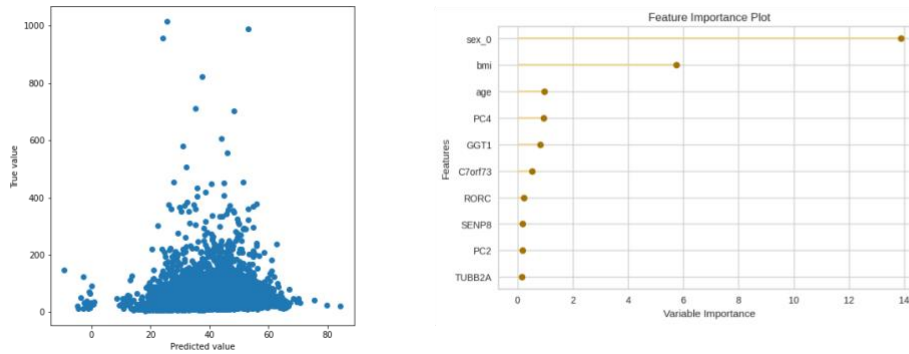


Figure S38 True vs. Predicted value plot (left) and top 10 features (right) for direct bilirubin A. covariates model B. genes model C. PRS model and D. combined model.

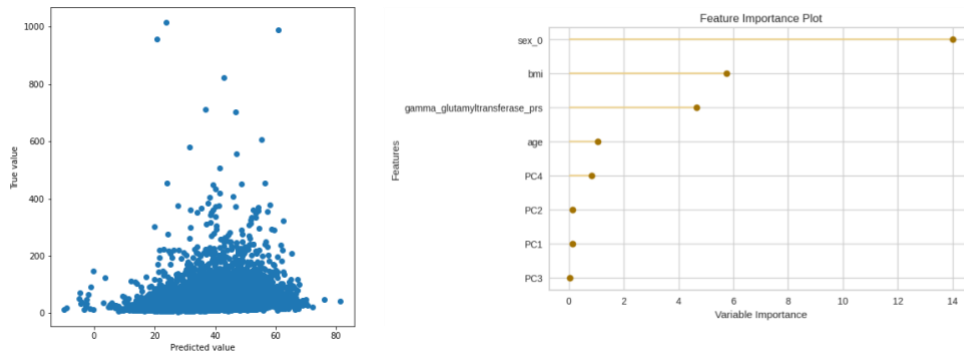
A. Gamma glutamyltransferase cov model



B. Gamma glutamyltransferase genes model



C. Gamma glutamyltransferase prs model



D. Gamma glutamyltransferase genes prs model

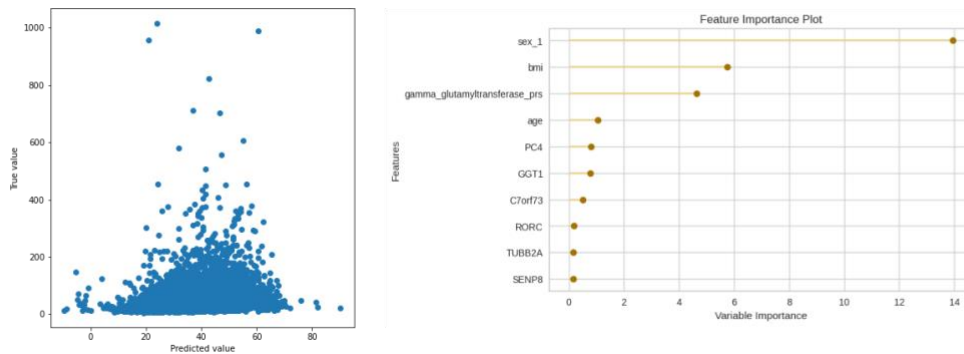
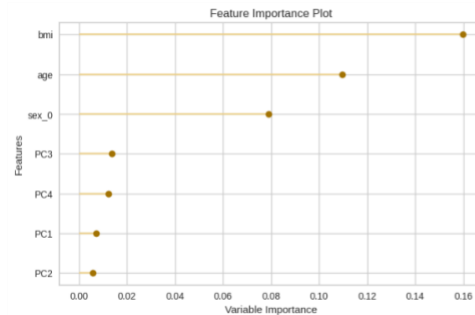
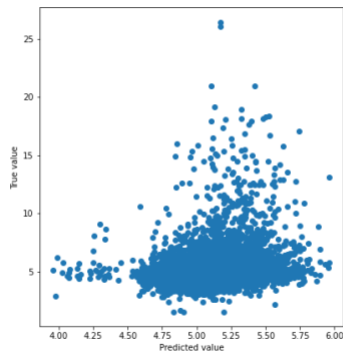
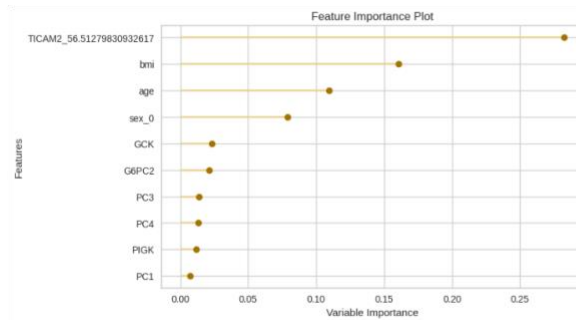
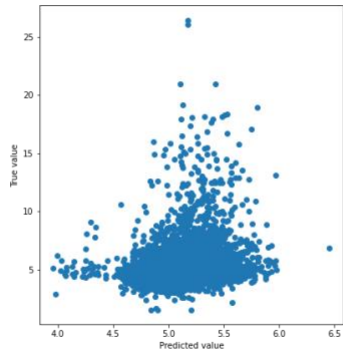


Figure S39 True vs. Predicted value plot (left) and top 10 features (right) for gamma glutamyltransferase A. covariates model B. genes model C. PRS model and D. combined model.

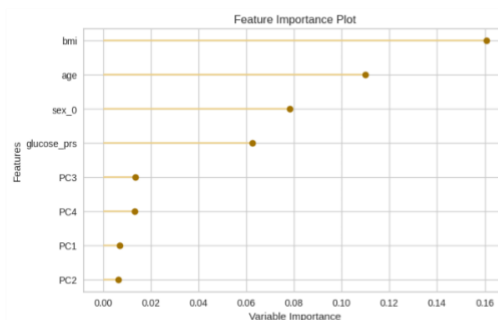
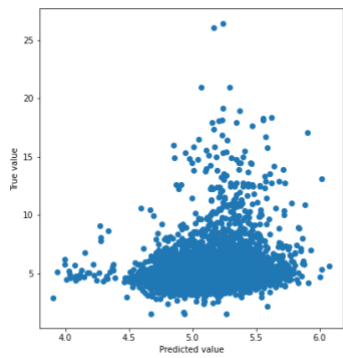
A. Glucose cov model



B. Glucose genes model



C. Glucose prs model



D. Glucose genes prs model

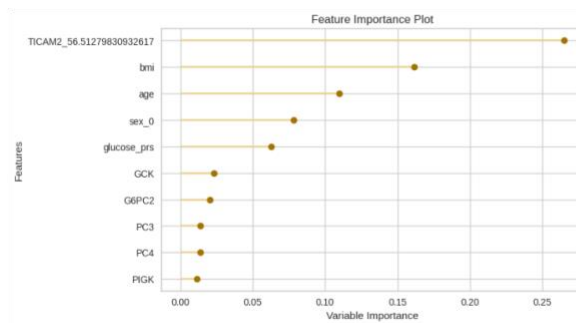
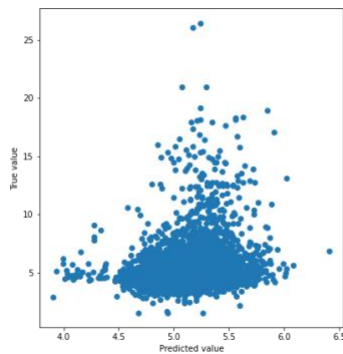
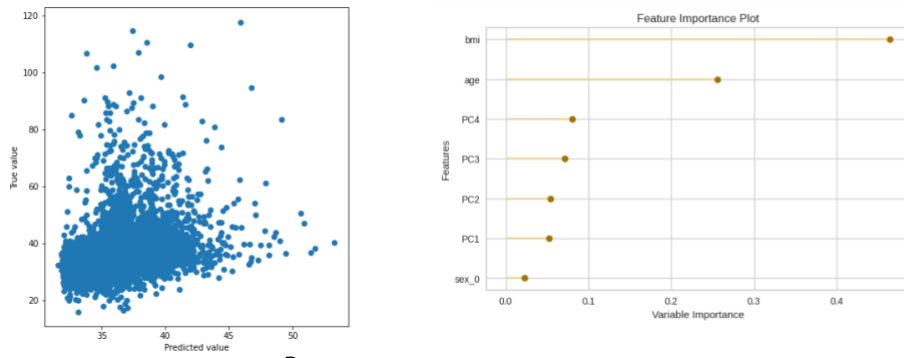
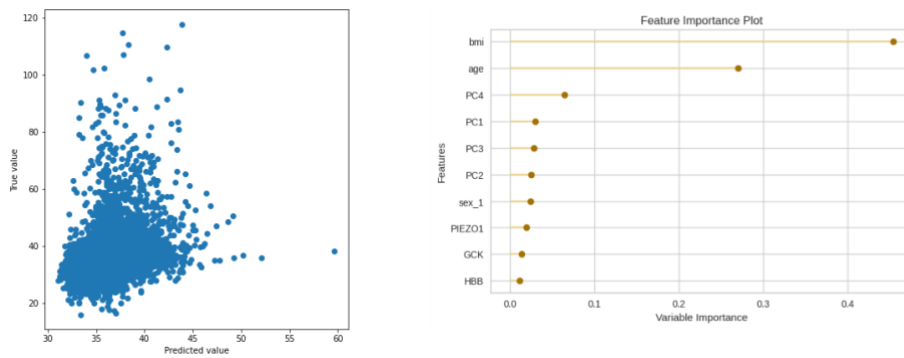


