# AMP-DCC Data Analysis Report

# CAMP

# Phase 2

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This document was generated using Loamstream [16] and the AMP-DCC Data Analysis Pipeline [17]

## Contents

# 1 Introduction

## 2 Data

In order to run the data we received through our analysis pipeline in an efficient manner, the genotype arrays were each given a short code name; EX. In Table 1, we list the corresponding filename of the data set we received, the format of the file set (*note: 'bfile' refers to binary Plink format [1]*), and a liftOver [2] chain file if it was required to remap the variants to GRCh37 / hg19 coordinates

See Figure 1 for intersection counts of samples available for analysis. After applying variant filters, there were 404,854 variants remaining for analysis.

Table 1: Genotype array information

| ID | Filename | Format | LiftOver |
|---|---|---|---|
| EX | boxfixSEXFill_binary_11.loamstream | bfile | N/A |

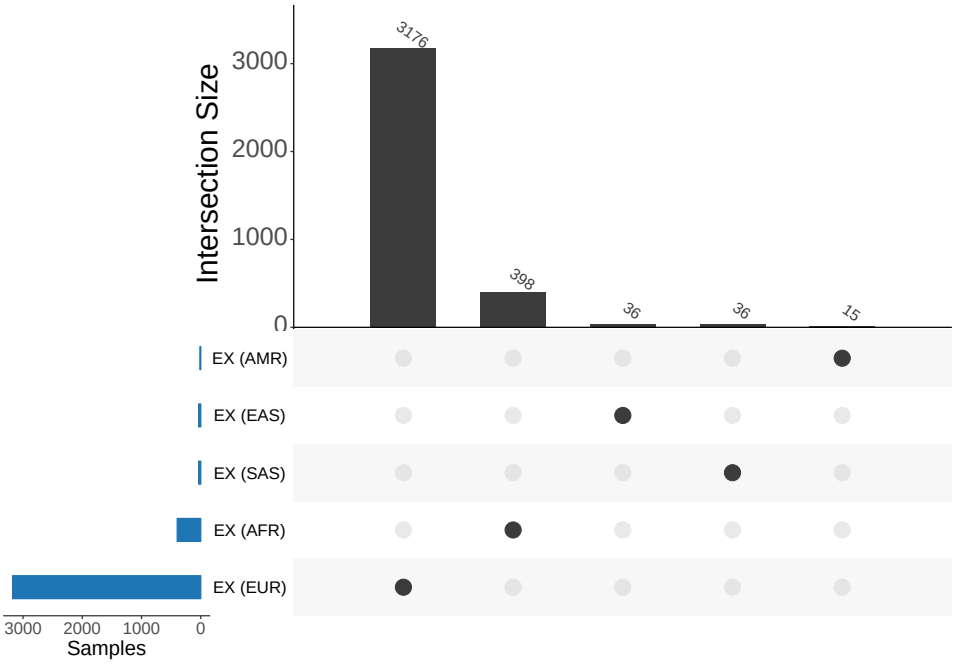



Figure 1: Samples remaining for analysis after quality control

# 3 Strategy

## 3.1 Sample structure and pipeline

The strategy we used to perform association testing can be found below. The 'ID' columns are the names used to identify each set of association test results in this document. The 'Report' columns indicate whether or not that particular set of association results will be presented in the tables and plots of the proceeding sections.

### 3.1.1 Cohort-level analysis

In Table 2, all of the cohorts available for analysis are defined. Each cohort was defined by a single array and one or more ancestral populations.

Table 2: Cohort-level analysis

| ID | Array | Ancestry | Report |
|---|---|---|---|
| EUR | EX | EUR | NO |
| AFR | EX | AFR | NO |

### 3.1.2 Meta-analysis

Table 3 defines any meta-analyses performed on the cohorts. Each cohort that was included is detailed along with the number of samples removed prior to cohort-level association testing. In order to identify samples that needed to be removed due to relatedness across cohorts, the cohorts genotypes were first merged on common variants. Then, autosomal variants with $MAF >= 0.01$ and $callrate >= 0.98$ were extracted and kinship values were calculated using King [4] with the '--kinship' flag. The reference cohort, the first one listed, maintained all of its samples. Starting from the last listed cohort, any samples shown to have some relation ($kinship >= 0.0884$) to a sample from any preceeding cohort was removed. This was continued until all cohorts subsequent to the reference cohort had been processed.

Table 3: Meta-analysis

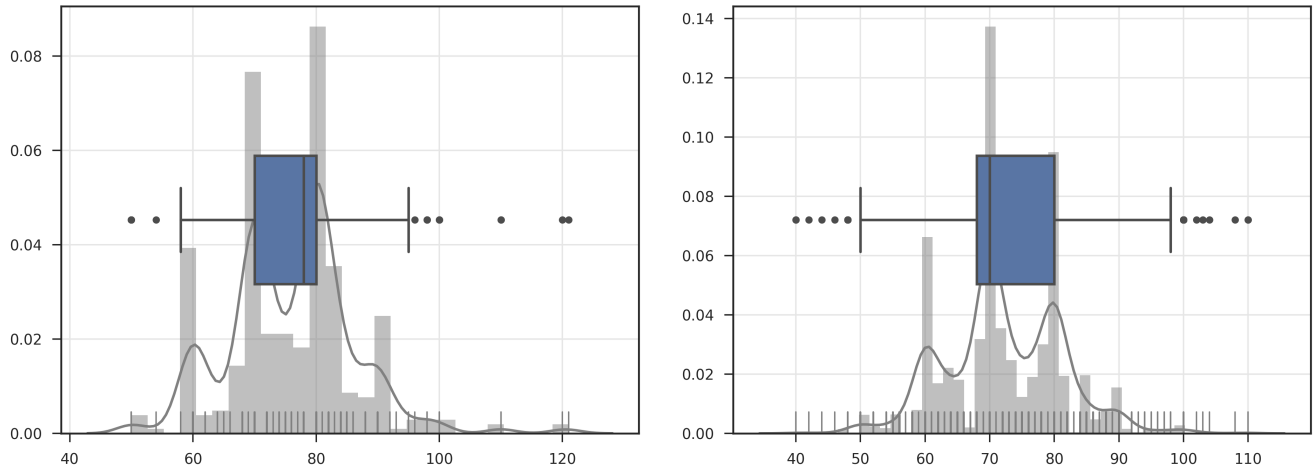
| ID | Cohort | KinshipRemove | Report |
|---|---|---|---|
| META | | | YES |
| | EUR | 0 | |
| | AFR | 0 | |

## 3.2 Ancestry Adjustment and Outlier Removal

Adjusting the statistical models for underlying ancestry is often crucial to reduce or eliminate Type 1 error. Often analysts include principal components of ancestry as covariates in their models as a matter of convention. In our case, we undertook a more nuanced approach. First, the top 10 PC's were calculated for each cohort using the PC-AiR method [3]. Then, the phenotype of interest was regressed on the covariates to be used in the model and all of the PC's. If the $N$th PC exhibited a statistically significant $p$-value ($p <= 0.05$), we selected PC's $1 - N$ to be included in association testing. Once determined, any sample lying outside 6 standard deviations from the mean on any of the $N$ PC's was marked as an outlier and removed from the sample set. This process was repeated up to a maximum of ten times until no outliers were found, resulting in more homogeneous sample sets for each particular analysis. For this project, a hard minimum of 0 PC's to be included in analysis was set by the analyst.

# 4 Diastolic Blood Pressure (DBP10)

## 4.1 Summary




(a) AFR

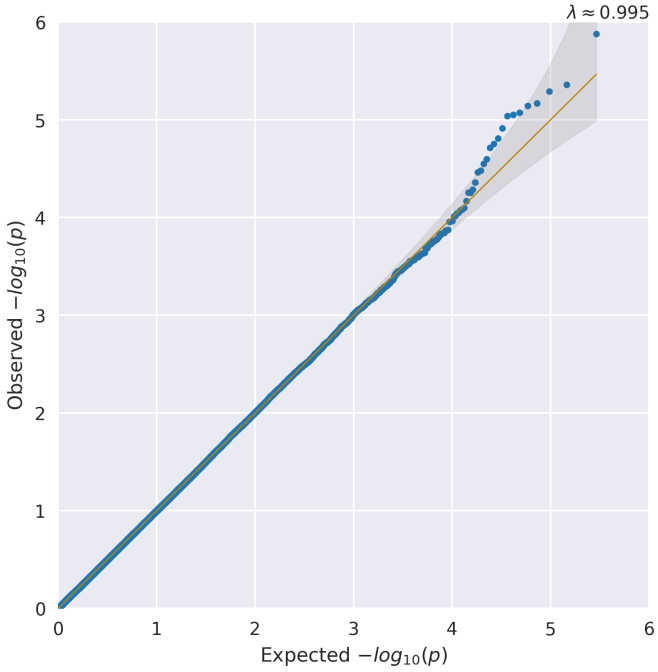
(b) EUR

Figure 2: Distribution of DBP10 in META by cohort

Table 4: Samples with Diastolic Blood Pressure data summarized by cohort, transformation, and run-time adjustments

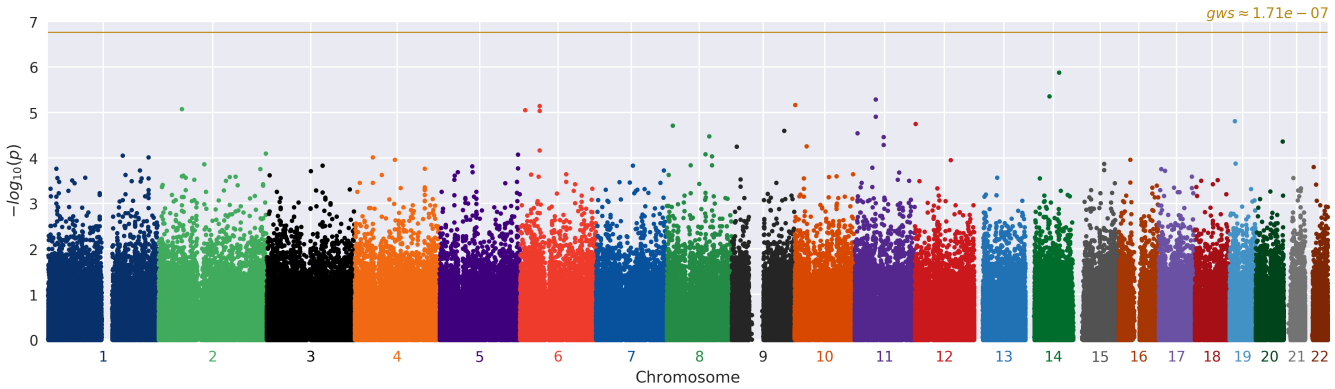
| Cohort | Array | Ancestry | Trans | Covars | PCs | N | Male | Female | Max | Min | $\mu$ | $\tilde{x}$ | $\sigma$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| META AFR | EX | AFR | invn | AGE_BP+AGE_BP2+SEX+BMI | 0 | 374 | 187 | 187 | 121.0 | 50.0 | 75.559 | 76.0 | 9.952 |
| META EUR | EX | EUR | invn | AGE_BP+AGE_BP2+SEX+BMI | 10 | 3041 | 1857 | 1184 | 110.0 | 40.0 | 72.162 | 70.0 | 9.095 |

## 4.2 Calibration




(a) invn Adjusted AGE_BP+AGE_BP2+SEX+BMI

Figure 3: QQ plots for DBP10 in the META analysis




(a) invn Adjusted AGE_BP+AGE_BP2+SEX+BMI

Figure 4: Manhattan plots for DBP10 in the META analysis

## 4.3 Top associations

Table 5: Top variants in the META invn Adjusted AGE_BP+AGE_BP2+SEX+BMI model (**bold** variants indicate previously identified associations)

| CHR | POS | ID | EA | OA | $GENE_{CLOSEST}$ | DIR | N | MALE | FEMALE | $FREQ_{AVG}$ | $FREQ_{MIN}$ | $FREQ_{MAX}$ | EFFECT | STDERR | OR | ZSCORE | P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 14 | 75279461 | rs2302835 | G | A | YLPM1 | ++ | 3,414 | 2,043 | 1,371 | $1.58 \cdot 10^{-2}$ | $2.14 \cdot 10^{-3}$ | 0.127 | 0.497 | 0.103 | 1.644 | −4.836 | $1.32 \cdot 10^{-6}$ |
| 14 | 54295649 | rs1958636 | G | A | BMP4 | ++ | 3,415 | 2,044 | 1,371 | 0.848 | 0.584 | 0.881 | 0.163 | $3.54 \cdot 10^{-2}$ | 1.177 | −4.593 | $4.36 \cdot 10^{-6}$ |
| 11 | 46893108 | rs2306029 | T | C | LRP4 | ++ | 3,415 | 2,044 | 1,371 | 0.502 | 0.207 | 0.538 | 0.112 | $2.46 \cdot 10^{-2}$ | 1.119 | −4.56 | $5.12 \cdot 10^{-6}$ |
| 10 | 1854773 | rs12570407 | T | C | ADARB2 | ++ | 3,414 | 2,044 | 1,370 | $1.54 \cdot 10^{-2}$ | $1.51 \cdot 10^{-2}$ | $1.74 \cdot 10^{-2}$ | 0.446 | $9.91 \cdot 10^{-2}$ | 1.562 | 4.501 | $6.77 \cdot 10^{-6}$ |
| 6 | 43976268 | rs9381273 | A | G | C6orf223 | ++ | 3,415 | 2,044 | 1,371 | 0.237 | 0.176 | 0.729 | 0.138 | $3.07 \cdot 10^{-2}$ | 1.148 | 4.488 | $7.19 \cdot 10^{-6}$ |
| 2 | 52324258 | rs10181636 | G | T | NRXN1 | ++ | 3,413 | 2,043 | 1,370 | 0.568 | 0.564 | 0.596 | 0.108 | $2.43 \cdot 10^{-2}$ | 1.114 | 4.454 | $8.42 \cdot 10^{-6}$ |
| 6 | 11590140 | rs9469574 | A | G | TMEM170B | ++ | 3,413 | 2,043 | 1,370 | 0.22 | 0.139 | 0.23 | 0.127 | $2.87 \cdot 10^{-2}$ | 1.136 | 4.444 | $8.83 \cdot 10^{-6}$ |
| 11 | 46810916 | rs11038993 | C | A | CKAP5 | ++ | 3,415 | 2,044 | 1,371 | 0.474 | 0.158 | 0.513 | 0.107 | $2.45 \cdot 10^{-2}$ | 1.113 | −4.373 | $1.22 \cdot 10^{-5}$ |
| 19 | 12014274 | rs279205 | G | A | ZNF69 | ++ | 3,415 | 2,044 | 1,371 | 0.327 | 0.292 | 0.618 | 0.114 | $2.64 \cdot 10^{-2}$ | 1.121 | 4.321 | $1.55 \cdot 10^{-5}$ |
| 12 | 1642198 | rs4765826 | A | G | FBXL14 | ++ | 3,415 | 2,044 | 1,371 | 0.168 | 0.16 | 0.226 | 0.138 | $3.23 \cdot 10^{-2}$ | 1.149 | 4.292 | $1.77 \cdot 10^{-5}$ |
| 8 | 13356621 | rs34591797 | G | T | DLC1 | ++ | 3,415 | 2,044 | 1,371 | $1.36 \cdot 10^{-2}$ | $8.22 \cdot 10^{-4}$ | 0.118 | 0.478 | 0.112 | 1.613 | 4.274 | $1.92 \cdot 10^{-5}$ |
| 9 | 117453668 | rs16930907 | T | C | RP11-402G3 | ++ | 3,415 | 2,044 | 1,371 | $5.81 \cdot 10^{-2}$ | $4.8 \cdot 10^{-2}$ | 0.14 | 0.219 | $5.21 \cdot 10^{-2}$ | 1.245 | 4.214 | $2.51 \cdot 10^{-5}$ |
| 11 | 6348639 | rs4758408 | T | C | PRKCDBP | ++ | 3,414 | 2,043 | 1,371 | 0.849 | 0.492 | 0.892 | 0.15 | $3.59 \cdot 10^{-2}$ | 1.162 | −4.187 | $2.83 \cdot 10^{-5}$ |
| 8 | 95238312 | rs2100602 | A | G | CDH17 | ++ | 3,413 | 2,042 | 1,371 | $4.47 \cdot 10^{-2}$ | $2.85 \cdot 10^{-2}$ | 0.177 | 0.25 | $6.01 \cdot 10^{-2}$ | 1.284 | 4.152 | $3.3 \cdot 10^{-5}$ |
| 11 | 64757496 | rs10897540 | C | T | BATF2 | ++ | 3,413 | 2,044 | 1,369 | $4.76 \cdot 10^{-2}$ | $3.62 \cdot 10^{-2}$ | 0.14 | 0.241 | $5.83 \cdot 10^{-2}$ | 1.273 | −4.142 | $3.44 \cdot 10^{-5}$ |
| 20 | 60735098 | rs6121926 | C | T | SS18L1 | ++ | 3,415 | 2,044 | 1,371 | 0.184 | 0.126 | 0.656 | 0.14 | $3.42 \cdot 10^{-2}$ | 1.15 | 4.088 | $4.35 \cdot 10^{-5}$ |
| 10 | 27459716 | rs35571315 | A | G | MASTL | ++ | 3,415 | 2,044 | 1,371 | $1.14 \cdot 10^{-2}$ | $1.34 \cdot 10^{-3}$ | $1.27 \cdot 10^{-2}$ | 0.462 | 0.115 | 1.587 | 4.031 | $5.56 \cdot 10^{-5}$ |
| 9 | 11114781 | rs10809343 | T | C | PTPRD | ++ | 3,413 | 2,044 | 1,369 | 0.914 | 0.733 | 0.936 | 0.181 | $4.49 \cdot 10^{-2}$ | 1.199 | −4.03 | $5.57 \cdot 10^{-5}$ |
| 2 | 240765562 | rs12987919 | A | G | NDUFA10 | ++ | 3,415 | 2,044 | 1,371 | 0.61 | 0.38 | 0.638 | 0.1 | $2.54 \cdot 10^{-2}$ | 1.106 | −3.946 | $7.94 \cdot 10^{-5}$ |
| 8 | 87330713 | rs7003059 | T | C | WWP1 | ++ | 3,415 | 2,044 | 1,371 | 0.276 | 0.272 | 0.302 | 0.108 | $2.73 \cdot 10^{-2}$ | 1.114 | 3.937 | $8.27 \cdot 10^{-5}$ |

## 4.4 Previously identified risk loci

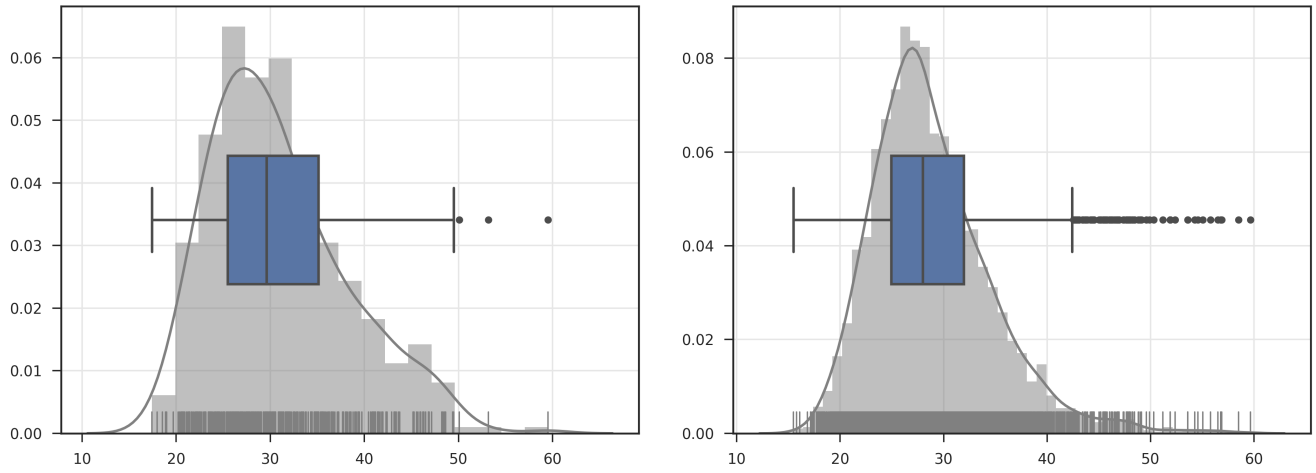
Table 6 shows statistics from the META cohort for 24 loci that were shown to be significantly associated with Diastolic Blood Pressure in the 2011 Nature paper by Ehret et al [9]. Where a previously reported variant was not genotyped in the study (indicated by $\bar{R}^2 < 1$), if available, a tagging variant in LD with the reported variant ($\bar{R}^2 >= 0.7$ and within 250kb) was provided. Tags were identified using 1000 Genomes data. None of the variants shows even nominal significance ($p < 0.05$) in this study. Out of the 20 variants in both studies, 10 exhibit the same direction of effect with the known result (binomial test $p = 0.588$).

