A Mendelian Randomization Study Provides Evidence That Adiposity and Dyslipidemia Lead to Lower Urinary Albumin-to-Creatinine Ratio, a Marker of Microvascular Function

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A Mendelian randomization study provides evidence that adiposity and dyslipidemia lead to lower urinary albumin creatinine ratio, a marker of microvascular function

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Abstract

Urinary albumin-creatinine ratio is a marker of diabetic nephropathy and microvascular damage. Metabolic-related traits are observationally associated with ACR but their causal role is uncertain. Here, we confirmed ACR as a marker of microvascular damage and tested whether metabolic-related traits have causal relationships with ACR.

The association between ACR and microvascular function (responses to acetylcholine and sodium nitroprusside) were tested in the SUMMIT study. Two sample Mendelian randomization (MR) was used to infer the causal effects of eleven metabolic risk factors, including glycemic, lipid and adiposity traits on ACR. MR was performed in up to 440,000 UK Biobank and 54,451 CKDGen participants.

ACR was robustly associated with microvascular function measures in SUMMIT. Using MR we inferred that higher triglyceride and LDL-cholesterol levels caused elevated ACR. A one standard deviation (SD) higher triglyceride and LDL-C level caused a 0.062 [95%CI: 0.040, 0.083] and a 0.026 [95%CI: 0.008, 0.044] SD higher ACR respectively. There was evidence that higher body fat and visceral body fat distribution caused elevated ACR, whilst a metabolically "favourable adiposity" phenotype lowered ACR.

ACR is a valid marker for microvascular function. MR suggested that 7 traits have causal effects on ACR, highlighting the role of adiposity related traits in causing lower microvascular function.

Introduction

The urinary albumin-creatinine ratio, a marker of diabetic nephropathy, is used as a proxy for damage to the systemic microcirculation (1) and predicts first myocardial infarction and mortality in those with diabetes, post stroke and the general population (2-4). There is evidence linking metabolic-related traits, including adiposity, dyslipidemia and insulin resistance with elevated ACR levels and microvascular damage (5; 6). It is well accepted that tight glucose control in patients with type 2 diabetes (T2D) reduces the risk of microvascular retinal complications (7; 8) and there is evidence that adiposity per se is associated with increased ACR. For example, population studies suggest that microalbuminuria is associated with central adiposity (9) and results from The Framingham Heart Study show that visceral but not subcutaneous fat is associated with increased albuminuria (10). Not all evidence linking metabolic-related traits come from randomized control trials and, in absence of these, the next best evidence of causality comes from genetic studies using a technique known as Mendelian randomization (MR, Figure 1).

In MR, genetic variants that are strongly associated with the risk factor of interest are used to test its causal effect on an outcome (11). The MR approach exploits the natural experiment of genetic variants being randomly assigned at conception, which means they are less likely to be associated with confounding factors and should not suffer from reverse causality (12). MR studies investigating the role of metabolic traits in increasing microvascular damage, including ACR, infer causal relationships for higher blood pressure (13) but not for lipids (14), but the latter study was small, limited in power and focused only on people with diabetes.

Here, we utilised data from 743 participants in the SUrrogate markers for Micro- and Macro-vascular hard endpoints for Innovative diabetes Tools (15) study to first confirm that ACR is a suitable proxy for early systemic microvascular damage, by testing its association with two validated measures of microvascular function – skin microvascular response to iontophoresis of vasodilators acetylcholine (endothelial dependent) and sodium nitroprusside (endothelial independent). Second, we tested the observational associations between ACR and 9 metabolic

risk factors in 438,075 participants in the UK Biobank. Finally, we used MR to test the effects of 11 metabolic risk factors on microvascular function using ACR as a proxy in the UK Biobank and summary results for 54,451 participants in the CKDgen GWAS results.

Methods

Populations studied

UK Biobank

The UK Biobank study recruited over 500,000 individuals aged between 37 and 73 years between 2006 and 2010. The study collected detailed information from all participants, via questionnaires, interviews and measurements (16). Here we used 438,075 individuals of White European ancestry (defined through principal component-based analyses (17) with ACR available. We also defined a subset of 368,754 unrelated individuals of European ancestry. Related individuals were defined using a KING Kinship and an optimal list of unrelated individuals was generated to allow maximum numbers of individuals to be included. Ancestral principal components were then generated within these identified individuals for use in subsequent analyses.

SUMMIT

Data for observational association and functional measures of microvascular function were collected in 743 individuals from two centres (Exeter and Dundee) participating in the vascular imaging cohort of the SUMMIT study. SUMMIT is a multicentre study aiming at identifying markers that predict the risks of developing diabetes related chronic micro- and macro-vascular complications (15; 18).