Figure S40 True vs. Predicted value plot (left) and top 10 features (right) for glucose A. covariates model B. genes model C. PRS model and D. combined model.

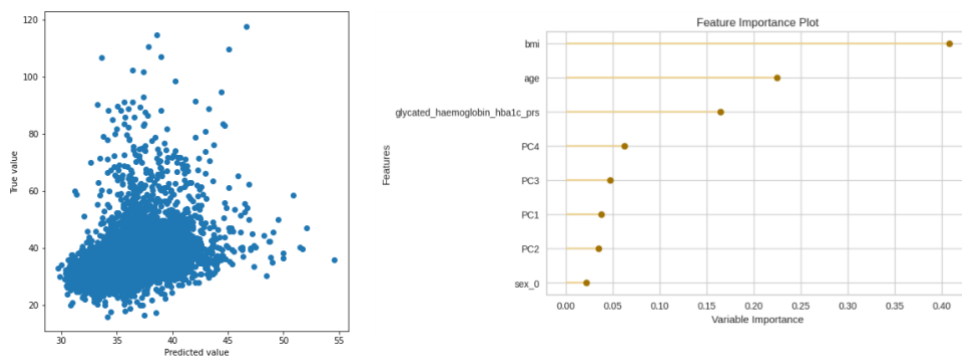
A. Glycated haemoglobin (hba1c) cov model



B. Glycated haemoglobin (hba1c) genes model



C. Glycated haemoglobin (hba1c) prs model



D. Glycated haemoglobin (hba1c) genes prs model

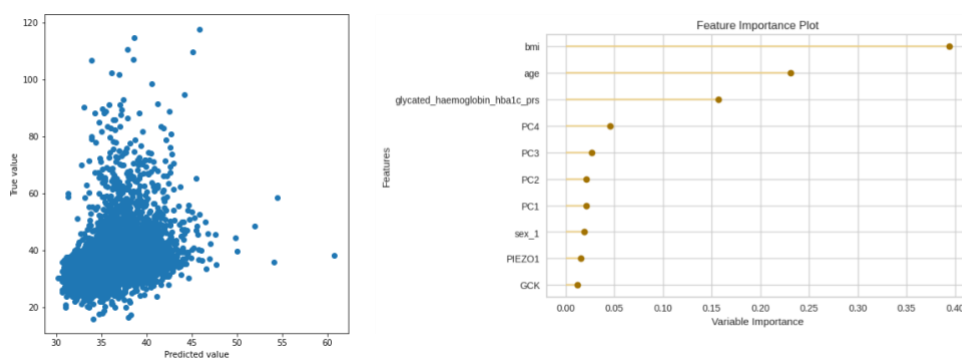
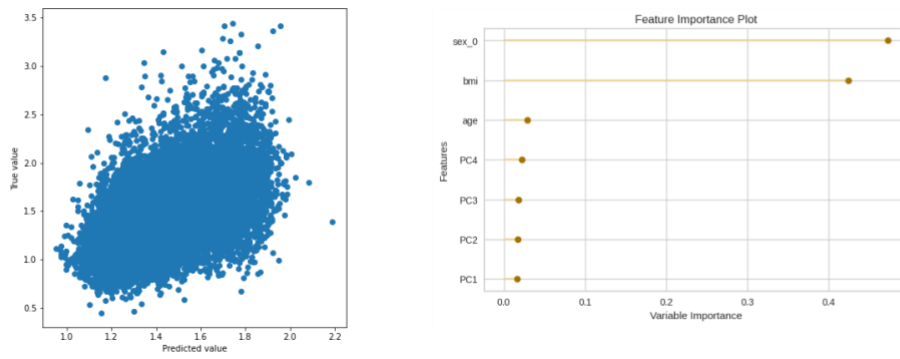
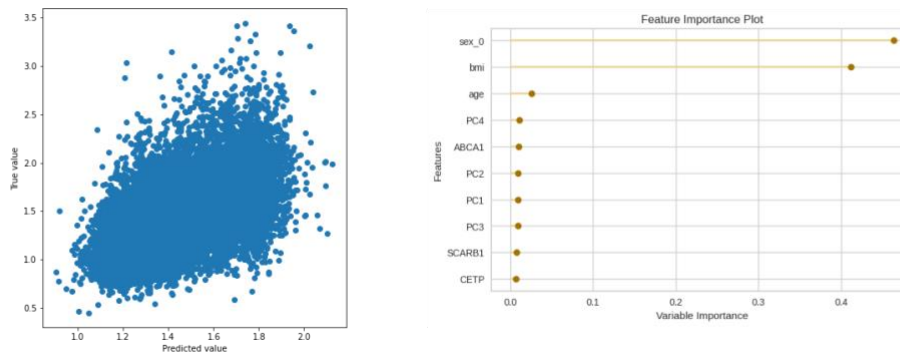


Figure S41 True vs. Predicted value plot (left) and top 10 features (right) for glycated haemoglobin (HbA1c) A. covariates model B. genes model C. PRS model and D. combined model.