Table 6: Top known loci in META model invn Adjusted AGE_BP+AGE_BP2+SEX+BMI (**bold** variants indicate matching direction of effect)

| CHR | POS | ID | EA | OA | N | $FREQ_{AVG}$ | $FREQ_{MIN}$ | $FREQ_{MAX}$ | EFFECT | STDERR | P | DIR | $GENE_{CLOSEST}$ | $R^2$ | $ID_{KNOWN}$ | $N_{KNOWN}$ | $EFFECT_{KNOWN}$ | $STDERR_{KNOWN}$ | $P_{KNOWN}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12 | 112007756 | **rs653178** | T | C | 3,415 | 0.533 | 0.487 | 0.908 | $1.73 \cdot 10^{-3}$ | $2.48 \cdot 10^{-2}$ | 0.944 | -+ | ATXN2 | 1 | rs653178 | $2 \cdot 10^5$ | 0.48 | $6.26 \cdot 10^{-2}$ | $1.64 \cdot 10^{-14}$ |
| 12 | 111884608 | **rs3184504** | T | C | 3,415 | 0.535 | 0.489 | 0.908 | $3.12 \cdot 10^{-3}$ | $2.49 \cdot 10^{-2}$ | 0.9 | +- | SH2B3 | 1 | rs3184504 | $2 \cdot 10^5$ | 0.48 | $6.29 \cdot 10^{-2}$ | $2.33 \cdot 10^{-14}$ |
| 4 | 81164723 | **rs1458038** | T | C | 3,415 | 0.258 | $8.42 \cdot 10^{-2}$ | 0.279 | $7.78 \cdot 10^{-3}$ | $2.78 \cdot 10^{-2}$ | 0.78 | ++ | FGF5 | 1 | rs1458038 | $2 \cdot 10^5$ | 0.503 | $7.02 \cdot 10^{-2}$ | $7.91 \cdot 10^{-13}$ |
| 12 | 112072424 | **rs11065987** | G | A | 3,414 | 0.422 | $8.16 \cdot 10^{-2}$ | 0.463 | $5.4 \cdot 10^{-3}$ | $2.5 \cdot 10^{-2}$ | 0.829 | +- | BRAP | 1 | rs11065987 | $2 \cdot 10^5$ | 0.449 | $6.46 \cdot 10^{-2}$ | $3.43 \cdot 10^{-12}$ |
| 15 | 75077367 | rs1378942 | A | C | 3,415 | 0.585 | 0.126 | 0.641 | $2.24 \cdot 10^{-2}$ | $2.63 \cdot 10^{-2}$ | 0.394 | ++ | CSK | 1 | rs1378942 | $2 \cdot 10^5$ | −0.445 | $6.4 \cdot 10^{-2}$ | $3.47 \cdot 10^{-12}$ |
| 12 | 112486818 | **rs17696736** | G | A | 3,415 | 0.431 | $8.56 \cdot 10^{-2}$ | 0.474 | $1.36 \cdot 10^{-2}$ | $2.49 \cdot 10^{-2}$ | 0.583 | +- | NAA25 | 1 | rs17696736 | $2 \cdot 10^5$ | 0.422 | $6.34 \cdot 10^{-2}$ | $2.8 \cdot 10^{-11}$ |
| 15 | 75125645 | **rs6495122** | C | A | 3,415 | 0.516 | 0.257 | 0.548 | $1.85 \cdot 10^{-2}$ | $2.47 \cdot 10^{-2}$ | 0.453 | ++ | CPLX3 | 1 | rs6495122 | $2 \cdot 10^5$ | 0.383 | $6.23 \cdot 10^{-2}$ | $8.41 \cdot 10^{-10}$ |
| 15 | 75047426 | **rs2470890** | T | C | 3,415 | 0.574 | 0.123 | 0.629 | $3.53 \cdot 10^{-2}$ | $2.63 \cdot 10^{-2}$ | 0.181 | ++ | CYP1A2 | 1 | rs2470890 | $2 \cdot 10^5$ | 0.394 | $6.46 \cdot 10^{-2}$ | $1.03 \cdot 10^{-9}$ |
| 15 | 75115895 | rs7162232 | A | G | 3,414 | 0.693 | 0.578 | 0.707 | $2.54 \cdot 10^{-2}$ | $2.63 \cdot 10^{-2}$ | 0.334 | ++ | LMAN1L | 1 | rs7162232 | $2 \cdot 10^5$ | −0.416 | $6.89 \cdot 10^{-2}$ | $1.58 \cdot 10^{-9}$ |
| 12 | 90008959 | rs2681472 | A | G | 3,415 | 0.182 | 0.119 | 0.19 | $2.34 \cdot 10^{-2}$ | $3.14 \cdot 10^{-2}$ | 0.456 | ++ | ATP2B1 | 1 | rs2681472 | $2 \cdot 10^5$ | −0.492 | $8.36 \cdot 10^{-2}$ | $3.9 \cdot 10^{-9}$ |
| 10 | 63524591 | rs1530440 | C | T | 3,415 | 0.175 | $7.35 \cdot 10^{-2}$ | 0.187 | $2.52 \cdot 10^{-2}$ | $3.19 \cdot 10^{-2}$ | 0.43 | ++ | C10orf107 | 1 | rs1530440 | $2 \cdot 10^5$ | −0.459 | $7.92 \cdot 10^{-2}$ | $6.71 \cdot 10^{-9}$ |
| 1 | 11862778 | **rs17367504** | G | A | 3,415 | 0.136 | 0.116 | 0.138 | $9.32 \cdot 10^{-3}$ | $3.57 \cdot 10^{-2}$ | 0.794 | +- | MTHFR | 1 | rs17367504 | $2 \cdot 10^5$ | 0.49 | $8.61 \cdot 10^{-2}$ | $1.29 \cdot 10^{-8}$ |
| 1 | 11887303 | **rs7537765** | G | A | 3,415 | 0.153 | 0.139 | 0.261 | $1.55 \cdot 10^{-2}$ | $3.39 \cdot 10^{-2}$ | 0.649 | ++ | CLCN6 | 1 | rs7537765 | $2 \cdot 10^5$ | 0.485 | $8.56 \cdot 10^{-2}$ | $1.43 \cdot 10^{-8}$ |
| 12 | 89942390 | rs11105328 | A | G | 3,415 | 0.181 | 0.144 | 0.185 | $3.27 \cdot 10^{-2}$ | $3.16 \cdot 10^{-2}$ | 0.302 | ++ | POC1B-GALNT4 | 1 | rs11105328 | $2 \cdot 10^5$ | −0.487 | $8.66 \cdot 10^{-2}$ | $1.83 \cdot 10^{-8}$ |
| 12 | 111818701 | rs11065884 | A | G | 3,415 | 0.266 | 0.213 | 0.699 | $7.46 \cdot 10^{-3}$ | $2.94 \cdot 10^{-2}$ | 0.8 | +- | FAM109A | 1 | rs11065884 | $2 \cdot 10^5$ | −0.409 | $7.42 \cdot 10^{-2}$ | $3.57 \cdot 10^{-8}$ |
| 15 | 75234610 | rs11072518 | C | T | 3,415 | 0.606 | 0.501 | 0.619 | $1.75 \cdot 10^{-2}$ | $2.47 \cdot 10^{-2}$ | 0.478 | ++ | COX5A | 1 | rs11072518 | $2 \cdot 10^5$ | −0.355 | $6.45 \cdot 10^{-2}$ | $3.78 \cdot 10^{-8}$ |
| 6 | 26107463 | rs198846 | A | G | 3,415 | 0.846 | 0.842 | 0.876 | $7 \cdot 10^{-3}$ | $3.31 \cdot 10^{-2}$ | 0.832 | ++ | HIST1H1T | 1 | rs198846 | $2 \cdot 10^5$ | −0.487 | $8.85 \cdot 10^{-2}$ | $3.8 \cdot 10^{-8}$ |
| 12 | 111788402 | rs10219736 | C | T | 3,415 | 0.213 | 0.187 | 0.425 | $6.94 \cdot 10^{-3}$ | $3.03 \cdot 10^{-2}$ | 0.819 | ++ | CUX2 | 1 | rs10219736 | $2 \cdot 10^5$ | −0.414 | $7.58 \cdot 10^{-2}$ | $4.88 \cdot 10^{-8}$ |
| 6 | 26107463 | rs198846 | A | G | 3,415 | 0.846 | 0.842 | 0.876 | $7 \cdot 10^{-3}$ | $3.31 \cdot 10^{-2}$ | 0.832 | ++ | HIST1H2BC | 1 | rs198833 | $2 \cdot 10^5$ | −0.485 | $8.88 \cdot 10^{-2}$ | $4.58 \cdot 10^{-8}$ |
| 15 | 75189930 | **rs1130741** | G | A | 3,414 | 0.5 | 0.312 | 0.524 | $1.57 \cdot 10^{-2}$ | $2.46 \cdot 10^{-2}$ | 0.522 | ++ | MPI | 1 | rs7495739 | $2 \cdot 10^5$ | 0.335 | $6.15 \cdot 10^{-2}$ | $5.02 \cdot 10^{-8}$ |
| 15 | 75189930 | **rs1130741** | G | A | 3,414 | 0.5 | 0.312 | 0.524 | $1.57 \cdot 10^{-2}$ | $2.46 \cdot 10^{-2}$ | 0.522 | ++ | SCAMP2 | 0.981 | rs11072511 | $2 \cdot 10^5$ | 0.339 | $6.16 \cdot 10^{-2}$ | $3.6 \cdot 10^{-8}$ |
| 12 | 112486818 | **rs17696736** | G | A | 3,415 | 0.431 | $8.56 \cdot 10^{-2}$ | 0.474 | $1.36 \cdot 10^{-2}$ | $2.49 \cdot 10^{-2}$ | 0.583 | +- | TRAFD1 | 0.922 | rs17630235 | $2 \cdot 10^5$ | 0.447 | $6.4 \cdot 10^{-2}$ | $2.92 \cdot 10^{-12}$ |
| 12 | 112486818 | **rs17696736** | G | A | 3,415 | 0.431 | $8.56 \cdot 10^{-2}$ | 0.474 | $1.36 \cdot 10^{-2}$ | $2.49 \cdot 10^{-2}$ | 0.583 | +- | HECTD4 | 0.913 | rs11066188 | $2 \cdot 10^5$ | 0.447 | $6.41 \cdot 10^{-2}$ | $3.06 \cdot 10^{-12}$ |
| 7 | 2508072 | rs2906166 | T | C | 3,415 | 0.693 | 0.668 | 0.9 | $3.12 \cdot 10^{-2}$ | $2.67 \cdot 10^{-2}$ | 0.244 | +- | GRIFIN | 0.819 | rs2969070 | $2 \cdot 10^5$ | −0.386 | $6.47 \cdot 10^{-2}$ | $2.57 \cdot 10^{-9}$ |

# 5 Body Mass Index (BMI)

## 5.1 Summary




(a) AFR

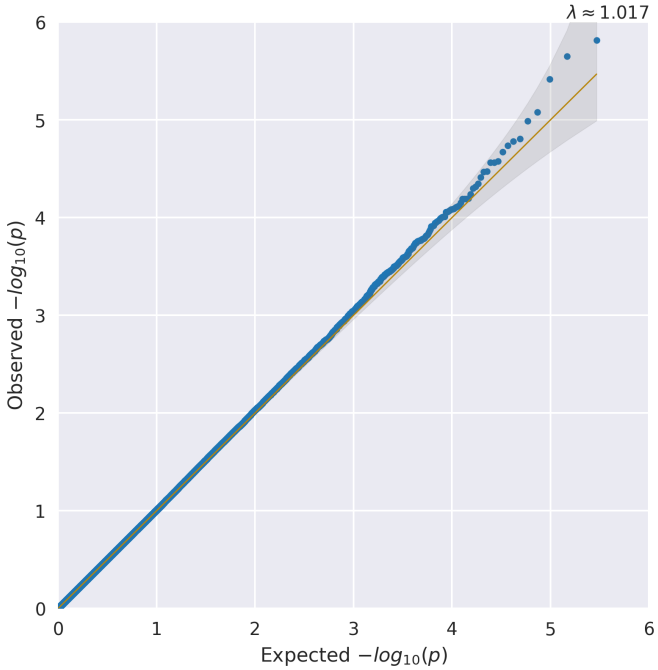
(b) EUR

Figure 5: Distribution of BMI in META by cohort

Table 7: Samples with Body Mass Index data summarized by cohort, transformation, and run-time adjustments

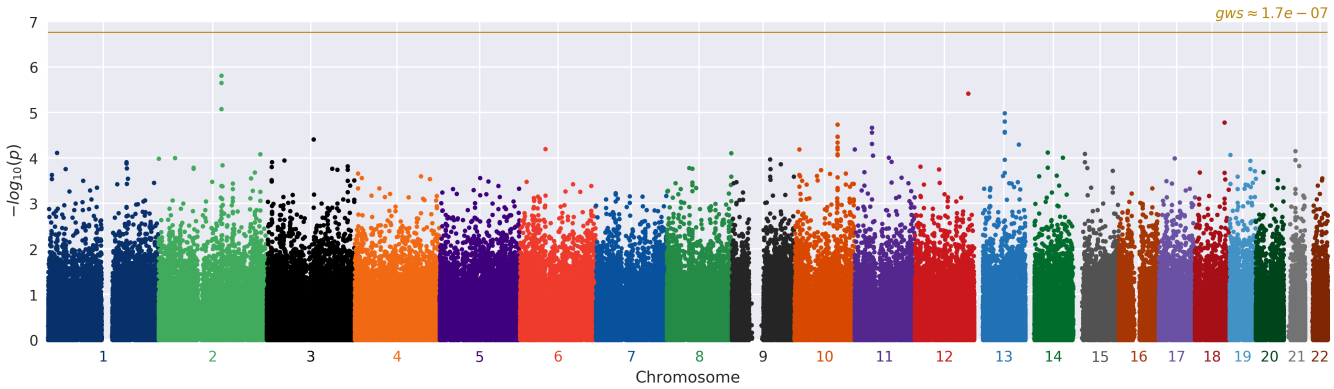
| Cohort | Array | Ancestry | Trans | Covars | PCs | N | Male | Female | Max | Min | $\mu$ | $\tilde{x}$ | $\sigma$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| META AFR | EX | AFR | invn | AGE_ANTHRO+AGE_ANTHRO2+SEX | 0 | 383 | 188 | 195 | 59.514 | 17.442 | 30.944 | 29.756 | 7.364 |
| META EUR | EX | EUR | invn | AGE_ANTHRO+AGE_ANTHRO2+SEX | 3 | 3075 | 1868 | 1207 | 59.671 | 15.49 | 28.845 | 27.955 | 5.797 |

## 5.2 Calibration




(a) invn Adjusted AGE_ANTHRO+AGE_ANTHRO2+SEX

Figure 6: QQ plots for BMI in the META analysis




(a) invn Adjusted AGE_ANTHRO+AGE_ANTHRO2+SEX

Figure 7: Manhattan plots for BMI in the META analysis

## 5.3 Top associations

Table 8: Top variants in the META invn Adjusted AGE_ANTHRO+AGE_ANTHRO2+SEX model (**bold** variants indicate previously identified associations)

| CHR | POS | ID | EA | OA | $GENE_{CLOSEST}$ | DIR | N | MALE | FEMALE | $FREQ_{AVG}$ | $FREQ_{MIN}$ | $FREQ_{MAX}$ | EFFECT | STDERR | OR | ZSCORE | P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 141190436 | rs11897270 | T | C | **LRP1B** | ++ | 3,442 | 2,044 | 1,398 | 0.334 | 0.331 | 0.358 | 0.123 | $2.56 \cdot 10^{-2}$ | 1.131 | 4.807 | $1.53 \cdot 10^{-6}$ |
| 12 | 120029538 | rs5005556 | G | A | TMEM233 | ++ | 3,458 | 2,056 | 1,402 | $6.26 \cdot 10^{-2}$ | $4.73 \cdot 10^{-2}$ | 0.185 | 0.23 | $4.97 \cdot 10^{-2}$ | 1.258 | −4.62 | $3.84 \cdot 10^{-6}$ |
| 13 | 68518831 | rs2175815 | T | C | PCDH9 | ++ | 3,458 | 2,056 | 1,402 | 0.478 | 0.478 | 0.482 | 0.106 | $2.39 \cdot 10^{-2}$ | 1.111 | −4.41 | $1.03 \cdot 10^{-5}$ |
| 18 | 66541652 | rs948638 | C | A | CCDC102B | ++ | 3,458 | 2,056 | 1,402 | 0.762 | 0.758 | 0.792 | 0.12 | $2.8 \cdot 10^{-2}$ | 1.128 | 4.307 | $1.65 \cdot 10^{-5}$ |
| 10 | 96493058 | rs1126545 | C | T | CYP2C18 | ++ | 3,458 | 2,056 | 1,402 | 0.153 | 0.145 | 0.211 | 0.143 | $3.33 \cdot 10^{-2}$ | 1.153 | −4.284 | $1.83 \cdot 10^{-5}$ |
| 11 | 38590019 | rs4756448 | A | G | LRRC4C | ++ | 3,452 | 2,052 | 1,400 | 0.869 | 0.336 | 0.935 | 0.183 | $4.31 \cdot 10^{-2}$ | 1.201 | 4.251 | $2.13 \cdot 10^{-5}$ |
| 3 | 105333715 | rs7621204 | C | T | ALCAM | ++ | 3,458 | 2,056 | 1,402 | 0.319 | 0.234 | 0.33 | 0.104 | $2.53 \cdot 10^{-2}$ | 1.11 | 4.115 | $3.87 \cdot 10^{-5}$ |
| 10 | 96602398 | rs28399513 | T | A | CYP2C19 | ++ | 3,431 | 2,038 | 1,393 | 0.151 | 0.144 | 0.211 | 0.138 | $3.37 \cdot 10^{-2}$ | 1.147 | −4.08 | $4.51 \cdot 10^{-5}$ |
| 13 | 100381250 | rs9517863 | A | G | CLYBL | ++ | 3,458 | 2,056 | 1,402 | 0.184 | 0.179 | 0.225 | 0.125 | $3.08 \cdot 10^{-2}$ | 1.133 | −4.054 | $5.04 \cdot 10^{-5}$ |
| 6 | 56920804 | rs12190575 | G | A | KIAA1586 | ++ | 3,455 | 2,054 | 1,401 | 0.153 | 0.152 | 0.153 | 0.134 | $3.34 \cdot 10^{-2}$ | 1.143 | 3.999 | $6.35 \cdot 10^{-5}$ |
| 10 | 10624738 | rs4131374 | A | G | CELF2 | ++ | 3,405 | 2,025 | 1,380 | 0.294 | 0.289 | 0.335 | 0.106 | $2.65 \cdot 10^{-2}$ | 1.112 | −3.997 | $6.41 \cdot 10^{-5}$ |
| 11 | 284503 | exm869836 | C | T | NLRP6 | ++ | 3,426 | 2,036 | 1,390 | $5.84 \cdot 10^{-4}$ | $4.93 \cdot 10^{-4}$ | $1.31 \cdot 10^{-3}$ | 1.987 | 0.497 | 7.291 | −3.997 | $6.41 \cdot 10^{-5}$ |
| 21 | 26305530 | rs9984573 | C | A | MRPL39 | +- | 3,439 | 2,044 | 1,395 | 0.265 | $7.85 \cdot 10^{-2}$ | 0.288 | 0.11 | $2.77 \cdot 10^{-2}$ | 1.116 | −3.974 | $7.07 \cdot 10^{-5}$ |
| 14 | 50462432 | rs4900974 | G | T | ARF6 | ++ | 3,452 | 2,053 | 1,399 | 0.734 | 0.709 | 0.937 | 0.108 | $2.74 \cdot 10^{-2}$ | 1.115 | −3.959 | $7.52 \cdot 10^{-5}$ |
| 1 | 20645086 | rs35480773 | A | T | VWA5B1 | +- | 3,458 | 2,056 | 1,402 | $5.78 \cdot 10^{-2}$ | $5.22 \cdot 10^{-3}$ | $6.44 \cdot 10^{-2}$ | 0.201 | $5.07 \cdot 10^{-2}$ | 1.222 | 3.954 | $7.7 \cdot 10^{-5}$ |
| 8 | 144722192 | rs4873814 | G | A | ZNF623 | ++ | 3,458 | 2,056 | 1,402 | 0.13 | 0.123 | 0.189 | 0.142 | $3.59 \cdot 10^{-2}$ | 1.152 | 3.948 | $7.88 \cdot 10^{-5}$ |
| 15 | 26469100 | rs8026670 | G | A | GABRB3 | +- | 3,455 | 2,055 | 1,400 | 0.179 | 0.135 | 0.533 | 0.13 | $3.3 \cdot 10^{-2}$ | 1.139 | 3.942 | $8.07 \cdot 10^{-5}$ |
| 2 | 228293381 | rs4470337 | A | G | AGFG1 | ++ | 3,458 | 2,056 | 1,402 | 0.567 | 0.529 | 0.571 | $9.6 \cdot 10^{-2}$ | $2.44 \cdot 10^{-2}$ | 1.101 | −3.938 | $8.21 \cdot 10^{-5}$ |
| 19 | 1978271 | rs740423 | C | T | CSNK1G2 | ++ | 3,458 | 2,056 | 1,402 | 0.119 | $9.09 \cdot 10^{-2}$ | 0.347 | 0.148 | $3.77 \cdot 10^{-2}$ | 1.16 | −3.928 | $8.56 \cdot 10^{-5}$ |
| 14 | 84351424 | rs11159614 | G | A | FLRT2 | ++ | 3,450 | 2,049 | 1,401 | 0.114 | 0.107 | 0.17 | 0.147 | $3.78 \cdot 10^{-2}$ | 1.159 | −3.897 | $9.76 \cdot 10^{-5}$ |