Validation of ACR as a proxy for microvascular function

In SUMMIT, skin microvascular function in the forearm is measured using laser Doppler fluximetry. A laser Doppler imager (LDI, Moor Instruments MODEL LDI2) was used to measure perfusion before and after iontophoresis of endothelium dependent (acetylcholine , ACH) and

endothelium independent (sodium nitroprusside) vasodilatory stimuli. The full protocol of the techniques used are detailed elsewhere (18).

ACR was measured in SUMMIT from random spot urine collection (Exeter Pathology Services, Royal Devon and Exeter NHS Foundation Trust, and Dundee Pathology Services, Ninewells NHS trust), in accordance with the UK national quality assessment scheme. Analysis of albumin concentration was performed using immunoturbidimetric method a detection limit of 3.0 mg/L (Cobas system, Roche), creatinine was measured using the Jaffe methods. In order to maintain a consistent approach with UK Biobank analysis, values below detection limit were set at 2.9 mg/L prior to the calculation of the ratio. The ACR variable was inverse normalised prior to analysis.

The relationship between the gold standard microvascular functional measures and ACR was explored using linear regression models, with age and sex included as covariates.

Exposure and outcome measures in UK Biobank

We selected 11 metabolic markers which have previously been associated with ACR and have strong genetic instruments available in the form of multiple variants (**Supplementary table 2**) identified in large genome wide association studies (GWAS). More information on how the outcome and exposures were defined in the UK Biobank are explained below.

OUTCOME: Albumin to creatinine ratio (ACR)

A continuous measure of ACR was derived using urinary measures of albumin and creatinine. If albumin was <6.7 mg/L (the detection level of the assay in UK Biobank, http://biobank.ctsu.ox.ac.uk/crystal/docs/urine_assay.pdf) then the albumin was set at 6.7 mg/L prior to the calculation of the ratio, an approach consistent with that of previous studies (13; 19). Albumin was measured using immuno-turbidimetric analysis method (Randox Bioscience, UK) while creatinine was measured using enzymatic analysis method (Beckman Coulter, UK). The ACR variable was inverse normalised prior to analysis.

EXPOSURES:

Nine of the eleven metabolic markers were measured in the UK Biobank.

Lipids

Serum concentrations of LDL-Cholesterol (LDL-C, N=417,386) were obtained using an Enzymatic Selective Protection analysis method (Beckman Coulter AU5800, Beckman Coulter (UK), Ltd), HDL-Cholesterol (HDL-C, N=382,598) using a EnzymeImmuno-inhibition analysis method (Beckman Coulter AU5800, Beckman Coulter (UK), Ltd) and triglycerides (TG, N=417,825) using Enzymatic analysis method (Beckman Coulter AU5800, Beckman Coulter (UK), Ltd). More details on the acquisition of these biomarkers can be found here: http://biobank.ndph.ox.ac.uk/showcase/docs/serum_biochemistry.pdf

Body composition

We used three measures of body composition: body mass index (BMI), waist hip ratio (WHR) adjusted for BMI and, using genetics, a measure of higher body fat percentage but lower metabolic disease risk, termed favourable adiposity. BMI was calculated for all participants from measured weight and height ((kg)/height $(m)^2$) and was available for 436,631 individuals with ACR and genetic data available. WHR was calculated from measured waist and hip circumference measures and adjusted for BMI, this was available in 436,530 individuals. Body fat percentage was calculated from bioelectrical impedance data collected using Tanita BC418MA body composition analyser and was available in 430,546 individuals.

Blood pressure

Systolic blood pressure (SBP, N=437,121) and diastolic blood pressure (DBP, N=436,394) were measured. The blood pressure readings were obtained from averaging two readings obtained in a seated position 5 minutes apart using an automated blood pressure device (Omron 705 IT, Omron Healthcare Europe B.V. Hoofddorp, The Netherlands). In participants where only one

valid blood pressure was available this was utilised. Blood pressure medication use was accounted for by adding 10 and 15 to diastolic and systolic measures respectively.

Type 2 diabetes (T2D)

Type 2 diabetes cases were defined through self-report of diabetes using the baseline questionnaire. Cases were participants diagnosed at >35 years of age, and without reporting of insulin use within the first year of diagnosis (20). This resulted in 13,799 cases and 415,908 controls (**Table 1**).

Metabolic predictors not available in the UK Biobank

Two measures of glycemic control were not measured in the UK Biobank at the time of study: fasting glucose (FG) and fasting insulin (FI).

For all continuous measurements in UK Biobank values more than 4.56SD away from the mean were excluded. These variables when then inverse normalised prior to analysis.

The observational associations between the measured exposures and ACR were tested in UK Biobank using linear regression models, adjusted for age, sex and assessment centre.