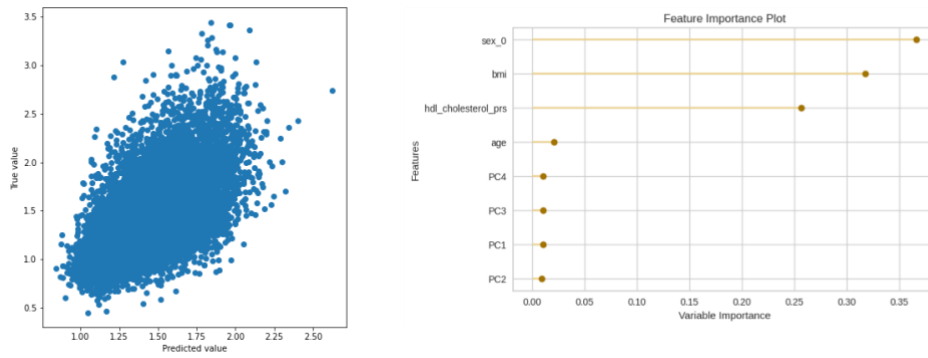
A. Hdl cholesterol cov model



B. Hdl cholesterol genes model



C. Hdl cholesterol prs model



D. Hdl cholesterol genes prs model

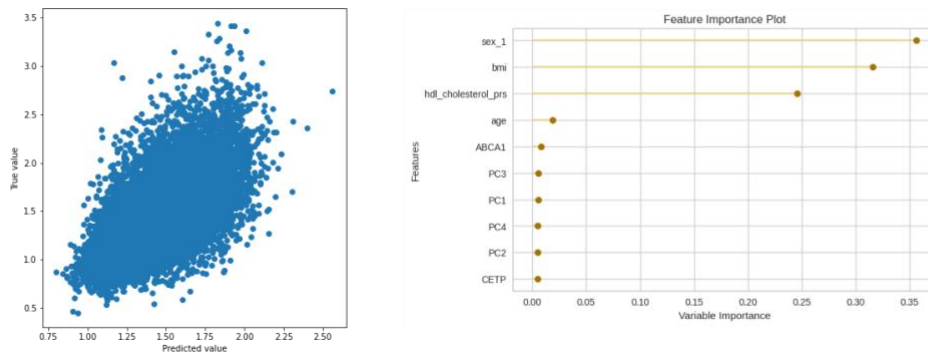
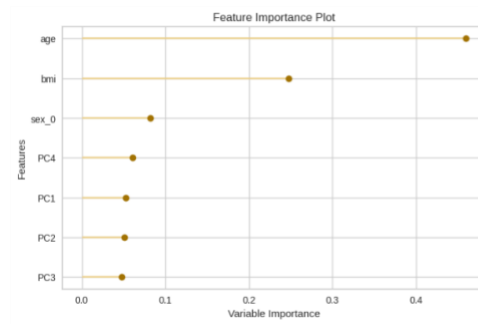
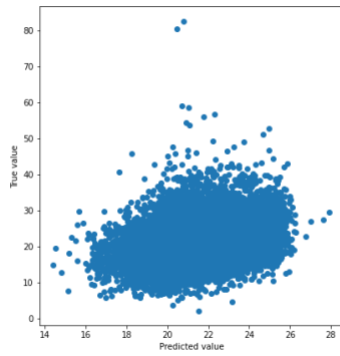
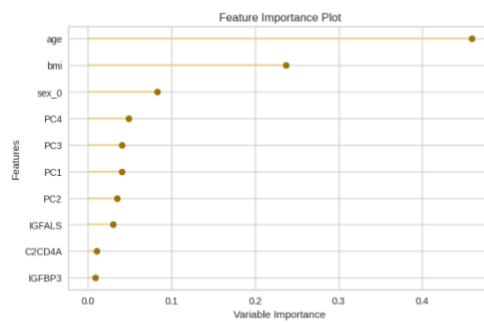
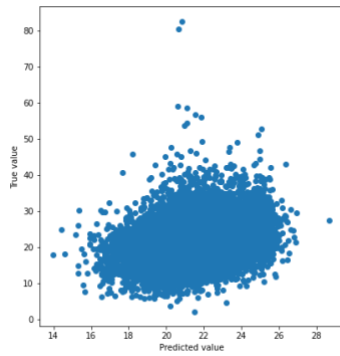


Figure S42 True vs. Predicted value plot (left) and top 10 features (right) for HDL cholesterol A. covariates model B. genes model C. PRS model and D. combined model.

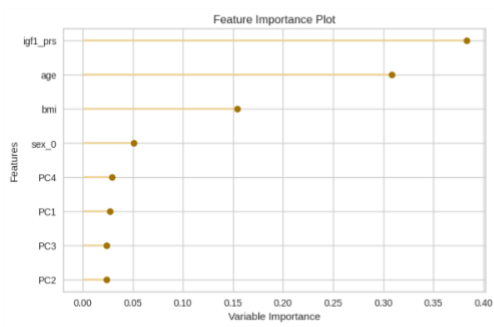
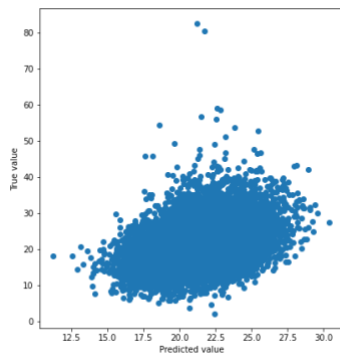
A. Igf1 cov model



B. IGF1 genes model



C. IGF1 prs model



D. IGF1 genes prs model

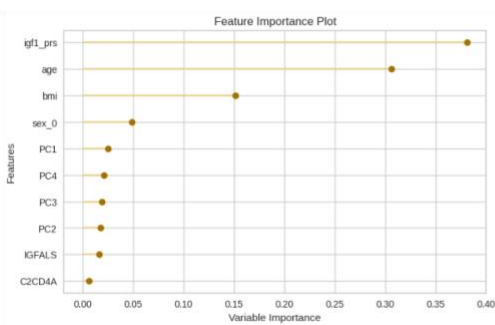
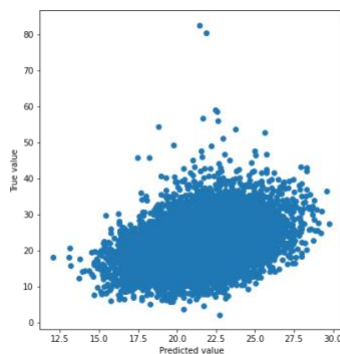
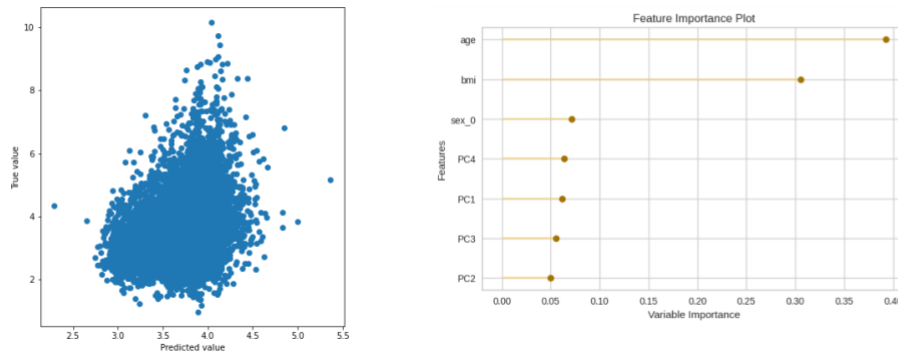
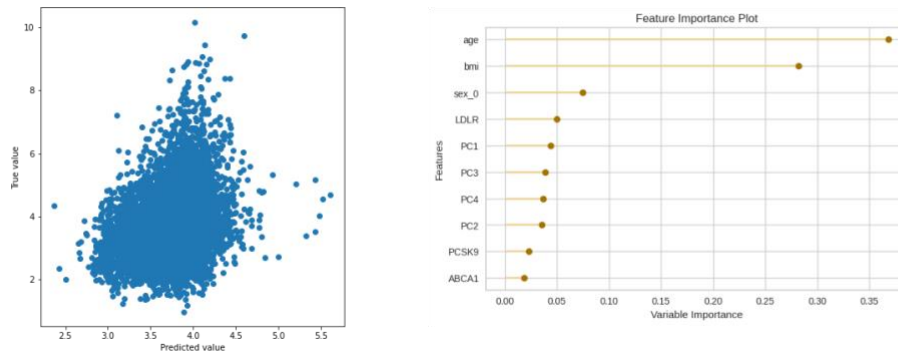


Figure S43 True vs. Predicted value plot (left) and top 10 features (right) for IGF1 A. covariates model B. genes model C. PRS model and D. combined model.