## 5.4 Previously identified risk loci

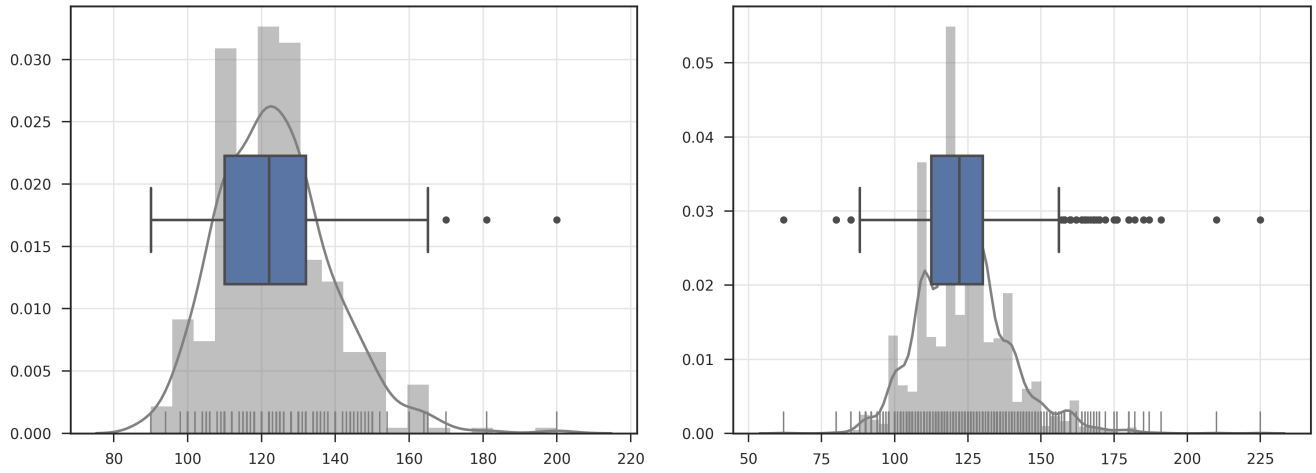
Table 9 shows statistics from the META cohort for 50 loci that were shown to be significantly associated with Body Mass Index in the 2015 Nature paper by Locke et al [11]. Where a previously reported variant was not genotyped in the study (indicated by $\bar{R^2} < 1$), if available, a tagging variant in LD with the reported variant ($\bar{R^2} >= 0.7$ and within 250kb) was provided. Tags were identified using 1000 Genomes data. There are 12 variants that show at least nominal significance ($p < 0.05$) in this study. Out of the 50 variants in both studies, 42 exhibit the same direction of effect with the known result (binomial test $p = 5.82e - 07$).

Table 9: Top known loci in META model invn Adjusted AGE_ANTHRO+AGE_ANTHRO2+SEX (**bold** variants indicate matching direction of effect)

| CHR | POS | ID | EA | OA | N | $FREQ_{AVG}$ | $FREQ_{MIN}$ | $FREQ_{MAX}$ | EFFECT | STDERR | P | DIR | $GENE_{CLOSEST}$ | $R^2$ | $ID_{KNOWN}$ | $N_{KNOWN}$ | $EFFECT_{KNOWN}$ | $STDERR_{KNOWN}$ | $P_{KNOWN}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16 | 53803574 | rs1558902 | A | T | 3,457 | 0.393 | 0.107 | 0.429 | $8.19 \cdot 10^{-2}$ | $2.51 \cdot 10^{-2}$ | $1.1 \cdot 10^{-3}$ | ++ | FTO | 1 | rs1558902 | $3.22 \cdot 10^{5}$ | $-8.18 \cdot 10^{-2}$ | $3.1 \cdot 10^{-3}$ | $7.51 \cdot 10^{-153}$ |
| 18 | 57839769 | rs571312 | C | A | 3,458 | 0.244 | 0.231 | 0.35 | $3.85 \cdot 10^{-2}$ | $2.76 \cdot 10^{-2}$ | 0.162 | ++ | MC4R | 1 | rs571312 | $3.22 \cdot 10^{5}$ | $-5.53 \cdot 10^{-2}$ | $3.6 \cdot 10^{-3}$ | $1.45 \cdot 10^{-52}$ |
| 2 | 622827 | **rs2867125** | C | T | 3,458 | 0.822 | 0.814 | 0.885 | $8.43 \cdot 10^{-2}$ | $3.13 \cdot 10^{-2}$ | $7.09 \cdot 10^{-3}$ | ++ | TMEM18 | 1 | rs2867125 | $3.22 \cdot 10^{5}$ | $5.92 \cdot 10^{-2}$ | $4 \cdot 10^{-3}$ | $2.81 \cdot 10^{-49}$ |
| 18 | 57757978 | rs11662368 | A | G | 3,452 | 0.259 | 0.257 | 0.272 | $2.26 \cdot 10^{-2}$ | $2.71 \cdot 10^{-2}$ | 0.405 | ++ | PMAIP1 | 1 | rs11662368 | $3.22 \cdot 10^{5}$ | $-4.8 \cdot 10^{-2}$ | $3.6 \cdot 10^{-3}$ | $1.2 \cdot 10^{-41}$ |
| 4 | 45175691 | **rs13130484** | T | C | 3,458 | 0.419 | 0.26 | 0.439 | $2.6 \cdot 10^{-3}$ | $2.41 \cdot 10^{-2}$ | 0.914 | +- | GNPDA2 | 1 | rs13130484 | $3.22 \cdot 10^{5}$ | $4.01 \cdot 10^{-2}$ | $3.1 \cdot 10^{-3}$ | $4.24 \cdot 10^{-38}$ |
| 1 | 177889480 | **rs543874** | G | A | 3,458 | 0.181 | 0.176 | 0.219 | $5.03 \cdot 10^{-2}$ | $3.15 \cdot 10^{-2}$ | 0.111 | +- | SEC16B | 1 | rs543874 | $3.22 \cdot 10^{5}$ | $4.82 \cdot 10^{-2}$ | $3.9 \cdot 10^{-3}$ | $2.62 \cdot 10^{-35}$ |
| 6 | 50865820 | **rs943005** | T | C | 3,458 | 0.164 | $9.4 \cdot 10^{-2}$ | 0.173 | $6.76 \cdot 10^{-2}$ | $3.25 \cdot 10^{-2}$ | $3.73 \cdot 10^{-2}$ | +- | TFAP2B | 1 | rs943005 | $3.22 \cdot 10^{5}$ | $4.43 \cdot 10^{-2}$ | $4 \cdot 10^{-3}$ | $1.39 \cdot 10^{-28}$ |
| 11 | 27728539 | **rs2030323** | C | A | 3,457 | 0.806 | 0.791 | 0.928 | $1.02 \cdot 10^{-2}$ | $3.08 \cdot 10^{-2}$ | 0.739 | ++ | BDNF | 1 | rs2030323 | $3.22 \cdot 10^{5}$ | $4.07 \cdot 10^{-2}$ | $3.8 \cdot 10^{-3}$ | $2.04 \cdot 10^{-27}$ |
| 1 | 72823713 | **rs990871** | T | C | 3,458 | 0.618 | 0.436 | 0.641 | $2.13 \cdot 10^{-2}$ | $2.52 \cdot 10^{-2}$ | 0.398 | ++ | NEGR1 | 1 | rs990871 | $3.22 \cdot 10^{5}$ | $3.29 \cdot 10^{-2}$ | $3.1 \cdot 10^{-3}$ | $1.17 \cdot 10^{-25}$ |
| 12 | 50247468 | **rs7138803** | A | G | 3,458 | 0.357 | 0.176 | 0.379 | $4.08 \cdot 10^{-2}$ | $2.52 \cdot 10^{-2}$ | 0.105 | ++ | BCDIN3D | 1 | rs7138803 | $3.22 \cdot 10^{5}$ | $3.15 \cdot 10^{-2}$ | $3.1 \cdot 10^{-3}$ | $8.15 \cdot 10^{-24}$ |
| 16 | 28885659 | **rs7359397** | T | C | 3,458 | 0.321 | $7.57 \cdot 10^{-2}$ | 0.351 | $8.87 \cdot 10^{-2}$ | $2.59 \cdot 10^{-2}$ | $6.04 \cdot 10^{-4}$ | ++ | SH2B1 | 1 | rs7359397 | $3.22 \cdot 10^{5}$ | $3.06 \cdot 10^{-2}$ | $3.1 \cdot 10^{-3}$ | $7.4 \cdot 10^{-23}$ |
| 2 | 25141538 | **rs11676272** | G | A | 3,458 | 0.503 | 0.461 | 0.834 | $4.88 \cdot 10^{-2}$ | $2.5 \cdot 10^{-2}$ | $5.08 \cdot 10^{-2}$ | ++ | ADCY3 | 1 | rs11676272 | $3.22 \cdot 10^{5}$ | $3.22 \cdot 10^{-2}$ | $3.4 \cdot 10^{-3}$ | $1.12 \cdot 10^{-21}$ |
| 16 | 28837515 | **rs8049439** | C | T | 3,457 | 0.367 | 0.36 | 0.415 | $7 \cdot 10^{-2}$ | $2.47 \cdot 10^{-2}$ | $4.67 \cdot 10^{-3}$ | +- | ATXN2L | 1 | rs8049439 | $3.22 \cdot 10^{5}$ | $2.96 \cdot 10^{-2}$ | $3.1 \cdot 10^{-3}$ | $1.55 \cdot 10^{-21}$ |
| 3 | 185834290 | **rs7647305** | C | T | 3,457 | 0.767 | 0.56 | 0.792 | $9.22 \cdot 10^{-3}$ | $2.89 \cdot 10^{-2}$ | 0.75 | ++ | ETV5 | 1 | rs7647305 | $3.22 \cdot 10^{5}$ | $3.58 \cdot 10^{-2}$ | $3.8 \cdot 10^{-3}$ | $1.35 \cdot 10^{-20}$ |
| 2 | 25169200 | **rs1172294** | G | A | 3,458 | 0.503 | 0.46 | 0.85 | $3.95 \cdot 10^{-2}$ | $2.5 \cdot 10^{-2}$ | 0.114 | ++ | DNAJC27 | 1 | rs1172294 | $3.22 \cdot 10^{5}$ | $2.7 \cdot 10^{-2}$ | $3.1 \cdot 10^{-3}$ | $3.32 \cdot 10^{-18}$ |
| 19 | 46202172 | **rs2287019** | C | T | 3,458 | 0.193 | 0.119 | 0.203 | $8.19 \cdot 10^{-3}$ | $3.07 \cdot 10^{-2}$ | 0.789 | ++ | QPCTL | 1 | rs2287019 | $3.22 \cdot 10^{5}$ | $3.6 \cdot 10^{-2}$ | $4.2 \cdot 10^{-3}$ | $4.59 \cdot 10^{-18}$ |
| 16 | 28490517 | **rs151181** | C | T | 3,457 | 0.344 | 0.158 | 0.367 | $6.82 \cdot 10^{-2}$ | $2.52 \cdot 10^{-2}$ | $6.83 \cdot 10^{-3}$ | ++ | CLN3 | 1 | rs151181 | $3.22 \cdot 10^{5}$ | $2.69 \cdot 10^{-2}$ | $3.1 \cdot 10^{-3}$ | $8.51 \cdot 10^{-18}$ |
| 16 | 19933600 | **rs12444979** | C | T | 3,458 | 0.145 | $7.83 \cdot 10^{-2}$ | 0.153 | 0.103 | $3.38 \cdot 10^{-2}$ | $2.34 \cdot 10^{-3}$ | ++ | GPRC5B | 1 | rs12444979 | $3.22 \cdot 10^{5}$ | $3.96 \cdot 10^{-2}$ | $4.6 \cdot 10^{-3}$ | $1.34 \cdot 10^{-17}$ |
| 16 | 28543381 | **rs12446550** | A | G | 3,451 | 0.359 | 0.217 | 0.377 | $6.67 \cdot 10^{-2}$ | $2.49 \cdot 10^{-2}$ | $7.44 \cdot 10^{-3}$ | +- | NUPR1 | 1 | rs12446550 | $3.22 \cdot 10^{5}$ | $2.6 \cdot 10^{-2}$ | $3.1 \cdot 10^{-3}$ | $1.46 \cdot 10^{-17}$ |
| 15 | 68086838 | **rs2241423** | G | A | 3,457 | 0.256 | 0.243 | 0.356 | $1.57 \cdot 10^{-2}$ | $2.78 \cdot 10^{-2}$ | 0.572 | +- | MAP2K5 | 1 | rs2241423 | $3.22 \cdot 10^{5}$ | $3.1 \cdot 10^{-2}$ | $3.7 \cdot 10^{-3}$ | $2.37 \cdot 10^{-17}$ |
| 11 | 47650993 | **rs3817334** | T | C | 3,458 | 0.404 | 0.261 | 0.422 | $1.1 \cdot 10^{-2}$ | $2.46 \cdot 10^{-2}$ | 0.656 | ++ | MTCH2 | 1 | rs3817334 | $3.22 \cdot 10^{5}$ | $2.62 \cdot 10^{-2}$ | $3.1 \cdot 10^{-3}$ | $5.15 \cdot 10^{-17}$ |
| 5 | 75015242 | **rs2112347** | T | G | 3,458 | 0.378 | 0.363 | 0.493 | $1.78 \cdot 10^{-2}$ | $2.5 \cdot 10^{-2}$ | 0.476 | ++ | POC5 | 1 | rs2112347 | $3.22 \cdot 10^{5}$ | $2.61 \cdot 10^{-2}$ | $3.1 \cdot 10^{-3}$ | $6.19 \cdot 10^{-17}$ |
| 16 | 28631585 | **rs1968752** | T | G | 3,441 | 0.649 | 0.497 | 0.668 | $5.06 \cdot 10^{-2}$ | $2.5 \cdot 10^{-2}$ | $4.29 \cdot 10^{-2}$ | +- | SULT1A1 | 1 | rs1968752 | $3.22 \cdot 10^{5}$ | $2.72 \cdot 10^{-2}$ | $3.3 \cdot 10^{-3}$ | $9.06 \cdot 10^{-17}$ |
| 11 | 47529947 | **rs7124681** | A | C | 3,458 | 0.405 | 0.262 | 0.422 | $1.54 \cdot 10^{-2}$ | $2.46 \cdot 10^{-2}$ | 0.532 | ++ | CELF1 | 1 | rs7124681 | $3.22 \cdot 10^{5}$ | $2.59 \cdot 10^{-2}$ | $3.1 \cdot 10^{-3}$ | $1.16 \cdot 10^{-16}$ |
| 12 | 50218644 | **rs1031477** | T | C | 3,458 | 0.517 | 0.517 | 0.521 | $4.45 \cdot 10^{-2}$ | $2.4 \cdot 10^{-2}$ | $6.29 \cdot 10^{-2}$ | ++ | NCKAP5L | 1 | rs1031477 | $3.22 \cdot 10^{5}$ | $2.47 \cdot 10^{-2}$ | $3.1 \cdot 10^{-3}$ | $6.17 \cdot 10^{-16}$ |
| 19 | 47569003 | **rs3810291** | A | G | 3,427 | 0.607 | 0.188 | 0.66 | $7.76 \cdot 10^{-2}$ | $2.58 \cdot 10^{-2}$ | $2.59 \cdot 10^{-3}$ | ++ | ZC3H4 | 1 | rs3810291 | $3.22 \cdot 10^{5}$ | $2.83 \cdot 10^{-2}$ | $3.6 \cdot 10^{-3}$ | $4.81 \cdot 10^{-15}$ |
| 11 | 27583129 | **rs7481311** | T | C | 3,458 | 0.793 | 0.696 | 0.805 | $4 \cdot 10^{-2}$ | $2.99 \cdot 10^{-2}$ | 0.181 | ++ | LIN7C | 1 | rs7481311 | $3.22 \cdot 10^{5}$ | $2.83 \cdot 10^{-2}$ | $3.6 \cdot 10^{-3}$ | $7.42 \cdot 10^{-15}$ |
| 5 | 74956517 | **rs253414** | T | C | 3,453 | 0.646 | 0.457 | 0.67 | $1.8 \cdot 10^{-3}$ | $2.54 \cdot 10^{-2}$ | 0.944 | +- | ANKDD1B | 1 | rs253414 | $3.22 \cdot 10^{5}$ | $2.68 \cdot 10^{-2}$ | $3.5 \cdot 10^{-3}$ | $2.86 \cdot 10^{-14}$ |
| 9 | 28414339 | rs10968576 | A | G | 3,457 | 0.292 | 0.176 | 0.306 | $2.21 \cdot 10^{-2}$ | $2.67 \cdot 10^{-2}$ | 0.408 | +- | LINGO2 | 1 | rs10968576 | $3.22 \cdot 10^{5}$ | $-2.49 \cdot 10^{-2}$ | $3.3 \cdot 10^{-3}$ | $6.61 \cdot 10^{-14}$ |
| 11 | 47432303 | **rs755553** | G | A | 3,457 | 0.65 | 0.602 | 0.656 | $4.74 \cdot 10^{-3}$ | $2.54 \cdot 10^{-2}$ | 0.852 | +- | SLC39A13 | 1 | rs755553 | $3.22 \cdot 10^{5}$ | $2.45 \cdot 10^{-2}$ | $3.3 \cdot 10^{-3}$ | $7.31 \cdot 10^{-14}$ |
| 12 | 50263148 | **rs7132908** | A | G | 3,457 | 0.365 | 0.164 | 0.39 | $2.23 \cdot 10^{-2}$ | $2.52 \cdot 10^{-2}$ | 0.376 | ++ | FAIM2 | 1 | rs7132908 | $3.22 \cdot 10^{5}$ | $3.41 \cdot 10^{-2}$ | $4.6 \cdot 10^{-3}$ | $1.23 \cdot 10^{-13}$ |
| 1 | 74991644 | **rs1514175** | A | G | 3,458 | 0.55 | 0.325 | 0.578 | $1.73 \cdot 10^{-2}$ | $2.42 \cdot 10^{-2}$ | 0.475 | +- | FPGT-TNNI3K | 1 | rs1514175 | $3.22 \cdot 10^{5}$ | $2.3 \cdot 10^{-2}$ | $3.1 \cdot 10^{-3}$ | $1.46 \cdot 10^{-13}$ |
| 1 | 110082886 | **rs7550711** | T | C | 3,458 | $2.46 \cdot 10^{-2}$ | $1.44 \cdot 10^{-2}$ | $2.59 \cdot 10^{-2}$ | $8.99 \cdot 10^{-2}$ | $7.7 \cdot 10^{-2}$ | 0.243 | +- | GPR61 | 1 | rs7550711 | $3.22 \cdot 10^{5}$ | $6.62 \cdot 10^{-2}$ | $9 \cdot 10^{-3}$ | $1.56 \cdot 10^{-13}$ |
| 11 | 47385923 | **rs10838698** | G | A | 3,458 | 0.665 | 0.654 | 0.752 | $1 \cdot 10^{-2}$ | $2.58 \cdot 10^{-2}$ | 0.697 | +- | SPI1 | 1 | rs10838698 | $3.22 \cdot 10^{5}$ | $2.45 \cdot 10^{-2}$ | $3.3 \cdot 10^{-3}$ | $1.9 \cdot 10^{-13}$ |
| 16 | 28980531 | **rs11150675** | G | A | 3,456 | 0.326 | 0.121 | 0.352 | $4.67 \cdot 10^{-2}$ | $2.59 \cdot 10^{-2}$ | $7.14 \cdot 10^{-2}$ | ++ | NFATC2IP | 1 | rs11150675 | $3.22 \cdot 10^{5}$ | $2.38 \cdot 10^{-2}$ | $3.2 \cdot 10^{-3}$ | $2.03 \cdot 10^{-13}$ |
| 3 | 85850041 | **rs7640660** | T | C | 3,452 | 0.239 | 0.224 | 0.358 | $1.06 \cdot 10^{-2}$ | $2.86 \cdot 10^{-2}$ | 0.712 | -+ | CADM2 | 1 | rs7640660 | $3.22 \cdot 10^{5}$ | $2.75 \cdot 10^{-2}$ | $3.8 \cdot 10^{-3}$ | $3.97 \cdot 10^{-13}$ |
| 16 | 28992646 | **rs3922668** | G | A | 3,456 | 0.409 | 0.373 | 0.702 | $4.85 \cdot 10^{-2}$ | $2.49 \cdot 10^{-2}$ | $5.2 \cdot 10^{-2}$ | ++ | SPNS1 | 1 | rs3922668 | $3.22 \cdot 10^{5}$ | $2.35 \cdot 10^{-2}$ | $3.3 \cdot 10^{-3}$ | $9.6 \cdot 10^{-13}$ |
| 13 | 54102206 | **rs12429545** | A | G | 3,458 | 0.121 | $4.96 \cdot 10^{-2}$ | 0.13 | $6.41 \cdot 10^{-3}$ | $3.72 \cdot 10^{-2}$ | 0.863 | -+ | OLFM4 | 1 | rs12429545 | $3.22 \cdot 10^{5}$ | $3.34 \cdot 10^{-2}$ | $4.7 \cdot 10^{-3}$ | $1.09 \cdot 10^{-12}$ |
| 1 | 49438005 | rs3127553 | A | G | 3,458 | 0.647 | 0.636 | 0.735 | $1.65 \cdot 10^{-2}$ | $2.52 \cdot 10^{-2}$ | 0.512 | ++ | AGBL4 | 1 | rs3127553 | $3.22 \cdot 10^{5}$ | $-2.3 \cdot 10^{-2}$ | $3.2 \cdot 10^{-3}$ | $1.25 \cdot 10^{-12}$ |
| 11 | 115022404 | **rs12286929** | G | A | 3,457 | 0.536 | 0.532 | 0.573 | $1.29 \cdot 10^{-2}$ | $2.41 \cdot 10^{-2}$ | 0.595 | ++ | CADM1 | 1 | rs12286929 | $3.22 \cdot 10^{5}$ | $2.17 \cdot 10^{-2}$ | $3.1 \cdot 10^{-3}$ | $1.31 \cdot 10^{-12}$ |
| 4 | 103188709 | **rs13107325** | T | C | 3,458 | $7.53 \cdot 10^{-2}$ | $1.31 \cdot 10^{-2}$ | $8.31 \cdot 10^{-2}$ | $7.66 \cdot 10^{-2}$ | $4.59 \cdot 10^{-2}$ | $9.54 \cdot 10^{-2}$ | +- | SLC39A8 | 1 | rs13107325 | $3.22 \cdot 10^{5}$ | $4.77 \cdot 10^{-2}$ | $6.8 \cdot 10^{-3}$ | $1.83 \cdot 10^{-12}$ |
| 10 | 114758349 | **rs7903146** | C | T | 3,458 | 0.303 | 0.283 | 0.306 | $6.93 \cdot 10^{-4}$ | $2.62 \cdot 10^{-2}$ | 0.979 | -+ | TCF7L2 | 1 | rs7903146 | $3.22 \cdot 10^{5}$ | $2.34 \cdot 10^{-2}$ | $3.4 \cdot 10^{-3}$ | $1.11 \cdot 10^{-11}$ |
| 11 | 47694699 | **rs4539273** | T | C | 3,412 | 0.546 | 0.537 | 0.612 | $2.84 \cdot 10^{-2}$ | $2.41 \cdot 10^{-2}$ | 0.239 | ++ | AGBL2 | 1 | rs4539273 | $3.22 \cdot 10^{5}$ | $2.05 \cdot 10^{-2}$ | $3.1 \cdot 10^{-3}$ | $1.69 \cdot 10^{-11}$ |
| 2 | 59305625 | **rs1016287** | T | C | 3,457 | 0.701 | 0.693 | 0.766 | $1.73 \cdot 10^{-2}$ | $2.61 \cdot 10^{-2}$ | 0.508 | +- | FANCL | 1 | rs1016287 | $3.22 \cdot 10^{5}$ | $2.29 \cdot 10^{-2}$ | $3.4 \cdot 10^{-3}$ | $2.25 \cdot 10^{-11}$ |
| 11 | 27471596 | rs4923445 | G | A | 3,458 | 0.161 | $9.27 \cdot 10^{-2}$ | 0.169 | $3.57 \cdot 10^{-2}$ | $3.3 \cdot 10^{-2}$ | 0.279 | ++ | LGR4 | 1 | rs4923445 | $3.22 \cdot 10^{5}$ | $-2.74 \cdot 10^{-2}$ | $4.1 \cdot 10^{-3}$ | $2.26 \cdot 10^{-11}$ |
| 16 | 28944396 | rs2904880 | C | G | 3,458 | 0.736 | 0.71 | 0.941 | $6.02 \cdot 10^{-2}$ | $2.72 \cdot 10^{-2}$ | $2.69 \cdot 10^{-2}$ | ++ | CD19 | 1 | rs2904880 | $3.22 \cdot 10^{5}$ | $-2.39 \cdot 10^{-2}$ | $3.6 \cdot 10^{-3}$ | $4.11 \cdot 10^{-11}$ |
| 16 | 28594549 | **rs4788073** | G | A | 3,458 | 0.322 | 0.205 | 0.336 | $7.12 \cdot 10^{-2}$ | $2.57 \cdot 10^{-2}$ | $5.59 \cdot 10^{-3}$ | ++ | SGF29 | 1 | rs4788073 | $3.22 \cdot 10^{5}$ | $2.5 \cdot 10^{-2}$ | $3.8 \cdot 10^{-3}$ | $4.74 \cdot 10^{-11}$ |
| 11 | 47929846 | rs6485795 | A | G | 3,458 | 0.282 | $7.44 \cdot 10^{-2}$ | 0.308 | $7.08 \cdot 10^{-3}$ | $2.7 \cdot 10^{-2}$ | 0.793 | ++ | NUP160 | 1 | rs6485795 | $3.22 \cdot 10^{5}$ | $-2.24 \cdot 10^{-2}$ | $3.4 \cdot 10^{-3}$ | $6.31 \cdot 10^{-11}$ |
| 8 | 76608407 | **rs2588790** | C | T | 3,458 | 0.256 | $6.4 \cdot 10^{-2}$ | 0.28 | $9.58 \cdot 10^{-3}$ | $2.73 \cdot 10^{-2}$ | 0.726 | +- | HNF4G | 1 | rs2588790 | $3.22 \cdot 10^{5}$ | $2.71 \cdot 10^{-2}$ | $4.2 \cdot 10^{-3}$ | $1.1 \cdot 10^{-10}$ |
| 2 | 213413231 | **rs7599312** | G | A | 3,458 | 0.27 | 0.253 | 0.406 | $2.53 \cdot 10^{-2}$ | $2.71 \cdot 10^{-2}$ | 0.35 | ++ | ERBB4 | 1 | rs7599312 | $3.22 \cdot 10^{5}$ | $2.2 \cdot 10^{-2}$ | $3.4 \cdot 10^{-3}$ | $1.17 \cdot 10^{-10}$ |