Genetic variants

For Mendelian randomization (MR) independent genetic variants were selected from the UK Biobank imputation dataset. Variants were excluded if imputation quality (INFO) was <0.3 or the minor allele frequency (MAF) was <0.1%.

The genetic variants for the exposure traits were selected based on published GWAS studies. Genetic variants were selected and extracted for the 11 metabolic markers including lipid levels (triglycerides, HDL-C and LDL-C), BMI, favourable adiposity (genetic variants associated with

higher body fat percentage but lower risk of metabolic disease (e.g. type 2 diabetes, coronary heart disease)), WHR (adjusted for BMI), systolic and diastolic blood pressure, type 2 diabetes, fasting glucose and fasting insulin (**Supplementary table 2**). Four variants were identified that were previously identified to associate with ACR at genome wide significance: rs1047891 (HDL variant), rs4865796 (fasting insulin variant), rs109953111 (DBP variant) and rs2068888 (triglyceride variant) (21).

The extracted genetic variants were utilised to create genetic risk scores (GRS) for each metabolic trait of interest. The variants were weighted by their effect size (β-coefficient) obtained from the primary GWAS, where possible using GWAS that did not include data from the UK Biobank (equation 1). The weighted score was then rescaled to reflect the number of trait raising alleles (equation 2).

$$Weighted\ score = \beta_1\, x\, SNP_1 + \beta_2\, x\, SNP_2 + \ldots \beta_n\, x\, SNP_n \quad \text{(Equation 1)}$$

$$Weighted\ genetic\ risk\ score = \frac{weighted\ score\ x\ number\ of\ SNPs}{sum\ of\ the\ \beta\ coefficients} \quad \text{(Equation 2)}$$

Mendelian randomization

We used MR to test for causal relationships between our 11 metabolic risk factors as exposures and ACR as an outcome. MR relies on several assumptions as outlined in Figure 1:

- the exposure GRS are robustly associated with the relevant measured exposure (**Supplementary table 1**);
- the exposure GRS are not associated, independently of their effects on the exposure, with confounding factors that bias conventional epidemiological associations.
- the exposure GRS is only associated with the outcome via its effect on the modifiable exposure.

In this study, we employed several methods of MR: one and two-sample MR. The primary analyses utilised data from 438,075 UK Biobank participants with measured ACR. We extracted the genetic variants for the 11 known metabolic traits (**Supplementary table 2**) from the BOLT-LMM (22) GWAS of ACR, which was adjusted for baseline age, sex, study centre, and genotyping array (0=BiLEVE, 1=Axiom UK Biobank interim release, 2=Axiom UK Biobank final release). We also extracted association statistics for the same SNPs from the largest GWAS of ACR (54,451 participants from CDKGen consortium meta-analysis, Teumer et al. 2016) which did not include the UK Biobank.

Two-sample MR

Our primary MR approach was to use the inverse variance weighted (IVW) estimator. The IVW method involves a weighted regression of the effect sizes of variant-outcome associations against the effect sizes of the variant-risk factor associations constraining the intercept to zero. The beta coefficient from the weighted regression represents the standard deviation change in the ACR per SD change in the outcome variable (with the exception of type 2 diabetes, where we present our findings as an SD change in ACR per two-fold higher genetic liability for type 2 diabetes). Several sensitivity analyses were performed to test whether the MR IVW estimates are biased by genetic variants that affect the outcome independently of the exposure of interest (i.e. horizontal pleiotropy). These methods were MR-Egger regression (23) and the weighted median (WM) estimator (24). MR-Egger is similar to IVW, except that the intercept is unconstrained. The intercept in MR-Egger reflects the average pleiotropic effect across genetic variants. Hence this method is less susceptible to potentially pleiotropic variants having a stronger effect on the outcome compared with their effect on the primary traits. The weighted median method is also more resistant to pleiotropy and gives consistent estimates even when 50% of the variants are invalid. Given these different assumptions, if all methods are broadly consistent it strengthens our causal inference. The R code for the various 2-sample methods is available in (23; 24).

We performed sensitivity analyses for the four traits where one variant was known to be associated with ACR at genome-wide significance. Here, the 2-sample MR was repeated excluding that one variant.

The results from the 2-sample MR in the UK Biobank and the GWAS studies were meta-analysed using the metan command in Stata.

There is some overlap between the genetic variants for LDL-C, HDL-C and TG. Therefore, as well as individually exploring the role of the LDL-C, HDL-C and TG SNPs on the outcomes we also ran multivariate models adjusting for the other lipid associations (25). For example, when testing the causal role of LDL-C we included the LDL-C-SNP-TG association and the LDL-C-SNP-HDL association as covariates in our model.