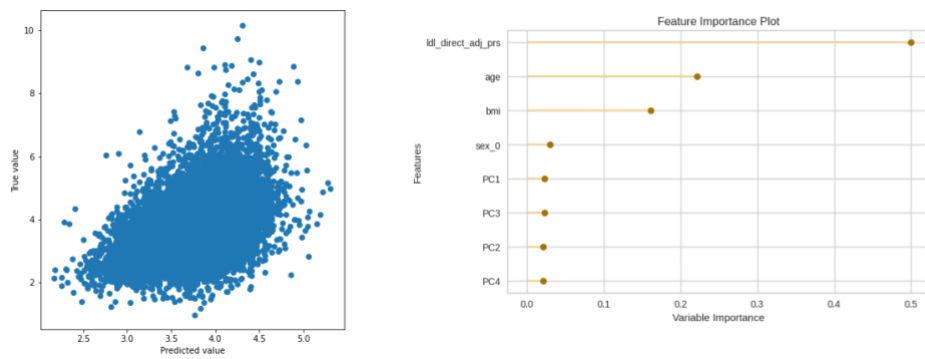
A. Ldl direct * cov model



B. Ldl direct * genes model



C. Ldl direct * prs model



D. Ldl direct * genes prs model

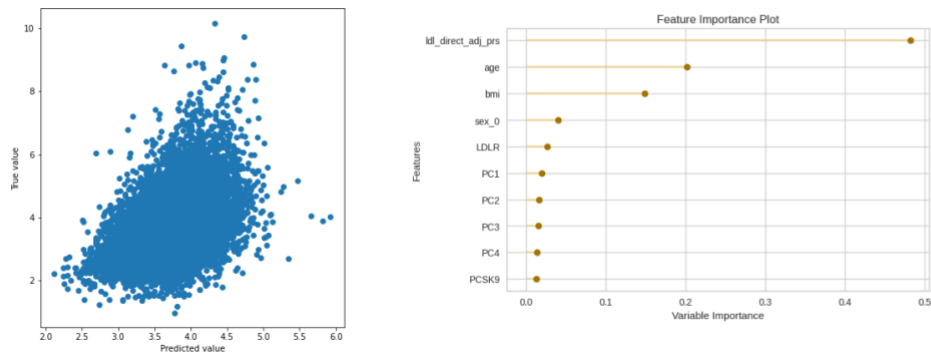
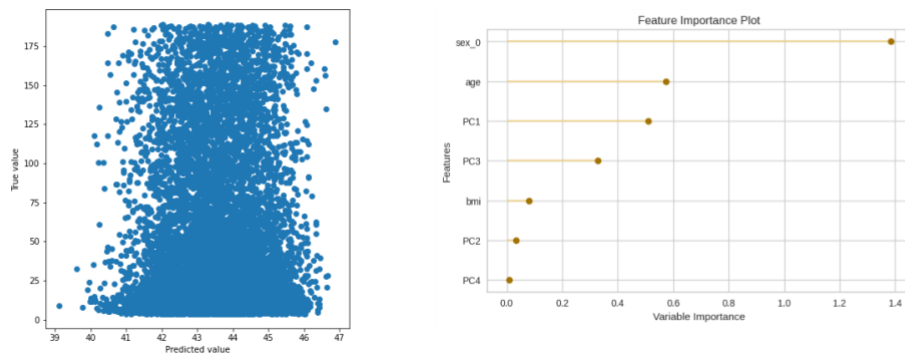
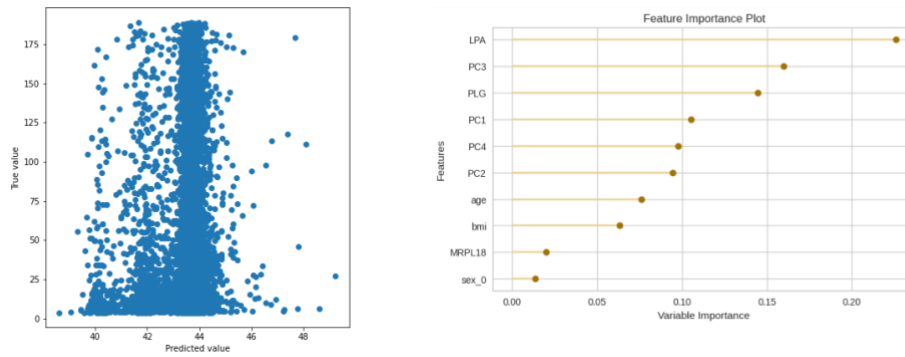


Figure S44 True vs. Predicted value plot (left) and top 10 features (right) for LDL direct* A. covariates model B. genes model C. PRS model and D. combined model.
* statin adjusted values

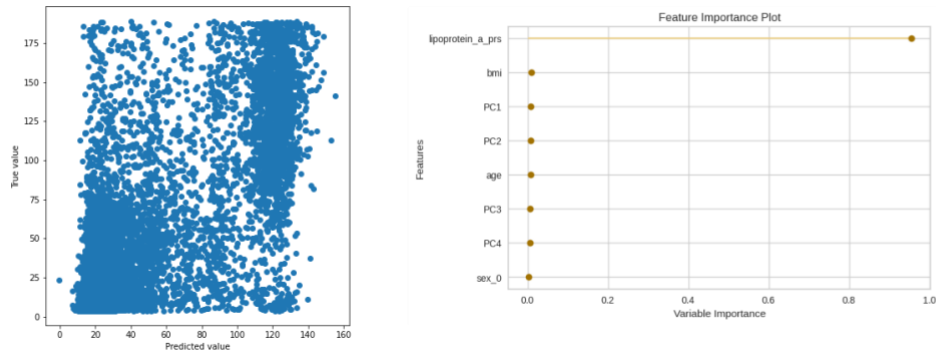
A. Lipoprotein a cov model



B. Lipoprotein a genes model



C. Lipoprotein a prs model



D. Lipoprotein a genes prs model

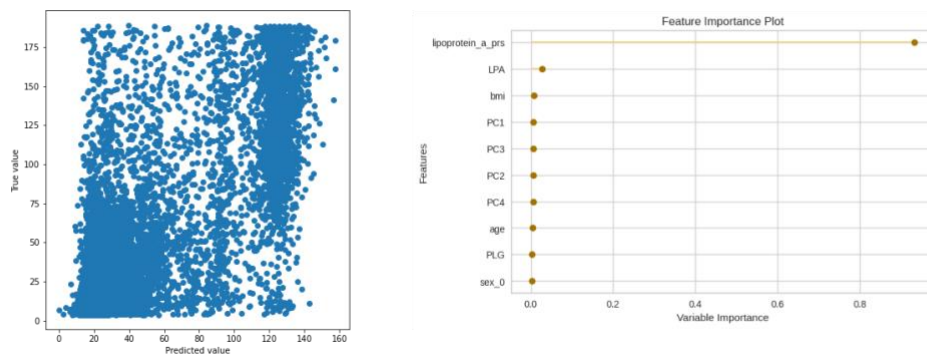
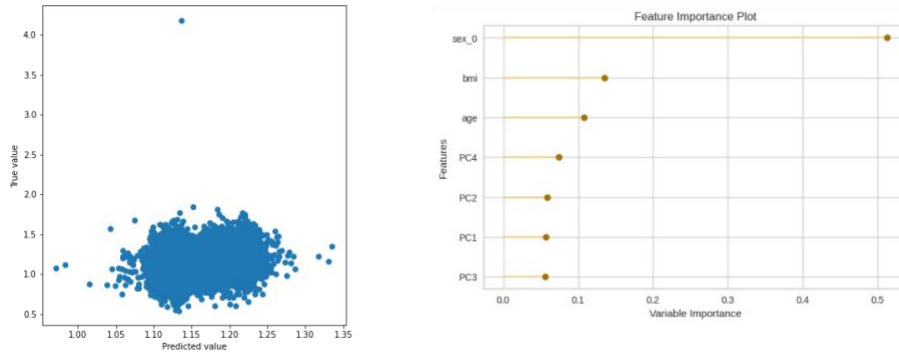
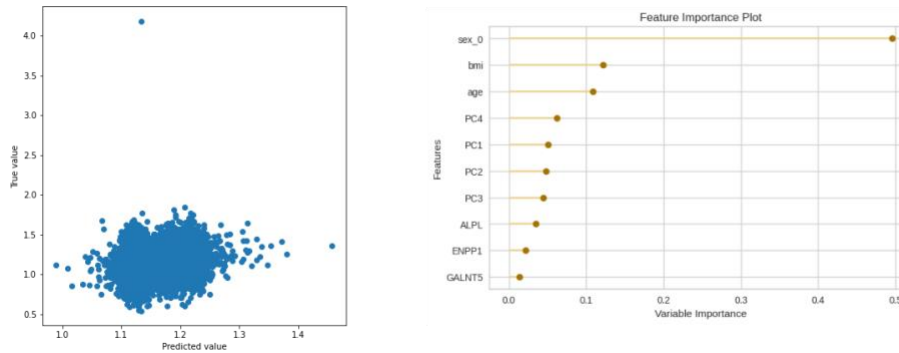


Figure S45 True vs. Predicted value plot (left) and top 10 features (right) for lipoprotein A A. covariates model B. genes model C. PRS model and D. combined model.