# 6 Systolic Blood Pressure (SBP15)

## 6.1 Summary




(a) AFR

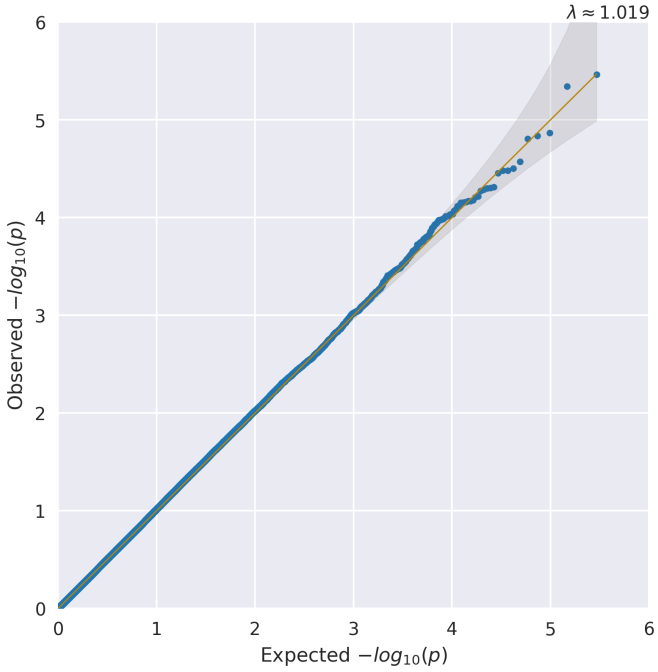
(b) EUR

Figure 8: Distribution of SBP15 in META by cohort

Table 10: Samples with Systolic Blood Pressure data summarized by cohort, transformation, and run-time adjustments

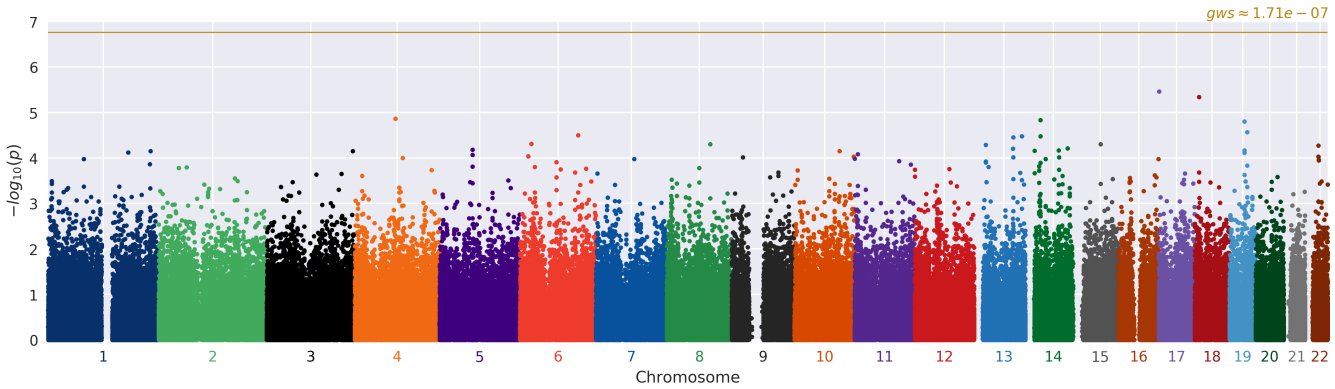
| Cohort | Array | Ancestry | Trans | Covars | PCs | N | Male | Female | Max | Min | $\mu$ | $\tilde{x}$ | $\sigma$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| META AFR | EX | AFR | invn | AGE_BP+AGE_BP2+SEX+BMI | 3 | 374 | 187 | 187 | 200.0 | 90.0 | 123.545 | 122.0 | 15.336 |
| META EUR | EX | EUR | invn | AGE_BP+AGE_BP2+SEX+BMI | 0 | 3063 | 1863 | 1200 | 225.0 | 80.0 | 123.536 | 122.0 | 14.992 |

## 6.2 Calibration




(a) invn Adjusted AGE_BP+AGE_BP2+SEX+BMI

Figure 9: QQ plots for SBP15 in the META analysis




(a) invn Adjusted AGE_BP+AGE_BP2+SEX+BMI

Figure 10: Manhattan plots for SBP15 in the META analysis

## 6.3 Top associations

Table 11: Top variants in the META invn Adjusted AGE_BP+AGE_BP2+SEX+BMI model (**bold** variants indicate previously identified associations)

| CHR | POS | ID | EA | OA | $GENE_{CLOSEST}$ | DIR | N | MALE | FEMALE | $FREQ_{AVG}$ | $FREQ_{MIN}$ | $FREQ_{MAX}$ | EFFECT | STDERR | OR | ZSCORE | P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17 | 650156 | rs182380523 | A | G | GEMIN4 | ++ | 3,437 | 2,050 | 1,387 | $5.53 \cdot 10^{-3}$ | $3.1 \cdot 10^{-3}$ | $2.54 \cdot 10^{-2}$ | 0.743 | 0.16 | 2.101 | −4.643 | $3.44 \cdot 10^{-6}$ |
| 18 | 9629316 | rs682431 | T | G | PPP4R1 | ++ | 3,435 | 2,048 | 1,387 | 0.329 | 0.316 | 0.33 | 0.117 | $2.54 \cdot 10^{-2}$ | 1.124 | −4.585 | $4.53 \cdot 10^{-6}$ |
| 4 | 91952313 | rs6819554 | C | T | CCSER1 | +- | 3,437 | 2,050 | 1,387 | 0.534 | 0.513 | 0.703 | 0.105 | $2.42 \cdot 10^{-2}$ | 1.111 | −4.35 | $1.36 \cdot 10^{-5}$ |
| 14 | 33970530 | rs17091741 | A | G | NPAS3 | ++ | 3,435 | 2,048 | 1,387 | 0.201 | $9.63 \cdot 10^{-2}$ | 0.213 | 0.131 | $3.02 \cdot 10^{-2}$ | 1.14 | −4.336 | $1.45 \cdot 10^{-5}$ |
| 19 | 33358012 | rs10404771 | G | T | SLC7A9 | ++ | 3,436 | 2,050 | 1,386 | 0.201 | 0.2 | 0.205 | 0.13 | $3.01 \cdot 10^{-2}$ | 1.139 | 4.321 | $1.56 \cdot 10^{-5}$ |
| 19 | 39542089 | rs7259197 | G | A | FBXO27 | ++ | 3,437 | 2,050 | 1,387 | 0.555 | 0.503 | 0.562 | 0.102 | $2.43 \cdot 10^{-2}$ | 1.107 | 4.199 | $2.68 \cdot 10^{-5}$ |
| 6 | 130966801 | rs2136055 | T | C | SMLR1 | +- | 3,417 | 2,039 | 1,378 | 0.338 | 0.298 | 0.661 | 0.11 | $2.65 \cdot 10^{-2}$ | 1.116 | 4.164 | $3.13 \cdot 10^{-5}$ |
| 13 | 107171744 | rs7490924 | G | A | EFNB2 | ++ | 3,429 | 2,046 | 1,383 | 0.539 | 0.432 | 0.552 | 0.101 | $2.43 \cdot 10^{-2}$ | 1.106 | 4.151 | $3.31 \cdot 10^{-5}$ |
| 13 | 87599109 | rs1718018 | C | A | SLITRK5 | ++ | 3,404 | 2,027 | 1,377 | 0.242 | 0.233 | 0.316 | 0.118 | $2.84 \cdot 10^{-2}$ | 1.125 | 4.137 | $3.52 \cdot 10^{-5}$ |
| 6 | 25758448 | rs17268697 | G | T | SLC17A4 | +- | 3,437 | 2,050 | 1,387 | 0.133 | $3.61 \cdot 10^{-2}$ | 0.145 | 0.144 | $3.55 \cdot 10^{-2}$ | 1.155 | −4.062 | $4.87 \cdot 10^{-5}$ |
| 8 | 97534651 | rs2575735 | C | T | SDC2 | ++ | 3,393 | 2,031 | 1,362 | 0.674 | 0.57 | 0.686 | 0.106 | $2.62 \cdot 10^{-2}$ | 1.112 | −4.057 | $4.96 \cdot 10^{-5}$ |
| 15 | 61994134 | rs2414739 | G | A | VPS13C | ++ | 3,437 | 2,050 | 1,387 | 0.707 | 0.519 | 0.73 | 0.109 | $2.69 \cdot 10^{-2}$ | 1.115 | −4.056 | $5 \cdot 10^{-5}$ |
| 13 | 25831888 | rs7995033 | T | C | MTMR6 | ++ | 3,437 | 2,050 | 1,387 | 0.766 | 0.251 | 0.829 | 0.126 | $3.11 \cdot 10^{-2}$ | 1.134 | −4.048 | $5.17 \cdot 10^{-5}$ |
| 22 | 29791234 | rs174775 | G | A | AP1B1 | +- | 3,437 | 2,050 | 1,387 | 0.575 | 0.536 | 0.893 | 0.1 | $2.48 \cdot 10^{-2}$ | 1.106 | 4.04 | $5.34 \cdot 10^{-5}$ |
| 14 | 95297441 | rs1243513 | G | A | GSC | ++ | 3,437 | 2,050 | 1,387 | 0.553 | 0.278 | 0.586 | $9.85 \cdot 10^{-2}$ | $2.46 \cdot 10^{-2}$ | 1.104 | −4.01 | $6.07 \cdot 10^{-5}$ |
| 5 | 74324548 | rs3811987 | A | G | GCNT4 | ++ | 3,436 | 2,050 | 1,386 | 0.334 | 0.294 | 0.664 | 0.106 | $2.66 \cdot 10^{-2}$ | 1.112 | 3.99 | $6.61 \cdot 10^{-5}$ |
| 14 | 75165825 | rs4899530 | A | G | AC007956 | ++ | 3,435 | 2,050 | 1,385 | 0.235 | 0.203 | 0.496 | 0.116 | $2.92 \cdot 10^{-2}$ | 1.124 | −3.983 | $6.8 \cdot 10^{-5}$ |
| 14 | 20920250 | rs2275007 | T | C | OSGEP | ++ | 3,437 | 2,050 | 1,387 | 0.595 | 0.579 | 0.597 | $9.75 \cdot 10^{-2}$ | $2.45 \cdot 10^{-2}$ | 1.102 | −3.979 | $6.92 \cdot 10^{-5}$ |
| 10 | 101222490 | rs11593108 | T | C | GOT1 | ++ | 3,437 | 2,050 | 1,387 | 0.155 | 0.1 | 0.161 | 0.133 | $3.34 \cdot 10^{-2}$ | 1.142 | 3.977 | $6.99 \cdot 10^{-5}$ |
| 3 | 193806588 | rs9872487 | G | A | HES1 | ++ | 3,435 | 2,048 | 1,387 | 0.265 | 0.224 | 0.603 | 0.115 | $2.9 \cdot 10^{-2}$ | 1.122 | 3.975 | $7.03 \cdot 10^{-5}$ |

## 6.4 Previously identified risk loci

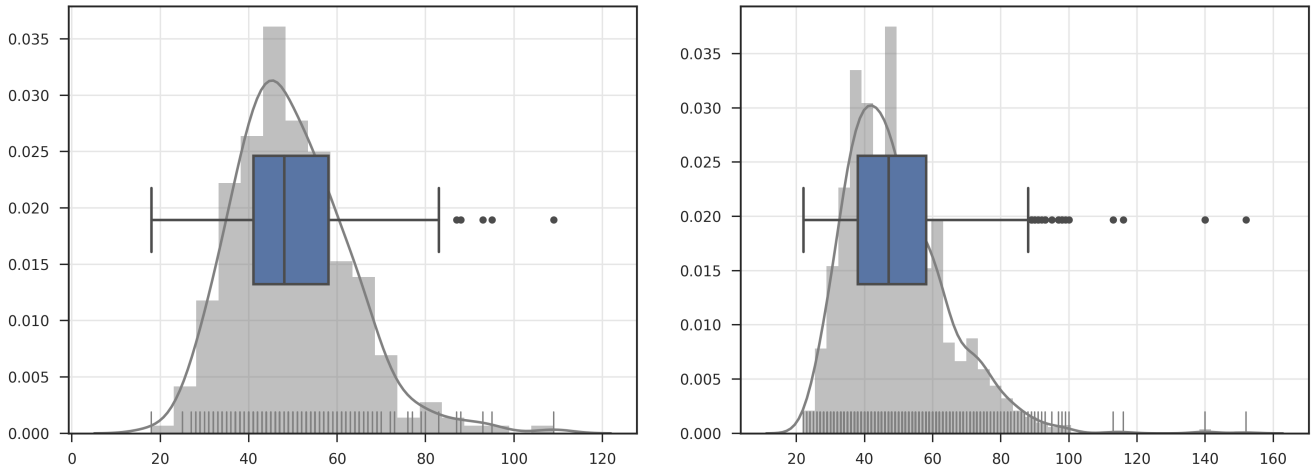
Table 12 shows statistics from the META cohort for 21 loci that were shown to be significantly associated with Systolic Blood Pressure in the 2011 Nature paper by Ehret et al [15]. Where a previously reported variant was not genotyped in the study (indicated by $\bar{R}^2 < 1$), if available, a tagging variant in LD with the reported variant ($\bar{R}^2 >= 0.7$ and within 250kb) was provided. Tags were identified using 1000 Genomes data. None of the variants shows even nominal significance ($p < 0.05$) in this study. Out of the 19 variants in both studies, 9 exhibit the same direction of effect with the known result (binomial test $p = 0.676$).

Table 12: Top known loci in META model invn Adjusted AGE_BP+AGE_BP2+SEX+BMI (**bold** variants indicate matching direction of effect)

| CHR | POS | ID | EA | OA | N | $FREQ_{AVG}$ | $FREQ_{MIN}$ | $FREQ_{MAX}$ | EFFECT | STDERR | P | DIR | $GENE_{CLOSEST}$ | $R^2$ | $ID_{KNOWN}$ | $N_{KNOWN}$ | $EFFECT_{KNOWN}$ | $STDERR_{KNOWN}$ | $P_{KNOWN}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12 | 90060586 | **rs17249754** | G | A | 3,437 | 0.185 | 0.14 | 0.191 | $2.51 \cdot 10^{-2}$ | $3.1 \cdot 10^{-2}$ | 0.417 | +- | ATP2B1 | 1 | rs17249754 | $2 \cdot 10^5$ | 0.955 | 0.134 | $9.73 \cdot 10^{-13}$ |
| 1 | 11862778 | **rs17367504** | G | A | 3,437 | 0.135 | 0.116 | 0.138 | $7.72 \cdot 10^{-3}$ | $3.54 \cdot 10^{-2}$ | 0.827 | +- | MTHFR | 1 | rs17367504 | $2 \cdot 10^5$ | 0.861 | 0.136 | $2.11 \cdot 10^{-10}$ |
| 15 | 75077367 | rs1378942 | A | C | 3,437 | 0.584 | 0.126 | 0.64 | $2.53 \cdot 10^{-2}$ | $2.61 \cdot 10^{-2}$ | 0.332 | ++ | CSK | 1 | rs1378942 | $2 \cdot 10^5$ | −0.632 | 0.101 | $3.43 \cdot 10^{-10}$ |
| 1 | 11887303 | **rs7537765** | G | A | 3,437 | 0.152 | 0.139 | 0.261 | $3.27 \cdot 10^{-2}$ | $3.37 \cdot 10^{-2}$ | 0.331 | ++ | CLCN6 | 1 | rs7537765 | $2 \cdot 10^5$ | 0.84 | 0.135 | $4.73 \cdot 10^{-10}$ |
| 10 | 104846178 | **rs11191548** | T | C | 3,426 | $7.85 \cdot 10^{-2}$ | $6.15 \cdot 10^{-2}$ | $8.06 \cdot 10^{-2}$ | $6.38 \cdot 10^{-2}$ | $4.42 \cdot 10^{-2}$ | 0.149 | ++ | CNNM2 | 1 | rs11191548 | $2 \cdot 10^5$ | 1.083 | 0.174 | $5.03 \cdot 10^{-10}$ |
| 10 | 104939215 | **rs11191593** | T | C | 3,436 | $8.31 \cdot 10^{-2}$ | $7.75 \cdot 10^{-2}$ | $8.38 \cdot 10^{-2}$ | $6.16 \cdot 10^{-2}$ | $4.31 \cdot 10^{-2}$ | 0.153 | ++ | NT5C2 | 1 | rs11191593 | $2 \cdot 10^5$ | 1.075 | 0.173 | $5.43 \cdot 10^{-10}$ |
| 10 | 104594507 | rs1004467 | A | G | 3,437 | 0.106 | $9.45 \cdot 10^{-2}$ | 0.198 | $4.3 \cdot 10^{-2}$ | $3.9 \cdot 10^{-2}$ | 0.27 | ++ | CYP17A1 | 1 | rs1004467 | $2 \cdot 10^5$ | −1.01 | 0.164 | $6.61 \cdot 10^{-10}$ |
| 12 | 112007756 | rs653178 | C | T | 3,437 | 0.534 | 0.488 | 0.908 | $2.71 \cdot 10^{-3}$ | $2.46 \cdot 10^{-2}$ | 0.912 | +- | ATXN2 | 1 | rs653178 | $2 \cdot 10^5$ | −0.605 | $9.88 \cdot 10^{-2}$ | $9.3 \cdot 10^{-10}$ |
| 12 | 89942390 | rs11105328 | A | G | 3,437 | 0.18 | 0.144 | 0.185 | $3.91 \cdot 10^{-2}$ | $3.14 \cdot 10^{-2}$ | 0.213 | ++ | POC1B-GALNT4 | 1 | rs11105328 | $2 \cdot 10^5$ | −0.838 | 0.137 | $1.08 \cdot 10^{-9}$ |
| 10 | 104660004 | rs11191454 | A | G | 3,437 | $7.55 \cdot 10^{-2}$ | $1.87 \cdot 10^{-2}$ | $8.24 \cdot 10^{-2}$ | $6.11 \cdot 10^{-2}$ | $4.56 \cdot 10^{-2}$ | 0.18 | ++ | BORCS7-ASMT | 1 | rs11191454 | $2 \cdot 10^5$ | −1.043 | 0.171 | $1.12 \cdot 10^{-9}$ |
| 12 | 111884608 | **rs3184504** | T | C | 3,437 | 0.535 | 0.49 | 0.908 | $5.11 \cdot 10^{-3}$ | $2.47 \cdot 10^{-2}$ | 0.836 | +- | SH2B3 | 1 | rs3184504 | $2 \cdot 10^5$ | 0.598 | $9.93 \cdot 10^{-2}$ | $1.69 \cdot 10^{-9}$ |
| 4 | 81164723 | **rs1458038** | T | C | 3,437 | 0.257 | $8.42 \cdot 10^{-2}$ | 0.278 | $2.37 \cdot 10^{-2}$ | $2.75 \cdot 10^{-2}$ | 0.389 | ++ | FGF5 | 1 | rs1458038 | $2 \cdot 10^5$ | 0.662 | 0.111 | $2.12 \cdot 10^{-9}$ |
| 11 | 16902268 | rs381815 | C | T | 3,428 | 0.275 | 0.189 | 0.285 | $2.25 \cdot 10^{-2}$ | $2.72 \cdot 10^{-2}$ | 0.408 | +- | PLEKHA7 | 1 | rs381815 | $2 \cdot 10^5$ | −0.655 | 0.11 | $2.45 \cdot 10^{-9}$ |
| 10 | 104546284 | **rs486955** | T | C | 3,435 | 0.879 | 0.723 | 0.898 | $1.58 \cdot 10^{-2}$ | $3.75 \cdot 10^{-2}$ | 0.674 | ++ | WBP1L | 1 | rs486955 | $2 \cdot 10^5$ | 0.895 | 0.156 | $9.47 \cdot 10^{-9}$ |
| 12 | 112072424 | rs11065987 | A | G | 3,436 | 0.421 | $8.16 \cdot 10^{-2}$ | 0.463 | $5.82 \cdot 10^{-3}$ | $2.47 \cdot 10^{-2}$ | 0.814 | ++ | BRAP | 1 | rs11065987 | $2 \cdot 10^5$ | −0.57 | 0.102 | $2.12 \cdot 10^{-8}$ |
| 15 | 75115895 | rs7162232 | A | G | 3,436 | 0.692 | 0.578 | 0.706 | $2.43 \cdot 10^{-2}$ | $2.61 \cdot 10^{-2}$ | 0.352 | +- | LMAN1L | 1 | rs7162232 | $2 \cdot 10^5$ | −0.606 | 0.109 | $2.33 \cdot 10^{-8}$ |
| 12 | 112486818 | **rs17696736** | G | A | 3,437 | 0.431 | $8.56 \cdot 10^{-2}$ | 0.473 | $5.57 \cdot 10^{-3}$ | $2.46 \cdot 10^{-2}$ | 0.821 | +- | NAA25 | 1 | rs17696736 | $2 \cdot 10^5$ | 0.549 | $9.96 \cdot 10^{-2}$ | $3.43 \cdot 10^{-8}$ |
| 11 | 100593538 | rs633185 | C | G | 3,434 | 0.719 | 0.711 | 0.783 | $1.85 \cdot 10^{-2}$ | $2.7 \cdot 10^{-2}$ | 0.493 | +- | ARHGAP42 | 1 | rs633185 | $2 \cdot 10^5$ | −0.584 | 0.107 | $5.23 \cdot 10^{-8}$ |
| 10 | 104652323 | rs11191447 | C | T | 3,437 | $8.41 \cdot 10^{-2}$ | $8.02 \cdot 10^{-2}$ | $8.46 \cdot 10^{-2}$ | $8.05 \cdot 10^{-2}$ | $4.3 \cdot 10^{-2}$ | $6.12 \cdot 10^{-2}$ | ++ | AS3MT | 1 | rs3740390 | $2 \cdot 10^5$ | −1.005 | 0.172 | $4.61 \cdot 10^{-9}$ |
| 12 | 112486818 | **rs17696736** | G | A | 3,437 | 0.431 | $8.56 \cdot 10^{-2}$ | 0.473 | $5.57 \cdot 10^{-3}$ | $2.46 \cdot 10^{-2}$ | 0.821 | +- | TRAFD1 | 0.922 | rs17630235 | $2 \cdot 10^5$ | 0.569 | 0.1 | $1.45 \cdot 10^{-8}$ |
| 12 | 112486818 | **rs17696736** | G | A | 3,437 | 0.431 | $8.56 \cdot 10^{-2}$ | 0.473 | $5.57 \cdot 10^{-3}$ | $2.46 \cdot 10^{-2}$ | 0.821 | +- | HECTD4 | 0.913 | rs11066188 | $2 \cdot 10^5$ | 0.567 | 0.101 | $1.72 \cdot 10^{-8}$ |

# 7 HDL Cholesterol (HDL)

## 7.1 Summary




(a) AFR

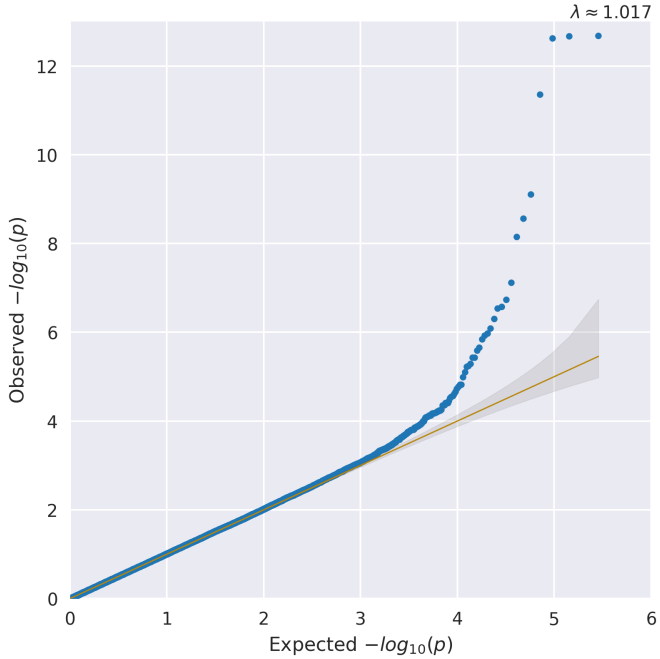
(b) EUR

Figure 11: Distribution of HDL in META by cohort

Table 13: Samples with HDL Cholesterol data summarized by cohort, transformation, and run-time adjustments

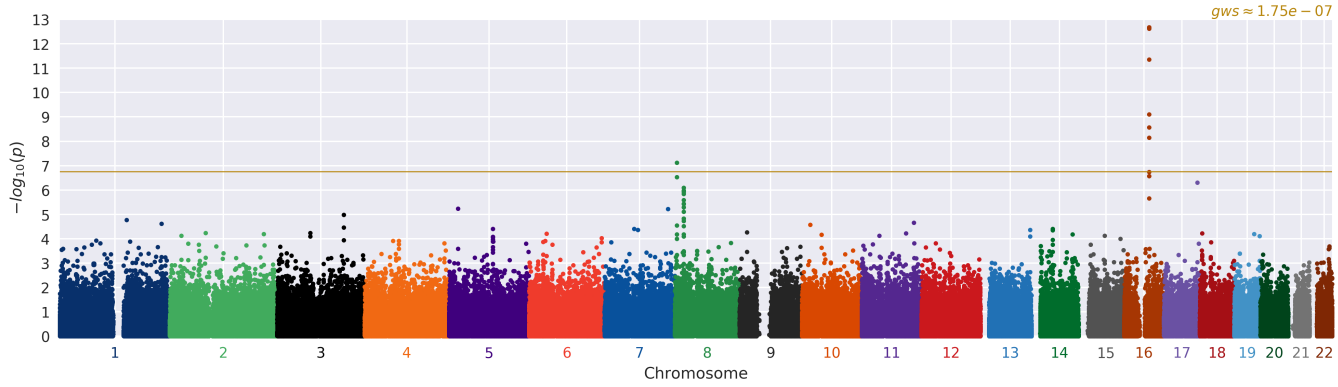
| Cohort | Array | Ancestry | Trans | Covars | PCs | N | Male | Female | Max | Min | $\mu$ | $\tilde{x}$ | $\sigma$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| META AFR | EX | AFR | invn | AGE_LIPIDS+AGE_LIPIDS2+SEX+BMI | 0 | 277 | 139 | 138 | 109.0 | 18.0 | 49.852 | 48.0 | 13.075 |
| META EUR | EX | EUR | invn | AGE_LIPIDS+AGE_LIPIDS2+SEX+BMI | 1 | 1515 | 894 | 621 | 152.0 | 22.0 | 49.16 | 46.0 | 14.914 |

## 7.2 Calibration




(a) invn Adjusted AGE_LIPIDS+AGE_LIPIDS2+SEX+BMI

Figure 12: QQ plots for HDL in the META analysis



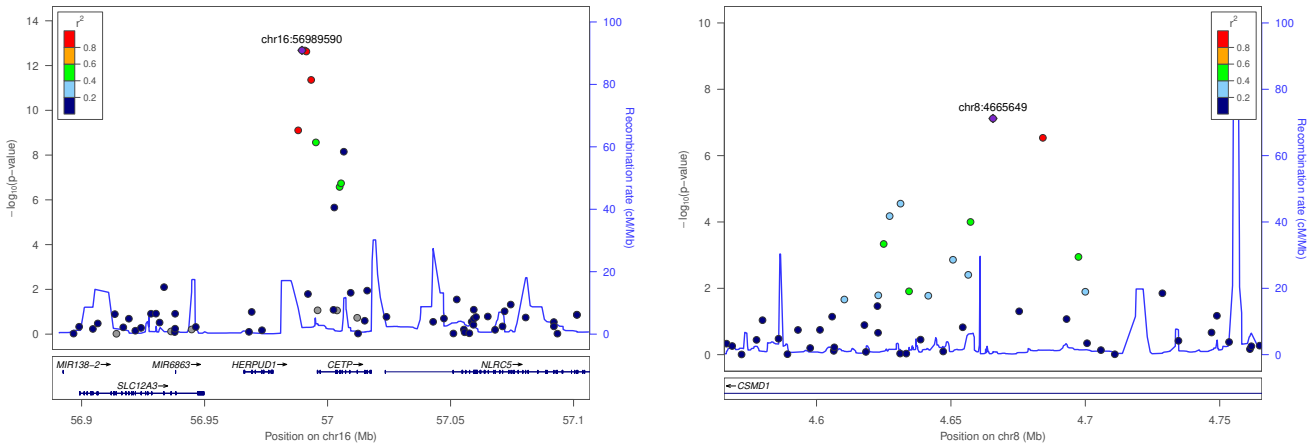

(a) invn Adjusted AGE_LIPIDS+AGE_LIPIDS2+SEX+BMI

Figure 13: Manhattan plots for HDL in the META analysis

## 7.3 Top associations

Table 14: Top variants in the META invn Adjusted AGE_LIPIDS+AGE_LIPIDS2+SEX+BMI model (**bold** variants indicate previously identified associations)

| CHR | POS | ID | EA | OA | $GENE_{CLOSEST}$ | DIR | N | MALE | FEMALE | $FREQ_{AVG}$ | $FREQ_{MIN}$ | $FREQ_{MAX}$ | EFFECT | STDERR | OR | ZSCORE | P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16 | 56989590 | **rs247616** | T | C | **CETP** | ++ | 1,791 | 1,032 | 759 | 0.299 | 0.251 | 0.308 | 0.269 | $3.66 \cdot 10^{-2}$ | 1.308 | 7.343 | $2.09 \cdot 10^{-13}$ |
| 8 | 4665649 | rs10086985 | G | A | CSMD1 | ++ | 1,792 | 1,033 | 759 | 0.508 | 0.421 | 0.524 | 0.178 | $3.31 \cdot 10^{-2}$ | 1.195 | 5.377 | $7.6 \cdot 10^{-8}$ |
| 17 | 75683953 | rs8070344 | G | A | SEPT9 | ++ | 1,792 | 1,033 | 759 | 0.214 | 0.119 | 0.231 | 0.204 | $4.05 \cdot 10^{-2}$ | 1.226 | 5.029 | $4.94 \cdot 10^{-7}$ |
| 8 | 19832646 | **rs17482753** | T | G | **LPL** | ++ | 1,792 | 1,033 | 759 | $9.24 \cdot 10^{-2}$ | $5.96 \cdot 10^{-2}$ | $9.84 \cdot 10^{-2}$ | 0.278 | $5.63 \cdot 10^{-2}$ | 1.32 | 4.933 | $8.12 \cdot 10^{-7}$ |
| 5 | 20459638 | rs1472892 | C | T | CDH18 | ++ | 1,792 | 1,033 | 759 | 0.775 | 0.769 | 0.807 | 0.178 | $3.92 \cdot 10^{-2}$ | 1.195 | −4.536 | $5.73 \cdot 10^{-6}$ |
| 7 | 143701438 | rs76575838 | A | G | OR6B1 | ++ | 1,792 | 1,033 | 759 | $1.95 \cdot 10^{-3}$ | $1.81 \cdot 10^{-3}$ | $1.98 \cdot 10^{-3}$ | 1.72 | 0.38 | 5.587 | 4.527 | $5.99 \cdot 10^{-6}$ |
| 3 | 150590168 | rs1444200 | C | T | CLRN1 | ++ | 1,792 | 1,033 | 759 | 0.47 | 0.431 | 0.686 | 0.148 | $3.35 \cdot 10^{-2}$ | 1.159 | 4.412 | $1.02 \cdot 10^{-5}$ |
| 1 | 151542176 | rs41310883 | T | C | TUFT1 | ++ | 1,792 | 1,033 | 759 | $1.12 \cdot 10^{-2}$ | $1.81 \cdot 10^{-3}$ | $1.29 \cdot 10^{-2}$ | 0.668 | 0.155 | 1.95 | 4.302 | $1.69 \cdot 10^{-5}$ |
| 11 | 117649675 | rs7924993 | A | G | DSCAML1 | ++ | 1,792 | 1,033 | 759 | 0.864 | 0.855 | 0.913 | 0.207 | $4.87 \cdot 10^{-2}$ | 1.23 | −4.246 | $2.18 \cdot 10^{-5}$ |
| 1 | 230398445 | rs3811485 | G | A | **GALNT2** | ++ | 1,792 | 1,033 | 759 | 0.149 | 0.132 | 0.24 | 0.202 | $4.78 \cdot 10^{-2}$ | 1.223 | −4.221 | $2.44 \cdot 10^{-5}$ |
| 10 | 18588285 | rs11013421 | A | G | CACNB2 | ++ | 1,790 | 1,031 | 759 | 0.211 | 0.167 | 0.219 | 0.171 | $4.08 \cdot 10^{-2}$ | 1.187 | −4.199 | $2.68 \cdot 10^{-5}$ |
| 14 | 48293464 | rs1956311 | C | A | MDGA2 | ++ | 1,792 | 1,033 | 759 | 0.275 | 0.17 | 0.294 | 0.151 | $3.67 \cdot 10^{-2}$ | 1.163 | 4.115 | $3.88 \cdot 10^{-5}$ |
| 5 | 99342047 | rs10067427 | G | A | FAM174A | ++ | 1,792 | 1,033 | 759 | 0.41 | 0.362 | 0.67 | 0.143 | $3.47 \cdot 10^{-2}$ | 1.153 | 4.114 | $3.89 \cdot 10^{-5}$ |
| 7 | 67109115 | rs6952180 | C | A | TYW1 | ++ | 1,792 | 1,033 | 759 | 0.128 | 0.119 | 0.177 | 0.202 | $4.9 \cdot 10^{-2}$ | 1.223 | −4.113 | $3.9 \cdot 10^{-5}$ |
| 13 | 112352992 | rs9522363 | T | C | TEX29 | ++ | 1,792 | 1,033 | 759 | 0.262 | 0.254 | 0.305 | 0.157 | $3.84 \cdot 10^{-2}$ | 1.17 | 4.089 | $4.34 \cdot 10^{-5}$ |
| 7 | 75511299 | exm627837 | G | A | RHBDD2 | ++ | 1,792 | 1,033 | 759 | $5.58 \cdot 10^{-4}$ | $3.3 \cdot 10^{-4}$ | $1.81 \cdot 10^{-3}$ | 2.881 | 0.705 | 17.825 | −4.086 | $4.39 \cdot 10^{-5}$ |
| 9 | 16795790 | rs16935073 | C | A | BNC2 | ++ | 1,792 | 1,033 | 759 | $6.31 \cdot 10^{-2}$ | $4.33 \cdot 10^{-2}$ | $6.67 \cdot 10^{-2}$ | 0.271 | $6.72 \cdot 10^{-2}$ | 1.312 | 4.034 | $5.48 \cdot 10^{-5}$ |
| 2 | 81102264 | rs2131255 | C | T | CTNNA2 | ++ | 1,792 | 1,033 | 759 | 0.528 | 0.49 | 0.736 | 0.138 | $3.44 \cdot 10^{-2}$ | 1.148 | 4.024 | $5.73 \cdot 10^{-5}$ |
| 3 | 74821600 | rs2049623 | G | A | CNTN3 | ++ | 1,792 | 1,033 | 759 | 0.513 | 0.507 | 0.543 | 0.134 | $3.33 \cdot 10^{-2}$ | 1.143 | 4.021 | $5.79 \cdot 10^{-5}$ |
| 11 | 100061865 | rs11223168 | A | G | CNTN5 | ++ | 1,757 | 1,009 | 748 | $8.94 \cdot 10^{-2}$ | $8.65 \cdot 10^{-2}$ | 0.105 | 0.241 | $6.01 \cdot 10^{-2}$ | 1.273 | −4.014 | $5.97 \cdot 10^{-5}$ |