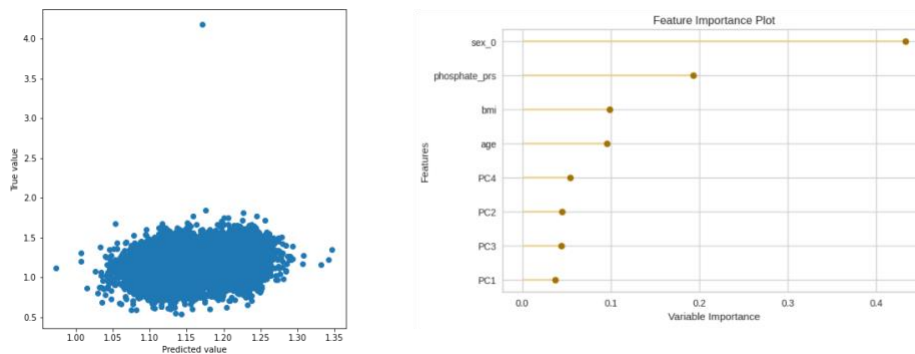
A. Phosphate cov model



B. Phosphate genes model



C. Phosphate prs model



D. Phosphate genes prs model

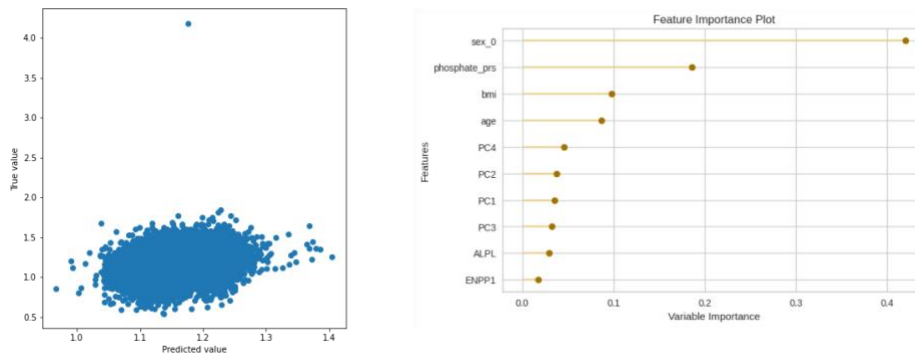
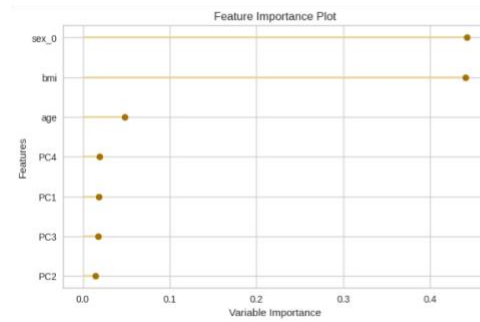
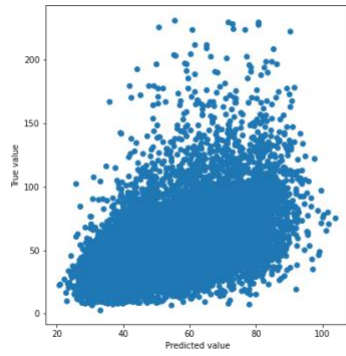
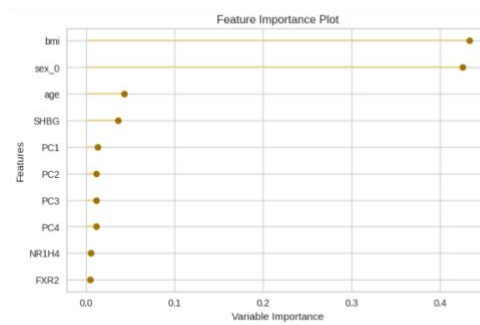
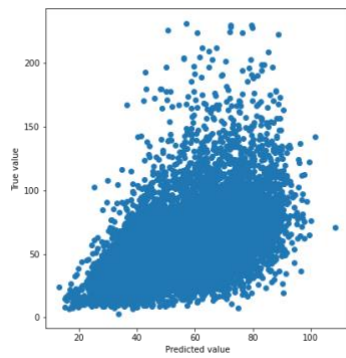


Figure S46 True vs. Predicted value plot (left) and top 10 features (right) for phosphate A. covariates model B. genes model C. PRS model and D. combined model.

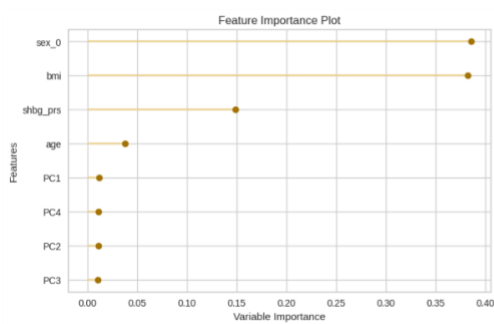
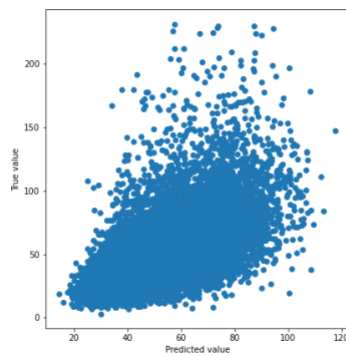
Shbg cov model



Shbg genes model



Shbg prs model



Shbg genes prs model

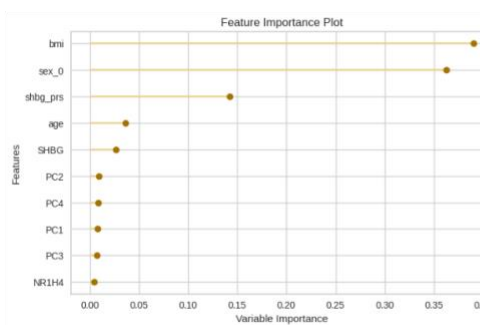
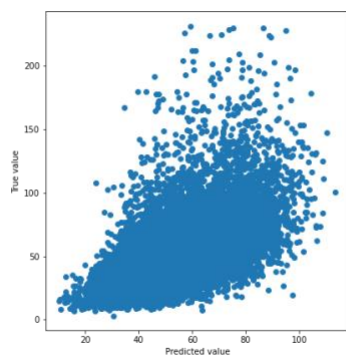
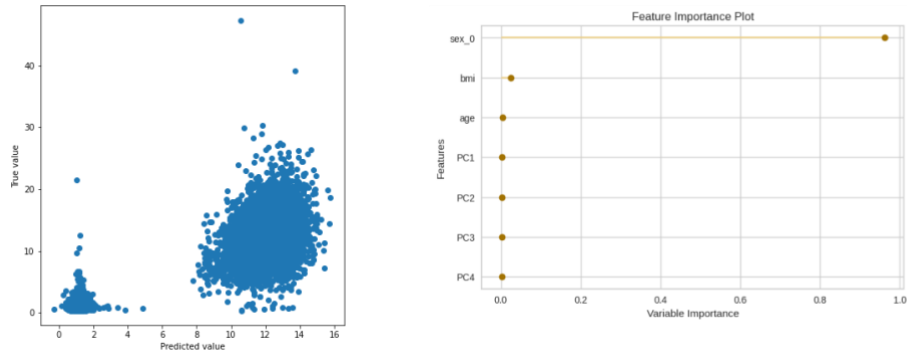
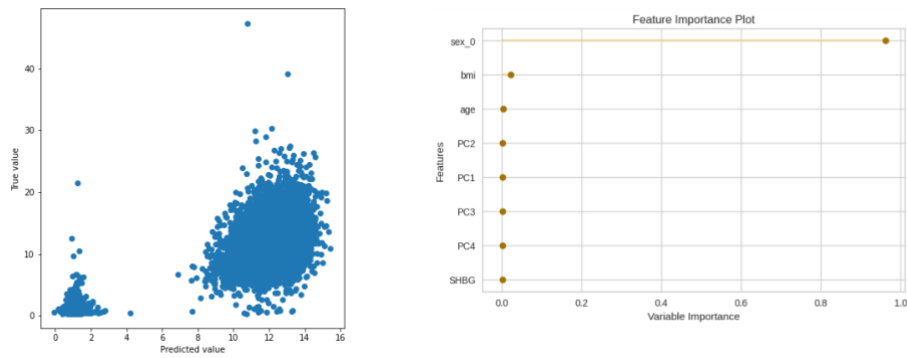


Figure S47 True vs. Predicted value plot (left) and top 10 features (right) for SHBG A. covariates model B. genes model C. PRS model and D. combined model.