(a) rs247616 $\pm 100kb$ (b) rs10086985 $\pm 100kb$

Figure 14: Regional plots for cohort META model invn Adjusted AGE_LIPIDS+AGE_LIPIDS2+SEX+BMI

## 7.4 Previously identified risk loci

Table 15 shows statistics from the META cohort for 50 loci that were shown to be significantly associated with HDL Cholesterol in the 2013 Nature Genetics paper by Willer et al [10]. Where a previously reported variant was not genotyped in the study (indicated by $\bar{R}^2 < 1$), if available, a tagging variant in LD with the reported variant ($\bar{R}^2 >= 0.7$ and within 250kb) was provided. Tags were identified using 1000 Genomes data. There

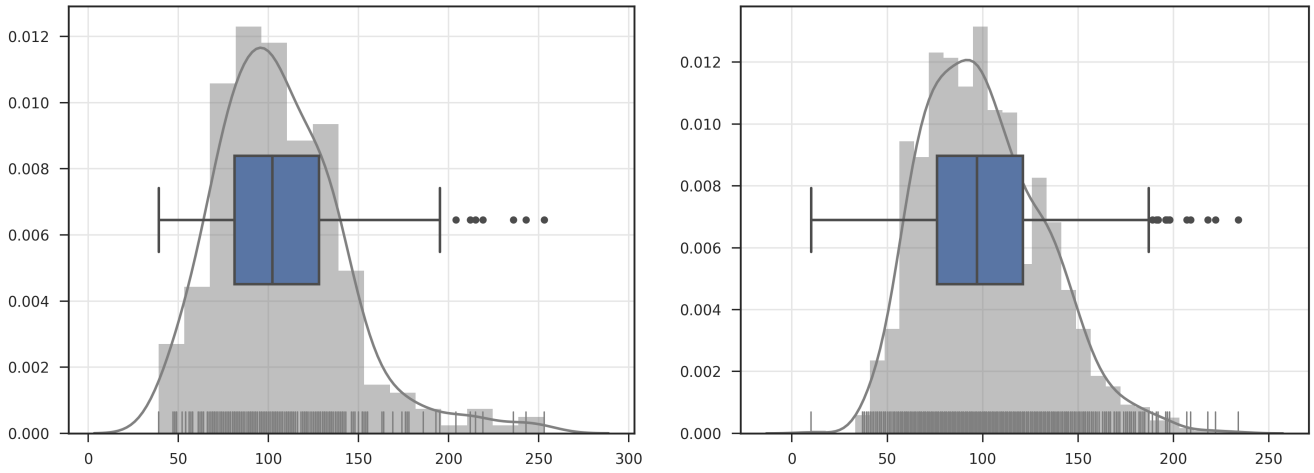
are 16 variants that show at least nominal significance ($p < 0.05$) in this study. Out of the 50 variants in both studies, 48 exhibit the same direction of effect with the known result (binomial test $p = 1.13e - 12$).

Table 15: Top known loci in META model invn Adjusted AGE_LIPIDS+AGE_LIPIDS2+SEX+BMI (**bold** variants indicate matching direction of effect)

| CHR | POS | ID | EA | OA | N | $FREQ_{AVG}$ | $FREQ_{MIN}$ | $FREQ_{MAX}$ | EFFECT | STDERR | P | DIR | $GENE_{CLOSEST}$ | $R^2$ | $ID_{KNOWN}$ | $N_{KNOWN}$ | $EFFECT_{KNOWN}$ | $STDERR_{KNOWN}$ | $P_{KNOWN}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16 | 57005479 | **rs1532624** | A | C | 1,792 | 0.385 | 0.148 | 0.429 | 0.183 | $3.51 \cdot 10^{-2}$ | $1.82 \cdot 10^{-7}$ | ++ | CETP | 1 | rs1532624 | 94,595 | 0.204 | $3.5 \cdot 10^{-3}$ | 0 |
| 15 | 58678512 | **rs10468017** | T | C | 1,792 | 0.267 | 0.177 | 0.283 | $8.13 \cdot 10^{-2}$ | $3.73 \cdot 10^{-2}$ | $2.94 \cdot 10^{-2}$ | ++ | LIPC | 1 | rs10468017 | 94,595 | 0.118 | $3.8 \cdot 10^{-3}$ | $1.21 \cdot 10^{-188}$ |
| 8 | 19824492 | **rs13702** | C | T | 1,792 | 0.315 | 0.284 | 0.484 | 0.165 | $3.63 \cdot 10^{-2}$ | $5.12 \cdot 10^{-6}$ | ++ | LPL | 1 | rs13702 | 94,595 | 0.106 | $3.8 \cdot 10^{-3}$ | $1.28 \cdot 10^{-160}$ |
| 18 | 47167214 | **rs4939883** | C | T | 1,792 | 0.794 | 0.594 | 0.831 | $2.56 \cdot 10^{-2}$ | $4.35 \cdot 10^{-2}$ | 0.555 | +- | LIPG | 1 | rs4939883 | 94,595 | $7.99 \cdot 10^{-2}$ | $4.5 \cdot 10^{-3}$ | $1.8 \cdot 10^{-66}$ |
| 9 | 107664301 | **rs1883025** | C | T | 1,790 | 0.275 | 0.261 | 0.353 | 0.106 | $3.77 \cdot 10^{-2}$ | $4.73 \cdot 10^{-3}$ | +- | ABCA1 | 1 | rs1883025 | 94,595 | $6.98 \cdot 10^{-2}$ | $4.1 \cdot 10^{-3}$ | $1.5 \cdot 10^{-65}$ |
| 2 | 21231524 | **rs676210** | A | G | 1,792 | 0.194 | 0.177 | 0.197 | $4.56 \cdot 10^{-2}$ | $4.21 \cdot 10^{-2}$ | 0.279 | +- | APOB | 1 | rs676210 | 94,595 | $6.6 \cdot 10^{-2}$ | $4 \cdot 10^{-3}$ | $2.35 \cdot 10^{-54}$ |
| 16 | 67928042 | **rs16942887** | A | G | 1,792 | 0.136 | 0.122 | 0.213 | 0.154 | $4.91 \cdot 10^{-2}$ | $1.67 \cdot 10^{-3}$ | ++ | PSKH1 | 1 | rs16942887 | 94,595 | $8.31 \cdot 10^{-2}$ | $5.1 \cdot 10^{-3}$ | $8.28 \cdot 10^{-54}$ |
| 16 | 67997920 | **rs3785100** | C | T | 1,780 | 0.147 | 0.134 | 0.217 | 0.167 | $4.78 \cdot 10^{-2}$ | $4.63 \cdot 10^{-4}$ | ++ | SLC12A4 | 1 | rs3785100 | 94,595 | $7.97 \cdot 10^{-2}$ | $5 \cdot 10^{-3}$ | $2.22 \cdot 10^{-51}$ |
| 11 | 116648917 | rs964184 | C | G | 1,792 | 0.839 | 0.803 | 0.846 | 0.115 | $4.55 \cdot 10^{-2}$ | $1.13 \cdot 10^{-2}$ | ++ | ZPR1 | 1 | rs964184 | 94,595 | $-0.107$ | $7.1 \cdot 10^{-3}$ | $6.09 \cdot 10^{-48}$ |
| 16 | 56933519 | **rs11643718** | A | G | 1,792 | $9.65 \cdot 10^{-2}$ | $2.53 \cdot 10^{-2}$ | 0.11 | 0.153 | $5.75 \cdot 10^{-2}$ | $7.95 \cdot 10^{-3}$ | +- | SLC12A3 | 1 | rs11643718 | 94,595 | $8.22 \cdot 10^{-2}$ | $5.4 \cdot 10^{-3}$ | $2.98 \cdot 10^{-46}$ |
| 16 | 68099821 | **rs7201742** | G | T | 1,792 | 0.166 | 0.141 | 0.3 | 0.101 | $4.59 \cdot 10^{-2}$ | $2.76 \cdot 10^{-2}$ | +- | DUS2 | 1 | rs7201742 | 94,595 | $7.36 \cdot 10^{-2}$ | $4.8 \cdot 10^{-3}$ | $5.13 \cdot 10^{-46}$ |
| 11 | 116603724 | **rs12272004** | C | A | 1,792 | $8.23 \cdot 10^{-2}$ | $7.29 \cdot 10^{-2}$ | 0.134 | $8.8 \cdot 10^{-2}$ | $6.19 \cdot 10^{-2}$ | 0.155 | ++ | BUD13 | 1 | rs12272004 | 94,595 | 0.102 | $7 \cdot 10^{-3}$ | $1.16 \cdot 10^{-45}$ |
| 8 | 9183596 | **rs4841132** | G | A | 1,792 | 0.912 | 0.888 | 0.917 | $9.51 \cdot 10^{-2}$ | $6.01 \cdot 10^{-2}$ | 0.114 | ++ | PPP1R3B | 1 | rs4841132 | 94,595 | $8.16 \cdot 10^{-2}$ | $5.8 \cdot 10^{-3}$ | $4.83 \cdot 10^{-45}$ |
| 2 | 21123352 | **rs6711016** | A | C | 1,792 | 0.187 | $6.68 \cdot 10^{-2}$ | 0.209 | $1.95 \cdot 10^{-2}$ | $4.32 \cdot 10^{-2}$ | 0.651 | +- | LDAH | 1 | rs6711016 | 94,595 | $5.69 \cdot 10^{-2}$ | $4 \cdot 10^{-3}$ | $9.32 \cdot 10^{-43}$ |
| 16 | 68024995 | **rs255052** | A | G | 1,792 | 0.157 | 0.146 | 0.218 | 0.148 | $4.63 \cdot 10^{-2}$ | $1.33 \cdot 10^{-3}$ | ++ | DPEP2 | 1 | rs255052 | 94,595 | $6.8 \cdot 10^{-2}$ | $4.7 \cdot 10^{-3}$ | $2.17 \cdot 10^{-42}$ |
| 1 | 230295691 | **rs4846914** | A | G | 1,792 | 0.53 | 0.143 | 0.601 | $8.51 \cdot 10^{-2}$ | $3.57 \cdot 10^{-2}$ | $1.71 \cdot 10^{-2}$ | ++ | GALNT2 | 1 | rs4846914 | 94,595 | $4.79 \cdot 10^{-2}$ | $3.4 \cdot 10^{-3}$ | $3.51 \cdot 10^{-41}$ |
| 16 | 67911517 | **rs8060686** | C | T | 1,792 | 0.254 | 0.186 | 0.623 | $7.84 \cdot 10^{-2}$ | $4.1 \cdot 10^{-2}$ | $5.55 \cdot 10^{-2}$ | +- | EDC4 | 1 | rs8060686 | 94,595 | $6.3 \cdot 10^{-2}$ | $4.4 \cdot 10^{-3}$ | $1.32 \cdot 10^{-40}$ |
| 15 | 58579956 | **rs2899624** | A | G | 1,791 | 0.149 | 0.149 | 0.149 | $5.86 \cdot 10^{-2}$ | $4.66 \cdot 10^{-2}$ | 0.208 | ++ | ALDH1A2 | 1 | rs2899624 | 94,595 | $7.14 \cdot 10^{-2}$ | $4.9 \cdot 10^{-3}$ | $1.39 \cdot 10^{-40}$ |
| 20 | 44554015 | **rs6065906** | T | C | 1,792 | 0.177 | 0.171 | 0.179 | $1.26 \cdot 10^{-2}$ | $4.34 \cdot 10^{-2}$ | 0.771 | +- | PCIF1 | 1 | rs6065906 | 94,595 | $5.94 \cdot 10^{-2}$ | $4.4 \cdot 10^{-3}$ | $5.34 \cdot 10^{-40}$ |
| 8 | 19943027 | **rs13265868** | A | G | 1,789 | 0.411 | 0.244 | 0.441 | $9.69 \cdot 10^{-2}$ | $3.47 \cdot 10^{-2}$ | $5.21 \cdot 10^{-3}$ | +- | SLC18A1 | 1 | rs13265868 | 94,595 | $4.78 \cdot 10^{-2}$ | $3.5 \cdot 10^{-3}$ | $6.1 \cdot 10^{-40}$ |
| 16 | 67708897 | **rs12449157** | G | A | 1,792 | 0.239 | 0.171 | 0.614 | $7.07 \cdot 10^{-2}$ | $4.18 \cdot 10^{-2}$ | $9.1 \cdot 10^{-2}$ | +- | GFOD2 | 1 | rs12449157 | 94,595 | $6.19 \cdot 10^{-2}$ | $4.6 \cdot 10^{-3}$ | $7.85 \cdot 10^{-37}$ |
| 11 | 47354787 | **rs1052373** | T | C | 1,792 | 0.312 | 0.276 | 0.507 | $2.02 \cdot 10^{-2}$ | $3.71 \cdot 10^{-2}$ | 0.587 | ++ | MYBPC3 | 1 | rs1052373 | 94,595 | $4.78 \cdot 10^{-2}$ | $3.7 \cdot 10^{-3}$ | $1.55 \cdot 10^{-36}$ |
| 11 | 47298360 | **rs326214** | G | A | 1,791 | 0.666 | 0.354 | 0.724 | $6.11 \cdot 10^{-3}$ | $3.74 \cdot 10^{-2}$ | 0.87 | ++ | MADD | 1 | rs326214 | 94,595 | $6.09 \cdot 10^{-2}$ | $4.5 \cdot 10^{-3}$ | $2.17 \cdot 10^{-36}$ |
| 20 | 44547068 | **rs17447545** | A | G | 1,791 | 0.184 | 0.183 | 0.191 | $1.75 \cdot 10^{-2}$ | $4.26 \cdot 10^{-2}$ | 0.681 | +- | PLTP | 1 | rs17447545 | 94,595 | $5.62 \cdot 10^{-2}$ | $4.4 \cdot 10^{-3}$ | $3.98 \cdot 10^{-36}$ |
| 11 | 116660686 | **rs2266788** | A | G | 1,791 | 0.929 | 0.92 | 0.982 | 0.148 | $6.5 \cdot 10^{-2}$ | $2.27 \cdot 10^{-2}$ | ++ | APOA5 | 1 | rs2266788 | 94,595 | $9.22 \cdot 10^{-2}$ | $6.8 \cdot 10^{-3}$ | $1.19 \cdot 10^{-35}$ |
| 18 | 47243912 | **rs6507945** | C | A | 1,792 | 0.608 | 0.581 | 0.758 | $6.8 \cdot 10^{-2}$ | $3.53 \cdot 10^{-2}$ | $5.43 \cdot 10^{-2}$ | ++ | ACAA2 | 1 | rs6507945 | 94,595 | $4.41 \cdot 10^{-2}$ | $3.4 \cdot 10^{-3}$ | $1.33 \cdot 10^{-34}$ |
| 20 | 43042364 | **rs1800961** | C | T | 1,792 | $2.65 \cdot 10^{-2}$ | $5.42 \cdot 10^{-3}$ | $3.04 \cdot 10^{-2}$ | 0.258 | 0.104 | $1.34 \cdot 10^{-2}$ | +- | HNF4A | 1 | rs1800961 | 94,595 | 0.127 | $9.9 \cdot 10^{-3}$ | $1.64 \cdot 10^{-34}$ |
| 16 | 56772157 | rs7184359 | T | C | 1,789 | 0.296 | 0.284 | 0.364 | $3.4 \cdot 10^{-2}$ | $3.71 \cdot 10^{-2}$ | 0.36 | ++ | NUP93 | 1 | rs7184359 | 94,595 | $-4.96 \cdot 10^{-2}$ | $3.8 \cdot 10^{-3}$ | $2.78 \cdot 10^{-34}$ |
| 11 | 47275064 | **rs10838681** | A | G | 1,792 | 0.26 | 0.224 | 0.457 | $5.86 \cdot 10^{-2}$ | $3.93 \cdot 10^{-2}$ | 0.136 | ++ | NR1H3 | 1 | rs10838681 | 94,595 | $4.8 \cdot 10^{-2}$ | $3.8 \cdot 10^{-3}$ | $1.72 \cdot 10^{-33}$ |
| 16 | 67964203 | **rs1134760** | C | T | 1,792 | 0.227 | 0.184 | 0.458 | $6.46 \cdot 10^{-2}$ | $4.12 \cdot 10^{-2}$ | 0.116 | +- | CTRL | 1 | rs1134760 | 94,595 | $6.79 \cdot 10^{-2}$ | $5.3 \cdot 10^{-3}$ | $2.82 \cdot 10^{-33}$ |
| 11 | 47249294 | **rs2957873** | G | A | 1,792 | 0.793 | 0.551 | 0.837 | $6.82 \cdot 10^{-2}$ | $4.3 \cdot 10^{-2}$ | 0.113 | ++ | DDB2 | 1 | rs2957873 | 94,595 | $5.21 \cdot 10^{-2}$ | $4.2 \cdot 10^{-3}$ | $1.81 \cdot 10^{-32}$ |
| 12 | 125261593 | **rs838880** | C | T | 1,792 | 0.633 | 0.319 | 0.69 | $3.56 \cdot 10^{-2}$ | $3.53 \cdot 10^{-2}$ | 0.313 | ++ | SCARB1 | 1 | rs838880 | 94,595 | $4.84 \cdot 10^{-2}$ | $3.9 \cdot 10^{-3}$ | $6.38 \cdot 10^{-32}$ |
| 16 | 67902070 | **rs2271293** | A | G | 1,792 | 0.11 | $7.4 \cdot 10^{-2}$ | 0.116 | 0.141 | $5.32 \cdot 10^{-2}$ | $8 \cdot 10^{-3}$ | ++ | NUTF2 | 1 | rs2271293 | 94,595 | $8.7 \cdot 10^{-2}$ | $7.2 \cdot 10^{-3}$ | $6.16 \cdot 10^{-31}$ |
| 19 | 54797848 | **rs103294** | T | C | 1,792 | 0.179 | 0.103 | 0.193 | 0.107 | $4.41 \cdot 10^{-2}$ | $1.57 \cdot 10^{-2}$ | +- | LILRB2 | 1 | rs103294 | 94,595 | $5.23 \cdot 10^{-2}$ | $4.4 \cdot 10^{-3}$ | $4 \cdot 10^{-30}$ |
| 8 | 126495818 | **rs10808546** | T | C | 1,792 | 0.396 | 0.37 | 0.401 | $3.66 \cdot 10^{-2}$ | $3.48 \cdot 10^{-2}$ | 0.292 | +- | TRIB1 | 1 | rs10808546 | 94,595 | $4.09 \cdot 10^{-2}$ | $3.4 \cdot 10^{-3}$ | $4.11 \cdot 10^{-30}$ |
| 11 | 46743247 | **rs3136441** | C | T | 1,792 | 0.103 | $3.79 \cdot 10^{-2}$ | 0.115 | $6.91 \cdot 10^{-2}$ | $5.51 \cdot 10^{-2}$ | 0.21 | +- | F2 | 1 | rs3136441 | 94,595 | $5.45 \cdot 10^{-2}$ | $4.7 \cdot 10^{-3}$ | $6.76 \cdot 10^{-29}$ |
| 11 | 47270255 | **rs2167079** | T | C | 1,789 | 0.303 | 0.254 | 0.576 | $3.91 \cdot 10^{-2}$ | $3.82 \cdot 10^{-2}$ | 0.306 | ++ | ACP2 | 1 | rs2167079 | 94,595 | $5.77 \cdot 10^{-2}$ | $4.8 \cdot 10^{-3}$ | $1.19 \cdot 10^{-28}$ |
| 16 | 67671804 | **rs6499137** | G | T | 1,792 | 0.112 | $7.82 \cdot 10^{-2}$ | 0.3 | $4.46 \cdot 10^{-2}$ | $5.39 \cdot 10^{-2}$ | 0.408 | +- | CTCF | 1 | rs6499137 | 94,595 | $7.22 \cdot 10^{-2}$ | $6.2 \cdot 10^{-3}$ | $5.9 \cdot 10^{-28}$ |
| 11 | 61557803 | **rs102275** | T | C | 1,792 | 0.394 | 0.348 | 0.646 | $1.99 \cdot 10^{-2}$ | $3.48 \cdot 10^{-2}$ | 0.568 | ++ | TMEM258 | 1 | rs102275 | 94,595 | $3.91 \cdot 10^{-2}$ | $3.5 \cdot 10^{-3}$ | $6.4 \cdot 10^{-28}$ |
| 11 | 61569830 | **rs174546** | C | T | 1,792 | 0.297 | $9.21 \cdot 10^{-2}$ | 0.334 | $1.33 \cdot 10^{-2}$ | $3.67 \cdot 10^{-2}$ | 0.717 | ++ | FADS1 | 1 | rs174546 | 94,595 | $3.91 \cdot 10^{-2}$ | $3.5 \cdot 10^{-3}$ | $8.3 \cdot 10^{-28}$ |
| 11 | 61551356 | **rs174535** | T | C | 1,792 | 0.319 | 0.204 | 0.34 | $3.44 \cdot 10^{-2}$ | $3.57 \cdot 10^{-2}$ | 0.335 | ++ | MYRF | 1 | rs174535 | 94,595 | $3.92 \cdot 10^{-2}$ | $3.5 \cdot 10^{-3}$ | $9.04 \cdot 10^{-28}$ |
| 11 | 61597972 | **rs1535** | A | G | 1,784 | 0.307 | 0.139 | 0.338 | $1.55 \cdot 10^{-2}$ | $3.62 \cdot 10^{-2}$ | 0.669 | ++ | FADS2 | 1 | rs1535 | 94,595 | $3.91 \cdot 10^{-2}$ | $3.6 \cdot 10^{-3}$ | $5.74 \cdot 10^{-27}$ |
| 9 | 15296034 | **rs643531** | A | C | 1,792 | 0.877 | 0.869 | 0.924 | $7.86 \cdot 10^{-2}$ | $5.14 \cdot 10^{-2}$ | 0.126 | ++ | TTC39B | 1 | rs643531 | 94,595 | $5.44 \cdot 10^{-2}$ | $4.9 \cdot 10^{-3}$ | $4.33 \cdot 10^{-26}$ |
| 19 | 45395619 | **rs2075650** | A | G | 1,792 | 0.125 | 0.112 | 0.127 | $9.06 \cdot 10^{-2}$ | $5.05 \cdot 10^{-2}$ | $7.28 \cdot 10^{-2}$ | +- | TOMM40 | 1 | rs2075650 | 94,595 | $5.54 \cdot 10^{-2}$ | $5.1 \cdot 10^{-3}$ | $9.72 \cdot 10^{-26}$ |
| 11 | 47540007 | **rs9666924** | C | T | 1,792 | 0.811 | 0.464 | 0.875 | $2.22 \cdot 10^{-2}$ | $4.65 \cdot 10^{-2}$ | 0.633 | +- | CELF1 | 1 | rs9666924 | 94,595 | $5.19 \cdot 10^{-2}$ | $4.7 \cdot 10^{-3}$ | $2.44 \cdot 10^{-25}$ |
| 11 | 46897446 | **rs2306033** | A | G | 1,792 | $9.63 \cdot 10^{-2}$ | $3.79 \cdot 10^{-2}$ | 0.107 | 0.102 | $5.67 \cdot 10^{-2}$ | $7.19 \cdot 10^{-2}$ | +- | LRP4 | 1 | rs2306033 | 94,595 | $5.35 \cdot 10^{-2}$ | $5 \cdot 10^{-3}$ | $3.33 \cdot 10^{-25}$ |
| 16 | 56969148 | **rs2217332** | G | A | 1,792 | 0.148 | 0.132 | 0.151 | $7.77 \cdot 10^{-2}$ | $4.75 \cdot 10^{-2}$ | 0.102 | +- | HERPUD1 | 1 | rs2217332 | 94,595 | $7.02 \cdot 10^{-2}$ | $7 \cdot 10^{-3}$ | $3.34 \cdot 10^{-25}$ |
| 16 | 67796315 | **rs8051587** | C | A | 1,792 | 0.242 | 0.174 | 0.616 | $7.43 \cdot 10^{-2}$ | $4.15 \cdot 10^{-2}$ | $7.36 \cdot 10^{-2}$ | +- | RANBP10 | 1 | rs8051587 | 94,595 | $6.82 \cdot 10^{-2}$ | $6.4 \cdot 10^{-3}$ | $1.42 \cdot 10^{-24}$ |
| 11 | 47454701 | **rs10742805** | A | G | 1,792 | 0.694 | 0.412 | 0.746 | $8.01 \cdot 10^{-3}$ | $3.8 \cdot 10^{-2}$ | 0.833 | +- | RAPSN | 1 | rs10742805 | 94,595 | $3.95 \cdot 10^{-2}$ | $3.7 \cdot 10^{-3}$ | $3.47 \cdot 10^{-24}$ |
| 11 | 47449544 | **rs7105122** | T | C | 1,788 | 0.279 | 0.253 | 0.42 | $1.68 \cdot 10^{-2}$ | $3.83 \cdot 10^{-2}$ | 0.661 | ++ | PSMC3 | 1 | rs7105122 | 94,595 | $3.94 \cdot 10^{-2}$ | $3.7 \cdot 10^{-3}$ | $4.69 \cdot 10^{-24}$ |

# 8 LDL Cholesterol (LDL_DIRECT)

## 8.1 Summary




(a) AFR

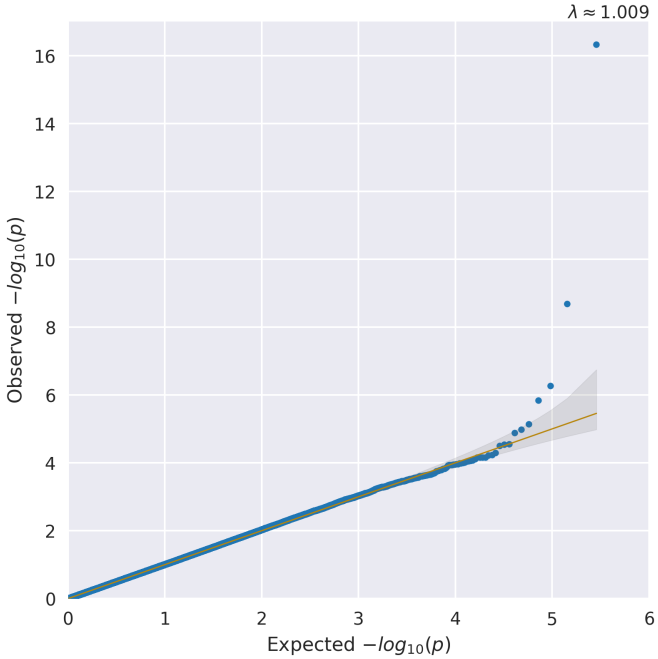
(b) EUR

Figure 15: Distribution of LDL_DIRECT in META by cohort

Table 16: Samples with LDL Cholesterol data summarized by cohort, transformation, and run-time adjustments

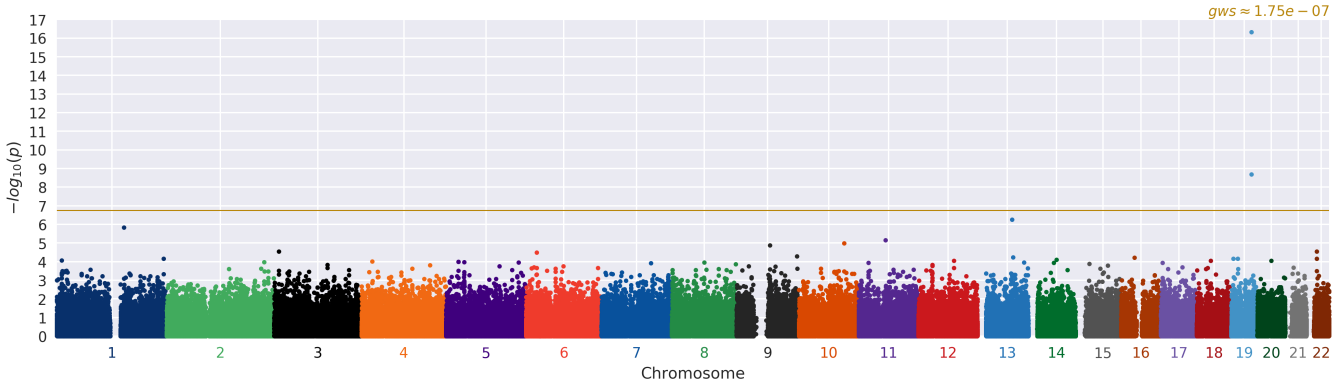
| Cohort | Array | Ancestry | Trans | Covars | PCs | N | Male | Female | Max | Min | $\mu$ | $\tilde{x}$ | $\sigma$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| META AFR | EX | AFR | invn | AGE_LIPIDS+AGE_LIPIDS2+SEX+BMI | 0 | 279 | 139 | 140 | 253.0 | 39.0 | 106.423 | 102.0 | 35.296 |
| META EUR | EX | EUR | invn | AGE_LIPIDS+AGE_LIPIDS2+SEX+BMI | 0 | 1515 | 894 | 621 | 234.0 | 10.0 | 100.766 | 97.0 | 32.096 |

## 8.2 Calibration




(a) invn Adjusted AGE_LIPIDS+AGE_LIPIDS2+SEX+BMI

Figure 16: QQ plots for LDL_DIRECT in the META analysis




(a) invn Adjusted AGE_LIPIDS+AGE_LIPIDS2+SEX+BMI

Figure 17: Manhattan plots for LDL_DIRECT in the META analysis

## 8.3 Top associations

Table 17: Top variants in the META invn Adjusted AGE_LIPIDS+AGE_LIPIDS2+SEX+BMI model (**bold** variants indicate previously identified associations)

| CHR | POS | ID | EA | OA | $GENE_{CLOSEST}$ | DIR | N | MALE | FEMALE | $FREQ_{AVG}$ | $FREQ_{MIN}$ | $FREQ_{MAX}$ | EFFECT | STDERR | OR | ZSCORE | P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 19 | 45412079 | **rs7412** | C | T | **APOE** | ++ | 1,785 | 1,029 | 756 | $7.73 \cdot 10^{-2}$ | $7.04 \cdot 10^{-2}$ | 0.115 | 0.513 | $6.12 \cdot 10^{-2}$ | 1.671 | −8.394 | $4.69 \cdot 10^{-17}$ |
| 19 | 45415640 | **rs445925** | G | A | **APOC1** | ++ | 1,794 | 1,033 | 761 | 0.127 | $9.97 \cdot 10^{-2}$ | 0.274 | 0.306 | $5.11 \cdot 10^{-2}$ | 1.358 | −5.993 | $2.07 \cdot 10^{-9}$ |
| 13 | 77782296 | rs2329029 | T | G | MYCBP2 | ++ | 1,794 | 1,033 | 761 | 0.781 | 0.509 | 0.831 | 0.207 | $4.13 \cdot 10^{-2}$ | 1.23 | −5.012 | $5.4 \cdot 10^{-7}$ |
| 1 | 152457624 | rs1199153 | G | A | LCE5A | ++ | 1,794 | 1,033 | 761 | 0.11 | $2.48 \cdot 10^{-2}$ | 0.57 | 0.328 | $6.81 \cdot 10^{-2}$ | 1.388 | −4.816 | $1.46 \cdot 10^{-6}$ |
| 11 | 61026713 | rs142603933 | G | A | VWCE | ++ | 1,794 | 1,033 | 761 | $1.39 \cdot 10^{-3}$ | $3.3 \cdot 10^{-4}$ | $7.17 \cdot 10^{-3}$ | 1.975 | 0.44 | 7.206 | −4.489 | $7.15 \cdot 10^{-6}$ |
| 10 | 102631263 | rs10883549 | A | G | SLF2 | ++ | 1,794 | 1,033 | 761 | 0.301 | 0.233 | 0.314 | 0.162 | $3.68 \cdot 10^{-2}$ | 1.176 | −4.407 | $1.05 \cdot 10^{-5}$ |
| 9 | 75469679 | rs72734808 | C | T | TMC1 | ++ | 1,794 | 1,033 | 761 | 0.127 | 0.126 | 0.133 | 0.219 | $5.03 \cdot 10^{-2}$ | 1.245 | −4.359 | $1.31 \cdot 10^{-5}$ |
| 3 | 10830031 | rs1601365 | T | C | SLC6A11 | ++ | 1,794 | 1,033 | 761 | 0.439 | 0.362 | 0.453 | 0.139 | $3.33 \cdot 10^{-2}$ | 1.15 | −4.186 | $2.84 \cdot 10^{-5}$ |
| 22 | 23463183 | rs756631 | G | A | GNAZ | ++ | 1,794 | 1,033 | 761 | 0.514 | 0.303 | 0.552 | 0.141 | $3.38 \cdot 10^{-2}$ | 1.152 | 4.185 | $2.86 \cdot 10^{-5}$ |
| 6 | 24060381 | rs1277145 | G | A | NRSN1 | ++ | 1,794 | 1,033 | 761 | 0.855 | 0.762 | 0.872 | 0.199 | $4.78 \cdot 10^{-2}$ | 1.22 | 4.161 | $3.17 \cdot 10^{-5}$ |
| 9 | 136723520 | rs12344583 | G | A | VAV2 | ++ | 1,794 | 1,033 | 761 | 0.246 | 0.198 | 0.507 | 0.163 | $4.03 \cdot 10^{-2}$ | 1.177 | 4.054 | $5.04 \cdot 10^{-5}$ |
| 13 | 80654666 | rs17072271 | A | G | SPRY2 | ++ | 1,783 | 1,029 | 754 | 0.24 | 0.231 | 0.286 | 0.157 | $3.9 \cdot 10^{-2}$ | 1.17 | −4.017 | $5.9 \cdot 10^{-5}$ |
| 16 | 30004800 | rs35431046 | A | G | HIRIP3 | ++ | 1,793 | 1,033 | 760 | $6.97 \cdot 10^{-3}$ | $3.3 \cdot 10^{-4}$ | $4.32 \cdot 10^{-2}$ | 0.796 | 0.198 | 2.216 | 4.009 | $6.09 \cdot 10^{-5}$ |
| 19 | 4517649 | rs201988075 | T | C | PLIN4 | ++ | 1,794 | 1,033 | 761 | $2.23 \cdot 10^{-3}$ | $3.3 \cdot 10^{-4}$ | $1.25 \cdot 10^{-2}$ | 1.415 | 0.355 | 4.116 | −3.981 | $6.87 \cdot 10^{-5}$ |
| 1 | 242404260 | rs425246 | C | T | PLD5 | ++ | 1,794 | 1,033 | 761 | $9.67 \cdot 10^{-2}$ | $5.78 \cdot 10^{-2}$ | 0.308 | 0.235 | $5.91 \cdot 10^{-2}$ | 1.265 | −3.98 | $6.88 \cdot 10^{-5}$ |
| 19 | 14375895 | rs7248277 | T | C | ADGRL1 | ++ | 1,794 | 1,033 | 761 | 0.384 | 0.383 | 0.391 | 0.135 | $3.39 \cdot 10^{-2}$ | 1.144 | 3.978 | $6.97 \cdot 10^{-5}$ |
| 14 | 63811438 | rs10134021 | A | G | GPHB5 | ++ | 1,794 | 1,033 | 761 | $8.97 \cdot 10^{-2}$ | $2.18 \cdot 10^{-2}$ | 0.459 | 0.279 | $7.06 \cdot 10^{-2}$ | 1.322 | −3.954 | $7.68 \cdot 10^{-5}$ |
| 1 | 11468442 | rs11121728 | C | T | DISP3 | ++ | 1,794 | 1,033 | 761 | 0.406 | 0.328 | 0.421 | 0.131 | $3.34 \cdot 10^{-2}$ | 1.14 | 3.934 | $8.37 \cdot 10^{-5}$ |
| 18 | 31324934 | rs7232237 | A | G | ASXL3 | ++ | 1,794 | 1,033 | 761 | 0.532 | 0.496 | 0.726 | 0.132 | $3.37 \cdot 10^{-2}$ | 1.141 | −3.922 | $8.78 \cdot 10^{-5}$ |
| 12 | 80771813 | rs2717477 | A | G | OTOGL | ++ | 1,763 | 1,017 | 746 | 0.783 | 0.498 | 0.837 | 0.17 | $4.34 \cdot 10^{-2}$ | 1.185 | 3.919 | $8.89 \cdot 10^{-5}$ |

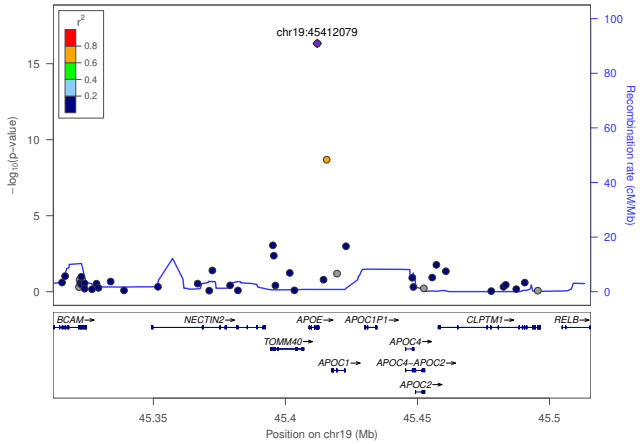



Figure 18: Regional plot for cohort META model invn Adjusted AGE_LIPIDS+AGE_LIPIDS2+SEX+BMI: rs7412 $\pm 100kb$

## 8.4 Previously identified risk loci

Table 18 shows statistics from the META cohort for 50 loci that were shown to be significantly associated with LDL Cholesterol in the 2013 Nature Genetics paper by Willer et al [12]. Where a previously reported variant was not genotyped in the study (indicated by $\bar{R^2} < 1$), if available, a tagging variant in LD with the reported variant ($\bar{R^2} >= 0.7$ and within 250kb) was provided. Tags were identified using 1000 Genomes data. There are 10

variants that show at least nominal significance ($p < 0.05$) in this study. Out of the 50 variants in both studies, 32 exhibit the same direction of effect with the known result (binomial test $p = 0.0325$).