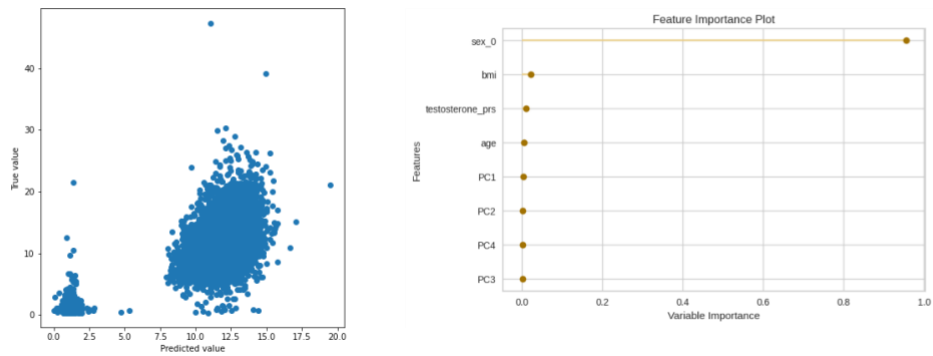
A. Testosterone cov model



B. Testosterone genes model



C. Testosterone prs model



D. Testosterone genes prs model

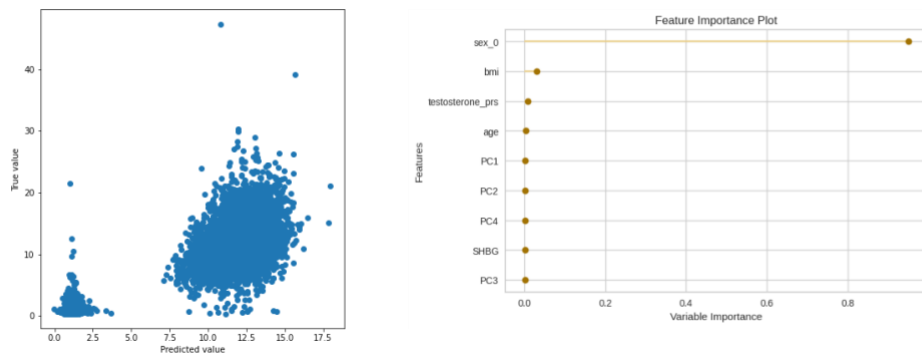
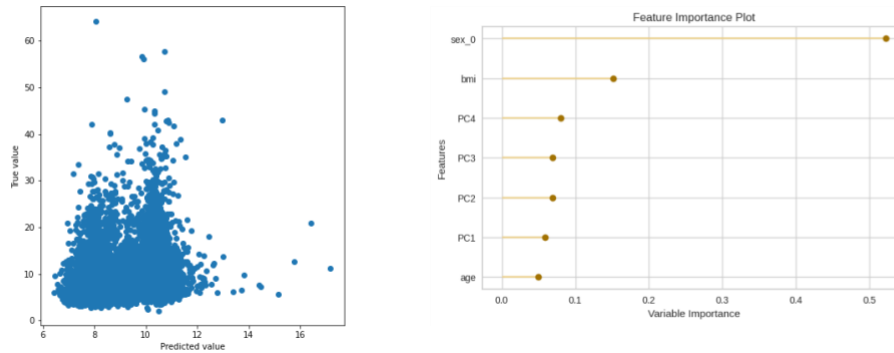
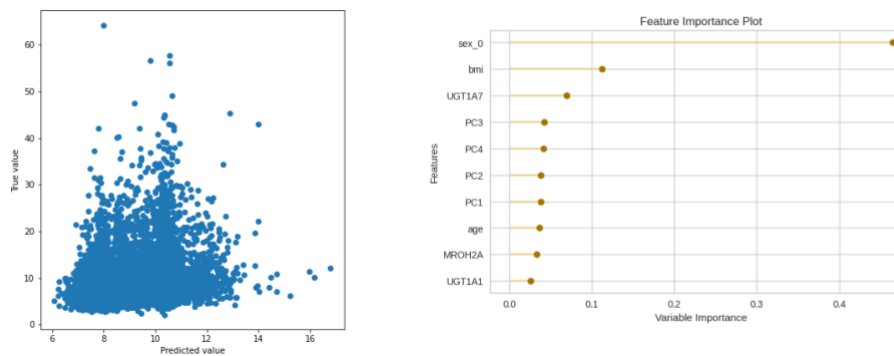


Figure S48 True vs. Predicted value plot (left) and top 10 features (right) for testosterone A. covariates model B. genes model C. PRS model and D. combined model.

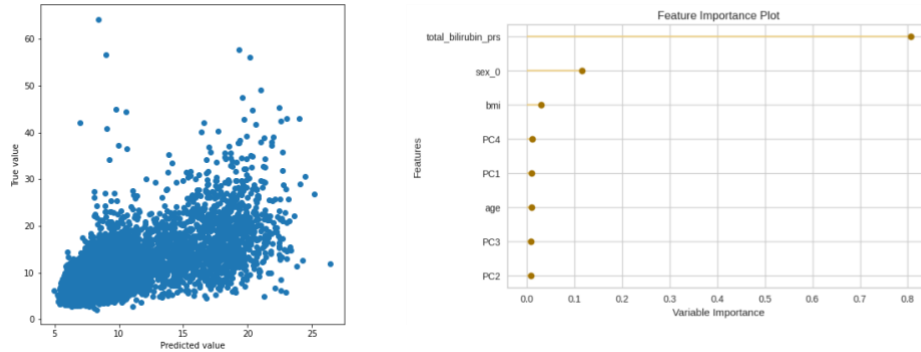
A. Total bilirubin cov model



B. Total bilirubin genes model



C. Total bilirubin prs model



D. Total bilirubin genes prs model

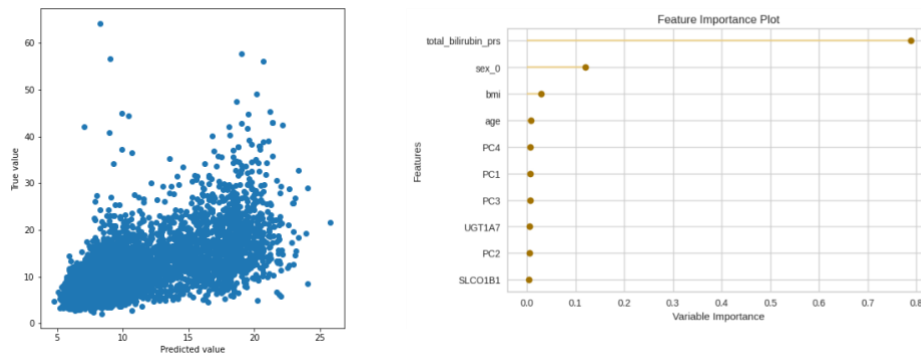
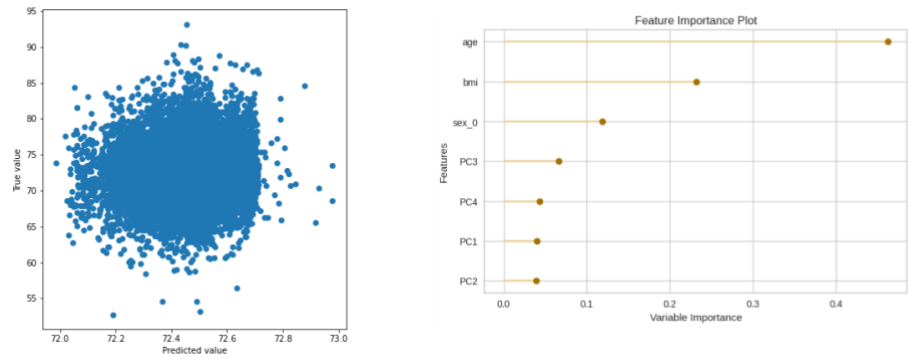
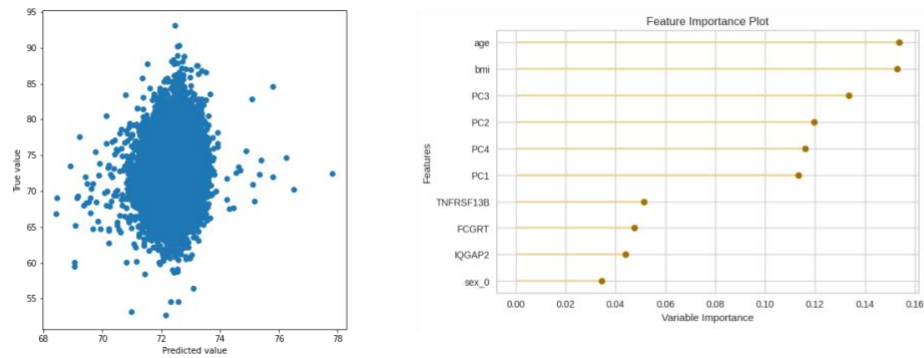


Figure S49 True vs. Predicted value plot (left) and top 10 features (right) for total bilirubin A. covariates model B. genes model C. PRS model and D. combined model.