Table 18: Top known loci in META model invn Adjusted AGE_LIPIDS+AGE_LIPIDS2+SEX+BMI (**bold** variants indicate matching direction of effect)

| CHR | POS | ID | EA | OA | N | $FREQ_{AVG}$ | $FREQ_{MIN}$ | $FREQ_{MAX}$ | EFFECT | STDERR | P | DIR | $GENE_{CLOSEST}$ | $R^2$ | $ID_{KNOWN}$ | $N_{KNOWN}$ | $EFFECT_{KNOWN}$ | $STDERR_{KNOWN}$ | $P_{KNOWN}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 19 | 45415640 | **rs445925** | G | A | 1,794 | 0.127 | $9.97 \cdot 10^{-2}$ | 0.274 | 0.306 | $5.11 \cdot 10^{-2}$ | $2.07 \cdot 10^{-9}$ | ++ | APOC1 | 1 | rs445925 | 94,595 | 0.363 | $8.1 \cdot 10^{-3}$ | 0 |
| 19 | 45412079 | **rs7412** | C | T | 1,785 | $7.73 \cdot 10^{-2}$ | $7.04 \cdot 10^{-2}$ | 0.115 | 0.513 | $6.12 \cdot 10^{-2}$ | $4.69 \cdot 10^{-17}$ | ++ | APOE | 1 | rs7412 | 94,595 | 0.59 | $1.01 \cdot 10^{-2}$ | 0 |
| 1 | 109818530 | **rs646776** | T | C | 1,794 | 0.78 | 0.668 | 0.8 | $5.38 \cdot 10^{-2}$ | $4.01 \cdot 10^{-2}$ | 0.18 | ++ | CELSR2 | 1 | rs646776 | 94,595 | 0.16 | $4.4 \cdot 10^{-3}$ | $1.63 \cdot 10^{-272}$ |
| 1 | 109822166 | **rs599839** | A | G | 1,794 | 0.712 | 0.278 | 0.792 | $3.68 \cdot 10^{-2}$ | $4.01 \cdot 10^{-2}$ | 0.359 | ++ | PSRC1 | 1 | rs599839 | 94,595 | 0.16 | $4.4 \cdot 10^{-3}$ | $2.75 \cdot 10^{-268}$ |
| 19 | 11202306 | **rs6511720** | G | T | 1,794 | 0.119 | 0.118 | 0.122 | 0.125 | $5.1 \cdot 10^{-2}$ | $1.46 \cdot 10^{-2}$ | ++ | LDLR | 1 | rs6511720 | 94,595 | 0.221 | $6.1 \cdot 10^{-3}$ | $3.85 \cdot 10^{-262}$ |
| 19 | 45395619 | **rs2075650** | G | A | 1,794 | 0.125 | 0.113 | 0.127 | 0.144 | $5.02 \cdot 10^{-2}$ | $4.27 \cdot 10^{-3}$ | +- | TOMM40 | 1 | rs2075650 | 94,595 | 0.177 | $5.5 \cdot 10^{-3}$ | $1.72 \cdot 10^{-214}$ |
| 2 | 21263900 | **rs1367117** | A | G | 1,794 | 0.28 | 0.109 | 0.312 | $6.2 \cdot 10^{-2}$ | $3.75 \cdot 10^{-2}$ | $9.81 \cdot 10^{-2}$ | ++ | APOB | 1 | rs1367117 | 94,595 | 0.119 | $4 \cdot 10^{-3}$ | $9.48 \cdot 10^{-183}$ |
| 1 | 55505647 | **rs11591147** | G | T | 1,794 | $1.14 \cdot 10^{-2}$ | $3.58 \cdot 10^{-3}$ | $1.29 \cdot 10^{-2}$ | 0.14 | 0.159 | 0.379 | ++ | PCSK9 | 1 | rs11591147 | 94,595 | 0.497 | $1.8 \cdot 10^{-2}$ | $8.58 \cdot 10^{-143}$ |
| 2 | 21383717 | **rs4560142** | T | C | 1,794 | 0.758 | 0.631 | 0.782 | $4.86 \cdot 10^{-2}$ | $3.98 \cdot 10^{-2}$ | 0.222 | ++ | TDRD15 | 1 | rs4560142 | 94,595 | 0.109 | $4.5 \cdot 10^{-3}$ | $7.52 \cdot 10^{-126}$ |
| 19 | 45333834 | **rs4803760** | C | T | 1,784 | 0.842 | 0.823 | 0.942 | $5.69 \cdot 10^{-2}$ | $4.58 \cdot 10^{-2}$ | 0.214 | +- | BCAM | 1 | rs4803760 | 94,595 | 0.119 | $4.9 \cdot 10^{-3}$ | $2.47 \cdot 10^{-123}$ |
| 19 | 45382034 | **rs6859** | A | G | 1,784 | 0.578 | 0.547 | 0.584 | $7.72 \cdot 10^{-3}$ | $3.46 \cdot 10^{-2}$ | 0.823 | +- | NECTIN2 | 1 | rs6859 | 94,595 | $8.35 \cdot 10^{-2}$ | $3.9 \cdot 10^{-3}$ | $4.65 \cdot 10^{-88}$ |
| 2 | 44073881 | **rs6544713** | T | C | 1,794 | 0.715 | 0.692 | 0.841 | $4.56 \cdot 10^{-2}$ | $3.74 \cdot 10^{-2}$ | 0.222 | ++ | ABCG8 | 1 | rs6544713 | 94,595 | $8.06 \cdot 10^{-2}$ | $4.1 \cdot 10^{-3}$ | $4.84 \cdot 10^{-83}$ |
| 5 | 74656539 | **rs12916** | C | T | 1,794 | 0.372 | 0.244 | 0.396 | $6.72 \cdot 10^{-2}$ | $3.51 \cdot 10^{-2}$ | $5.59 \cdot 10^{-2}$ | ++ | HMGCR | 1 | rs12916 | 94,595 | $7.33 \cdot 10^{-2}$ | $3.8 \cdot 10^{-3}$ | $7.79 \cdot 10^{-78}$ |
| 5 | 74757556 | **rs4704220** | A | G | 1,794 | 0.452 | 0.384 | 0.821 | $5.44 \cdot 10^{-2}$ | $3.58 \cdot 10^{-2}$ | 0.128 | ++ | COL4A3BP | 1 | rs4704220 | 94,595 | $6.39 \cdot 10^{-2}$ | $3.7 \cdot 10^{-3}$ | $5.13 \cdot 10^{-62}$ |
| 5 | 74574984 | **rs2126736** | G | A | 1,791 | 0.451 | 0.419 | 0.625 | $6.04 \cdot 10^{-2}$ | $3.47 \cdot 10^{-2}$ | $8.19 \cdot 10^{-2}$ | ++ | ANKRD31 | 1 | rs2126736 | 94,595 | $6.42 \cdot 10^{-2}$ | $3.7 \cdot 10^{-3}$ | $2.62 \cdot 10^{-61}$ |
| 19 | 45237812 | **rs2965101** | T | C | 1,791 | 0.355 | 0.344 | 0.41 | $2.45 \cdot 10^{-4}$ | $3.47 \cdot 10^{-2}$ | 0.994 | +- | BCL3 | 1 | rs2965101 | 94,595 | $6.68 \cdot 10^{-2}$ | $4 \cdot 10^{-3}$ | $1.07 \cdot 10^{-60}$ |
| 19 | 11163601 | **rs1122608** | G | T | 1,794 | 0.217 | $5.73 \cdot 10^{-2}$ | 0.246 | $5.65 \cdot 10^{-2}$ | $4.07 \cdot 10^{-2}$ | 0.164 | +- | SMARCA4 | 1 | rs1122608 | 94,595 | $7.4 \cdot 10^{-2}$ | $4.5 \cdot 10^{-3}$ | $8.5 \cdot 10^{-57}$ |
| 19 | 45296806 | **rs3208856** | C | T | 1,794 | $3.01 \cdot 10^{-2}$ | $2.77 \cdot 10^{-2}$ | $4.3 \cdot 10^{-2}$ | $6.17 \cdot 10^{-2}$ | $9.78 \cdot 10^{-2}$ | 0.528 | +- | CBLC | 1 | rs3208856 | 94,595 | 0.295 | $1.91 \cdot 10^{-2}$ | $4.03 \cdot 10^{-56}$ |
| 19 | 19407718 | rs10401969 | C | T | 1,794 | $7.94 \cdot 10^{-2}$ | $6.47 \cdot 10^{-2}$ | 0.16 | $1.02 \cdot 10^{-2}$ | $6.2 \cdot 10^{-2}$ | 0.869 | +- | SUGP1 | 1 | rs10401969 | 94,595 | $-0.118$ | $7.2 \cdot 10^{-3}$ | $2.65 \cdot 10^{-54}$ |
| 2 | 44065090 | **rs6756629** | G | A | 1,794 | $6.91 \cdot 10^{-2}$ | $6.77 \cdot 10^{-2}$ | $7.71 \cdot 10^{-2}$ | $8.07 \cdot 10^{-3}$ | $6.63 \cdot 10^{-2}$ | 0.903 | +- | ABCG5 | 1 | rs6756629 | 94,595 | 0.131 | $8.8 \cdot 10^{-3}$ | $1.29 \cdot 10^{-49}$ |
| 19 | 19658472 | rs16996148 | T | G | 1,794 | $8.03 \cdot 10^{-2}$ | $6.53 \cdot 10^{-2}$ | 0.161 | $4.72 \cdot 10^{-2}$ | $6.13 \cdot 10^{-2}$ | 0.441 | ++ | CILP2 | 1 | rs16996148 | 94,595 | $-9.86 \cdot 10^{-2}$ | $6.7 \cdot 10^{-3}$ | $1.97 \cdot 10^{-45}$ |
| 8 | 126495818 | **rs10808546** | C | T | 1,794 | 0.396 | 0.371 | 0.401 | $2.67 \cdot 10^{-3}$ | $3.47 \cdot 10^{-2}$ | 0.939 | -+ | TRIB1 | 1 | rs10808546 | 94,595 | $5.36 \cdot 10^{-2}$ | $3.7 \cdot 10^{-3}$ | $1.51 \cdot 10^{-44}$ |
| 9 | 136154168 | rs579459 | T | C | 1,794 | 0.193 | 0.149 | 0.201 | $5.2 \cdot 10^{-2}$ | $4.22 \cdot 10^{-2}$ | 0.218 | ++ | ABO | 1 | rs579459 | 94,595 | $-6.65 \cdot 10^{-2}$ | $4.5 \cdot 10^{-3}$ | $2.42 \cdot 10^{-44}$ |
| 19 | 19329924 | rs2228603 | T | C | 1,794 | $5.41 \cdot 10^{-2}$ | $1.61 \cdot 10^{-2}$ | $6.11 \cdot 10^{-2}$ | $9.59 \cdot 10^{-2}$ | $7.29 \cdot 10^{-2}$ | 0.188 | ++ | NCAN | 1 | rs2228603 | 94,595 | $-0.104$ | $7.2 \cdot 10^{-3}$ | $4.43 \cdot 10^{-44}$ |
| 16 | 72108093 | **rs2000999** | A | G | 1,792 | 0.196 | $5.04 \cdot 10^{-2}$ | 0.222 | $2.62 \cdot 10^{-2}$ | $4.27 \cdot 10^{-2}$ | 0.539 | ++ | HPR | 1 | rs2000999 | 94,595 | $6.5 \cdot 10^{-2}$ | $4.6 \cdot 10^{-3}$ | $4.22 \cdot 10^{-41}$ |
| 11 | 61609750 | rs174583 | T | C | 1,794 | 0.337 | 0.262 | 0.351 | $9.91 \cdot 10^{-2}$ | $3.51 \cdot 10^{-2}$ | $4.73 \cdot 10^{-3}$ | ++ | FADS2 | 1 | rs174583 | 94,595 | $-5.22 \cdot 10^{-2}$ | $3.8 \cdot 10^{-3}$ | $7 \cdot 10^{-41}$ |
| 11 | 61571478 | rs174550 | C | T | 1,794 | 0.296 | $9.14 \cdot 10^{-2}$ | 0.334 | 0.104 | $3.65 \cdot 10^{-2}$ | $4.43 \cdot 10^{-3}$ | +- | FADS1 | 1 | rs174550 | 94,595 | $-5.14 \cdot 10^{-2}$ | $3.8 \cdot 10^{-3}$ | $7.03 \cdot 10^{-40}$ |
| 11 | 61557803 | rs102275 | C | T | 1,794 | 0.394 | 0.348 | 0.645 | $8.53 \cdot 10^{-2}$ | $3.48 \cdot 10^{-2}$ | $1.41 \cdot 10^{-2}$ | +- | TMEM258 | 1 | rs102275 | 94,595 | $-5.12 \cdot 10^{-2}$ | $3.8 \cdot 10^{-3}$ | $7.61 \cdot 10^{-40}$ |
| 1 | 55713628 | **rs4927207** | G | A | 1,793 | 0.154 | 0.131 | 0.158 | $2.46 \cdot 10^{-2}$ | $4.61 \cdot 10^{-2}$ | 0.595 | +- | USP24 | 1 | rs4927207 | 94,595 | $6.92 \cdot 10^{-2}$ | $4.9 \cdot 10^{-3}$ | $2.36 \cdot 10^{-39}$ |
| 11 | 61551356 | rs174535 | C | T | 1,794 | 0.318 | 0.203 | 0.34 | $9.21 \cdot 10^{-2}$ | $3.56 \cdot 10^{-2}$ | $9.64 \cdot 10^{-3}$ | +- | MYRF | 1 | rs174535 | 94,595 | $-5.04 \cdot 10^{-2}$ | $3.8 \cdot 10^{-3}$ | $1.75 \cdot 10^{-38}$ |
| 19 | 19379549 | rs58542926 | T | C | 1,794 | $6.02 \cdot 10^{-2}$ | $3.41 \cdot 10^{-2}$ | $6.5 \cdot 10^{-2}$ | $4.15 \cdot 10^{-2}$ | $6.97 \cdot 10^{-2}$ | 0.551 | ++ | TM6SF2 | 1 | rs58542926 | 94,595 | $-0.128$ | $9.5 \cdot 10^{-3}$ | $1.96 \cdot 10^{-38}$ |
| 16 | 56989590 | **rs247616** | C | T | 1,793 | 0.299 | 0.249 | 0.308 | $2.02 \cdot 10^{-2}$ | $3.72 \cdot 10^{-2}$ | 0.588 | +- | CETP | 1 | rs247616 | 94,595 | $5.47 \cdot 10^{-2}$ | $4.1 \cdot 10^{-3}$ | $2.57 \cdot 10^{-37}$ |
| 2 | 21123352 | **rs6711016** | C | A | 1,794 | 0.186 | $6.63 \cdot 10^{-2}$ | 0.209 | $7.39 \cdot 10^{-2}$ | $4.33 \cdot 10^{-2}$ | $8.76 \cdot 10^{-2}$ | +- | LDAH | 1 | rs6711016 | 94,595 | $5.51 \cdot 10^{-2}$ | $4.3 \cdot 10^{-3}$ | $1.1 \cdot 10^{-35}$ |
| 1 | 109838918 | rs629001 | C | T | 1,794 | 0.903 | 0.724 | 0.936 | $1.68 \cdot 10^{-2}$ | $5.98 \cdot 10^{-2}$ | 0.78 | ++ | MYBPHL | 1 | rs629001 | 94,595 | $-0.1$ | $7.9 \cdot 10^{-3}$ | $2.28 \cdot 10^{-35}$ |
| 19 | 19531910 | rs11668386 | G | A | 1,794 | $9.31 \cdot 10^{-2}$ | $3.58 \cdot 10^{-2}$ | 0.104 | $3.42 \cdot 10^{-2}$ | $5.69 \cdot 10^{-2}$ | 0.548 | ++ | GATAD2A | 1 | rs11668386 | 94,595 | $-7.23 \cdot 10^{-2}$ | $5.6 \cdot 10^{-3}$ | $3.14 \cdot 10^{-35}$ |
| 11 | 61560081 | rs174538 | A | G | 1,794 | 0.266 | $7.71 \cdot 10^{-2}$ | 0.301 | 0.115 | $3.78 \cdot 10^{-2}$ | $2.31 \cdot 10^{-3}$ | +- | FEN1 | 1 | rs174538 | 94,595 | $-5 \cdot 10^{-2}$ | $4 \cdot 10^{-3}$ | $1.07 \cdot 10^{-34}$ |
| 5 | 74967386 | **rs40060** | C | T | 1,794 | 0.641 | 0.557 | 0.656 | $5.74 \cdot 10^{-2}$ | $3.56 \cdot 10^{-2}$ | 0.106 | ++ | ANKDD1B | 1 | rs40060 | 94,595 | $4.74 \cdot 10^{-2}$ | $3.8 \cdot 10^{-3}$ | $5.95 \cdot 10^{-34}$ |
| 1 | 63133930 | **rs4587594** | G | A | 1,794 | 0.35 | 0.334 | 0.441 | $5.82 \cdot 10^{-2}$ | $3.49 \cdot 10^{-2}$ | $9.55 \cdot 10^{-2}$ | ++ | DOCK7 | 1 | rs4587594 | 94,595 | $4.93 \cdot 10^{-2}$ | $3.9 \cdot 10^{-3}$ | $1.63 \cdot 10^{-32}$ |
| 19 | 19789528 | **rs2304130** | A | G | 1,794 | $8.78 \cdot 10^{-2}$ | $7.1 \cdot 10^{-2}$ | 0.179 | $1.06 \cdot 10^{-2}$ | $5.95 \cdot 10^{-2}$ | 0.859 | +- | ZNF101 | 1 | rs2304130 | 94,595 | $8.85 \cdot 10^{-2}$ | $7.2 \cdot 10^{-3}$ | $2.24 \cdot 10^{-32}$ |
| 5 | 156390297 | **rs6882076** | C | T | 1,780 | 0.592 | 0.368 | 0.633 | $2.27 \cdot 10^{-3}$ | $3.56 \cdot 10^{-2}$ | 0.949 | -+ | TIMD4 | 1 | rs6882076 | 94,595 | $4.56 \cdot 10^{-2}$ | $3.8 \cdot 10^{-3}$ | $3.31 \cdot 10^{-31}$ |
| 19 | 10916684 | rs2287029 | T | C | 1,794 | 0.157 | $4.3 \cdot 10^{-2}$ | 0.178 | $3.59 \cdot 10^{-2}$ | $4.66 \cdot 10^{-2}$ | 0.44 | +- | DNM2 | 1 | rs2287029 | 94,595 | $-8.28 \cdot 10^{-2}$ | $6.8 \cdot 10^{-3}$ | $8.05 \cdot 10^{-31}$ |
| 19 | 11275139 | **rs7188** | C | A | 1,793 | 0.299 | $6.3 \cdot 10^{-2}$ | 0.342 | $5.63 \cdot 10^{-3}$ | $3.78 \cdot 10^{-2}$ | 0.882 | +- | KANK2 | 1 | rs7188 | 94,595 | $5.21 \cdot 10^{-2}$ | $4.3 \cdot 10^{-3}$ | $9.39 \cdot 10^{-31}$ |
| 5 | 75015242 | **rs2112347** | G | T | 1,794 | 0.38 | 0.358 | 0.495 | $5.31 \cdot 10^{-2}$ | $3.57 \cdot 10^{-2}$ | 0.137 | ++ | POC5 | 1 | rs2112347 | 94,595 | $4.43 \cdot 10^{-2}$ | $3.8 \cdot 10^{-3}$ | $4.43 \cdot 10^{-30}$ |
| 19 | 11256285 | rs4804147 | A | G | 1,794 | 0.395 | $7.53 \cdot 10^{-2}$ | 0.454 | $3.85 \cdot 10^{-3}$ | $3.61 \cdot 10^{-2}$ | 0.915 | ++ | SPC24 | 1 | rs4804147 | 94,595 | $-4.35 \cdot 10^{-2}$ | $3.8 \cdot 10^{-3}$ | $5.31 \cdot 10^{-29}$ |
| 19 | 10728030 | rs8106664 | G | T | 1,794 | 0.799 | 0.789 | 0.853 | $8.49 \cdot 10^{-2}$ | $4.25 \cdot 10^{-2}$ | $4.58 \cdot 10^{-2}$ | ++ | SLC44A2 | 1 | rs8106664 | 94,595 | $-5.3 \cdot 10^{-2}$ | $4.6 \cdot 10^{-3}$ | $1.5 \cdot 10^{-27}$ |
| 11 | 116648917 | rs964184 | G | C | 1,794 | 0.838 | 0.797 | 0.846 | $5.42 \cdot 10^{-2}$ | $4.54 \cdot 10^{-2}$ | 0.232 | +- | ZPR1 | 1 | rs964184 | 94,595 | $-8.55 \cdot 10^{-2}$ | $7.8 \cdot 10^{-3}$ | $2.01 \cdot 10^{-26}$ |
| 20 | 39797465 | rs753381 | T | C | 1,794 | 0.604 | 0.548 | 0.907 | $1.76 \cdot 10^{-2}$ | $3.54 \cdot 10^{-2}$ | 0.619 | ++ | PLCG1 | 1 | rs753381 | 94,595 | $-3.81 \cdot 10^{-2}$ | $3.7 \cdot 10^{-3}$ | $3.57 \cdot 10^{-25}$ |
| 8 | 9183358 | rs9987289 | A | G | 1,794 | 0.901 | 0.819 | 0.916 | $9.19 \cdot 10^{-3}$ | $5.72 \cdot 10^{-2}$ | 0.872 | +- | PPP1R3B | 1 | rs9987289 | 94,595 | $-7.14 \cdot 10^{-2}$ | $6.6 \cdot 10^{-3}$ | $8.53 \cdot 10^{-24}$ |
| 11 | 116639104 | **rs10790162** | A | G | 1,794 | 0.929 | 0.919 | 0.984 | $8.58 \cdot 10^{-2}$ | $6.52 \cdot 10^{-2}$ | 0.188 | ++ | BUD13 | 1 | rs10790162 | 94,595 | $7.6 \cdot 10^{-2}$ | $7.2 \cdot 10^{-3}$ | $1.09 \cdot 10^{-23}$ |
| 1 | 109784781 | **rs586254** | A | G | 1,793 | 0.558 | 0.54 | 0.654 | $6.33 \cdot 10^{-2}$ | $3.34 \cdot 10^{-2}$ | $5.8 \cdot 10^{-2}$ | ++ | SARS | 1 | rs586254 | 94,595 | $5.58 \cdot 10^{-2}$ | $5.4 \cdot 10^{-3}$ | $2.5 \cdot 10^{-23}$ |

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