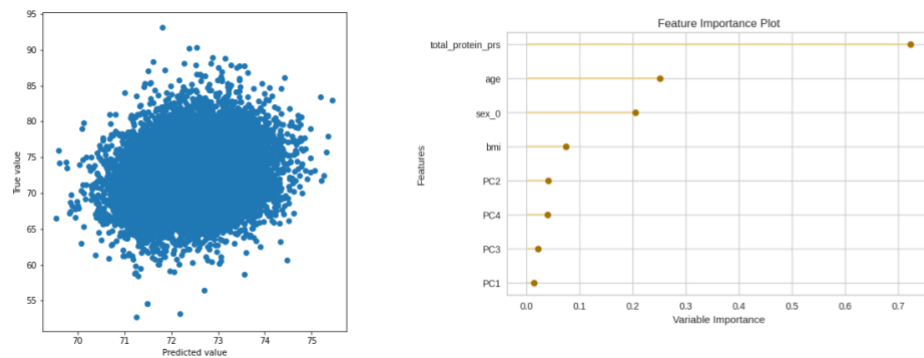
A. Total protein cov model



B. Total protein genes model



C. Total protein prs model



D. Total protein genes prs model

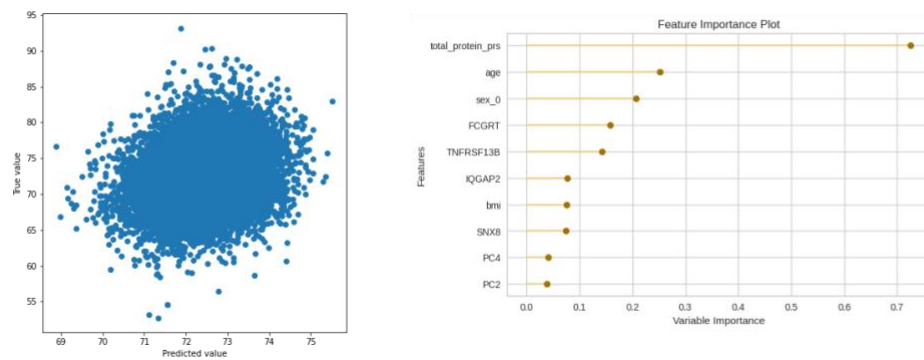
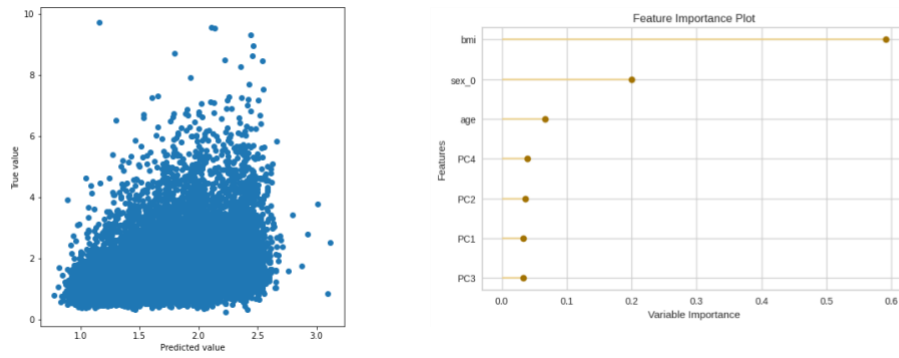
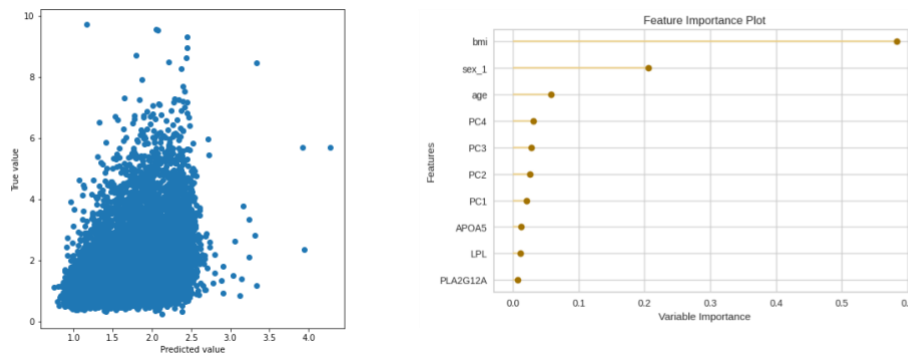


Figure S50 True vs. Predicted value plot (left) and top 10 features (right) for total protein A. covariates model B. genes model C. PRS model and D. combined model.

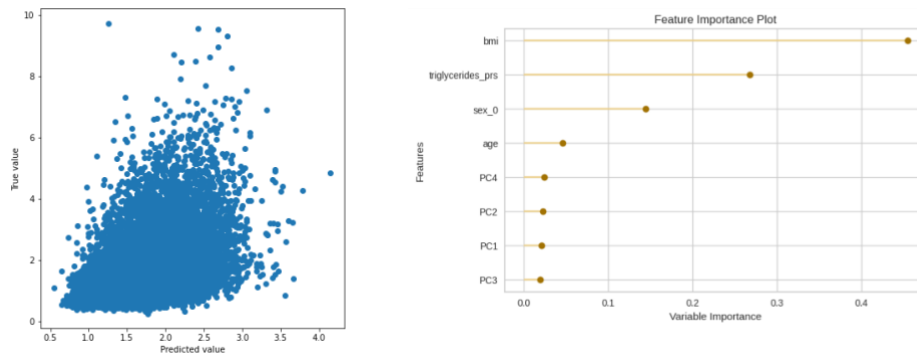
A. Triglycerides cov model



B. Triglycerides genes model



C. Triglycerides prs model



D. Triglycerides genes prs model

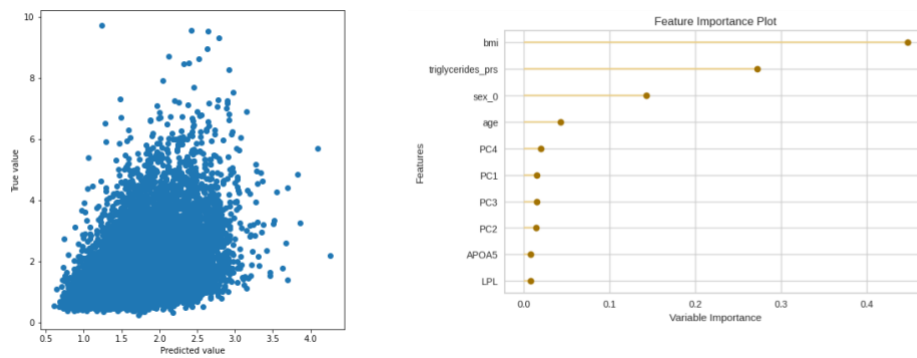
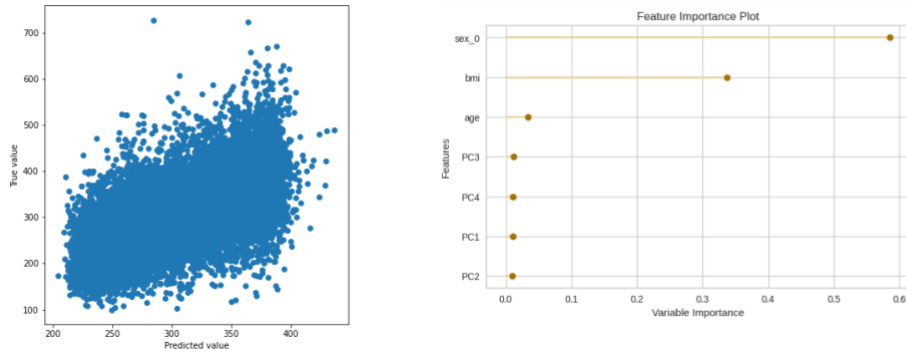
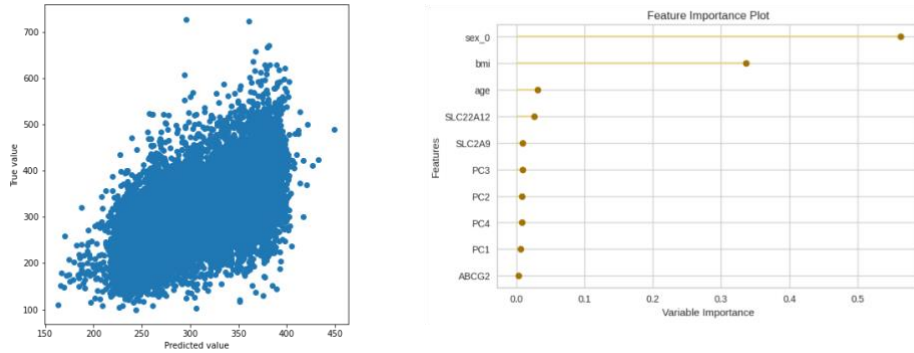


Figure S51 True vs. Predicted value plot (left) and top 10 features (right) for triglycerides A. covariates model B. genes model C. PRS model and D. combined model.

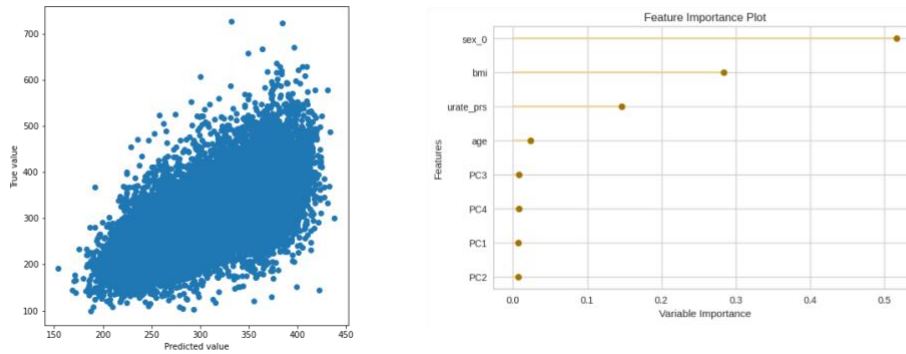
A. Urate cov model



B. Urate genes model



C. Urate prs model



D. Urate genes prs model

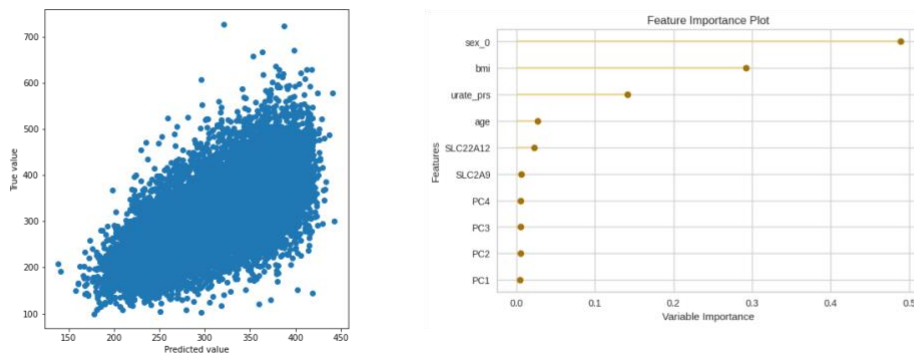
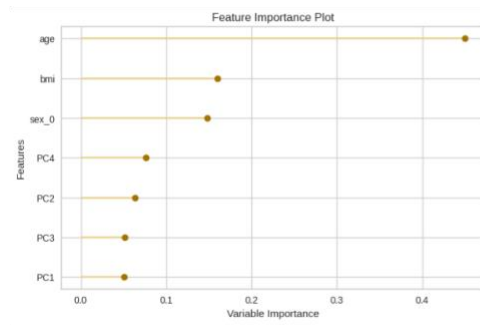
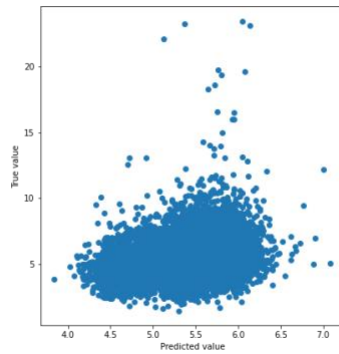
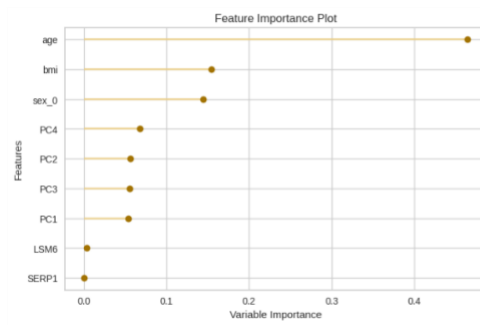
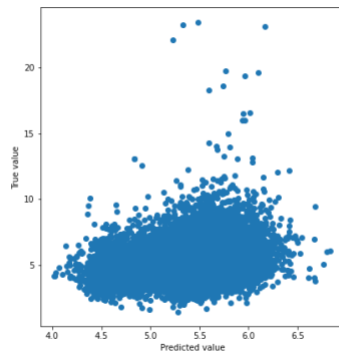


Figure S52 True vs. Predicted value plot (left) and top 10 features (right) for urate A. covariates model B. genes model C. PRS model and D. combined model.

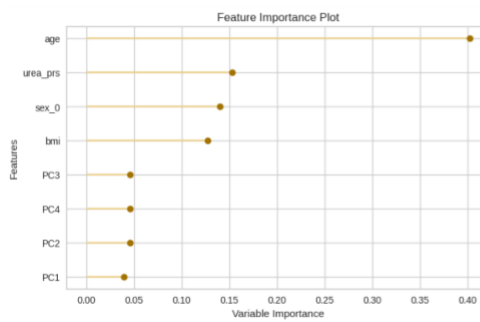
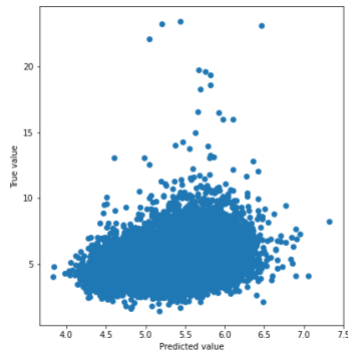
A. Urea cov model



B. Urea genes model



C. Urea prs model



D. Urea genes prs model

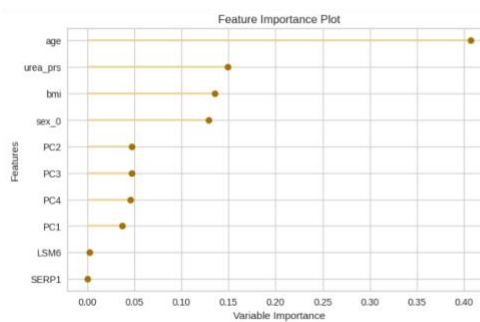
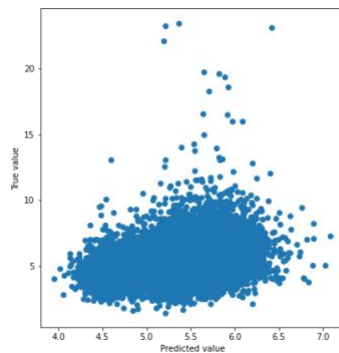
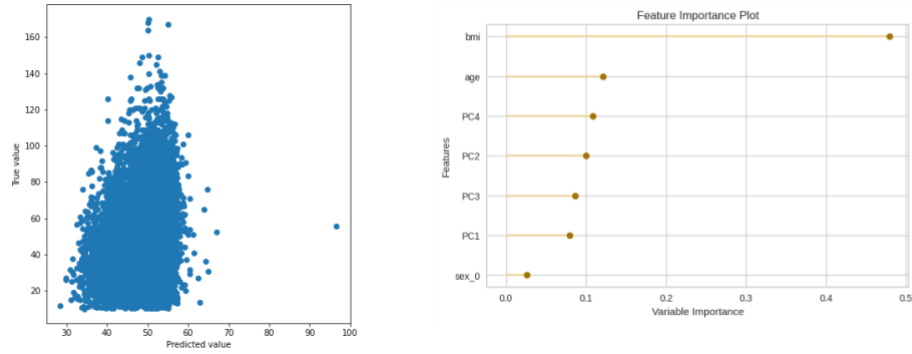
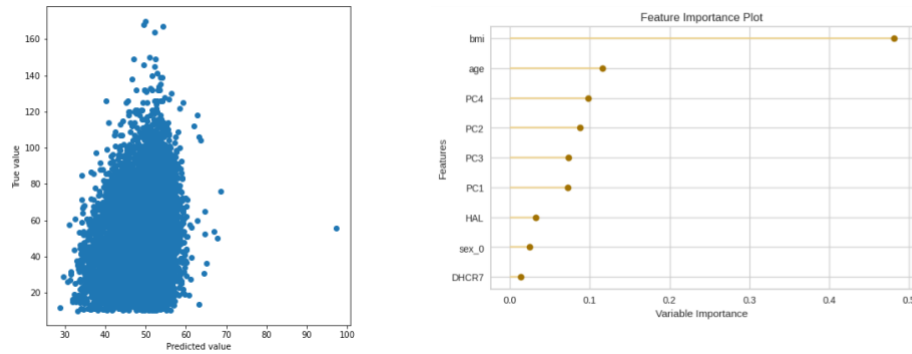


Figure S53 True vs. Predicted value plot (left) and top 10 features (right) for urea A. covariates model B. genes model C. PRS model and D. combined model.

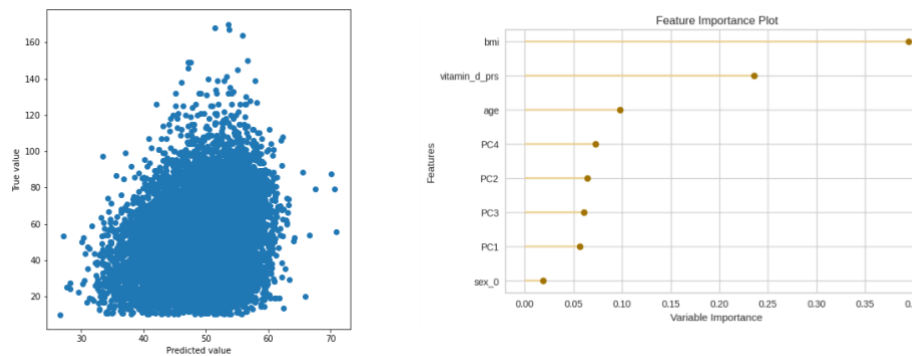
A. Vitamin d cov model



B. Vitamin d genes model



C. Vitamin d prs model



D. Vitamin d genes prs model

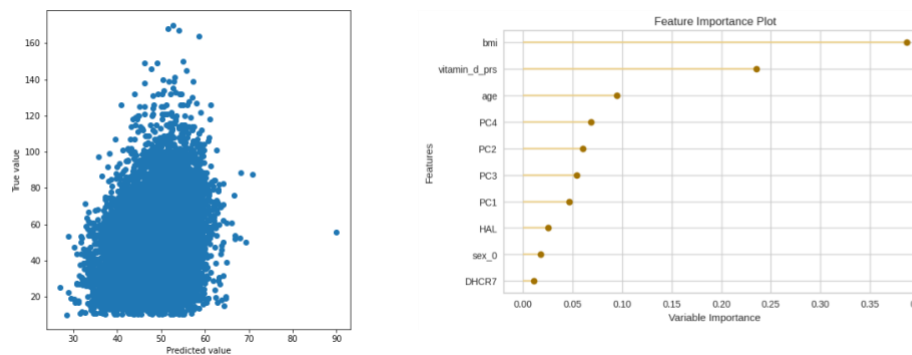


Figure S54 True vs. Predicted value plot (left) and top 10 features (right) for vitamin D A. covariates model B. genes model C. PRS model and D. combined model.