One sample MR

In an unrelated subset of the data we also performed one-sample MR using the GRS and the ivreg2 command in STATA. In these models age, sex, ancestral principal components, assessment centre and genotyping platform were included as covariates. In cases where the predictor was not measured in the UK Biobank we explored the association of the GRS directly with the outcome. As with the two sample MR we performed multivariate analyses for the lipids by adjusting models for the other lipid GRS. For example, we performed MR to explore the causal role of LDL-C on ACR adjusting our models for all the standard covariates and the HDL-C and TG GRS.

Data and resource availability

The UK Biobank resource can be utilised by any bonafide researcher and access to all the genetic and phenotypic data utilised in this study are available upon application to the UK Biobank (https://www.ukbiobank.ac.uk/). The summary statistics from the CDKGEN are

available: (https://ckdgen.imbi.uni-freiburg.de). SUMMIT data utilised in this study are available on request to the Diabetes and Vascular Research Centre, University of Exeter Medical School.

Results

Characteristics for the 438,075 UK Biobank and 743 SUMMIT participants are presented in **table 1**.

SUMMIT provided evidence that supports the use of ACR as a marker of microvascular function

Results from the SUMMIT study support the use of ACR as a proxy for microvascular function with lower microvascular function associated with raised ACR levels. There was a negative association between ACR and skin microvascular function for both endothelium dependent (ACH) and independent (sodium nitroprusside) function. One SD lower response in endothelium dependent microvascular function as measured by skin reactivity to iontophoresis of ACH was associated with a 0.155 SD higher ACR (95%CI: 0.078, 0.230, p = 5.8E-05). One SD lower response in endothelium independent microvascular function as measured by reactivity to sodium nitroprusside was associated with a 0.206 SD higher ACR (95%CI: 0.131, 0.281, p = 1.1E-07). Taken together these measures demonstrate that lower systemic microvascular response measured by skin reactivity to iontophoresis is associated with elevation in urinary ACR.

Observational associations for the 11 metabolic traits with ACR

Data for observational analyses in UK Biobank were available for 9 of the 11 of exposure traits. Observational analyses provided evidence that higher HDL cholesterol, systolic and diastolic blood pressure, higher WHR adjusted for BMI and type 2 diabetes were associated with elevated ACR (**Table 2**). Higher LDL cholesterol, triglycerides, BMI and higher body fat percentage were associated with lower levels of ACR (**Table 2**). The inverse association between higher LDL cholesterol, triglycerides, BMI and higher body fat with lower ACR was unexpected, but maybe due to treatment effects, confounding or survival bias, thus highlighting the importance of more robust approaches, like MR.

Mendelian randomization finds a stronger causal role of triglycerides in elevating ACR compared to LDL-cholesterol

MR inferred a causal role of higher TG and LDL-C in elevating ACR, with the effect of TG more than twice that of LDL-C. A one-SD higher TG (approximately 86 mg/dl) was associated with a 0.062 SD [95%CI: 0.040, 0.083] higher ACR (approximately 9.3 mg/mmol, **Table 3, Figure 2**), whilst a one-SD higher LDL-C (approximately 37 mg/dl) was associated with a 0.026 [95%CI: 0.008, 0.044] SD higher ACR. There was no evidence to infer that higher HDL-C altered ACR. The evidence for a causal role of higher TG in elevating ACR was strengthened using multivariate MR which adjusted for the association of the TG SNPs with HDL-C and LDL-C. A one SD higher TG (adjusted for LDL-C and HDL-C) associated with a 0.094 SD [95%CI: 0.073, 0.115] higher ACR (**Figure 2, Supplementary table 3**). In contrast, multivariate analyses attenuated the association between LDL-C and ACR, with a one SD higher LDL-C (adjusted for TG and HDL-C) associated with a 0.018 SD [95%CI: 0.001, 0.035] higher ACR (**Figure 2, Supplementary table 3**). There was no evidence that higher HDL-C adjusted for LDL-C and TG altered ACR.

Results were generally consistent when the more pleiotropy robust methods were utilised (**Table 3**). The estimates from the two studies (UK Biobank and CKDGen) and the one sample

MR in UK Biobank were consistent, strengthening the causal inference between triglycerides and ACR (**Supplementary table 4, Supplementary figure 1**). Findings for HDL and triglycerides were the same when variants known to be associated with ACR were excluded.

Mendelian randomization finds causal role of body composition measures in elevating ACR

We next tested three measurements of body size and composition – BMI, waist hip ratio (adjusted for BMI) and metabolically "favourable adiposity".

The MR analyses suggested that higher WHR caused elevated ACR levels, independently of BMI. A one-SD higher WHR adjusted for BMI was associated with a 0.040 SD higher ACR ([95%CI: 0.020, 0.059]; **Table 3, Figure 3**).

MR using the "favourable adiposity" genetic variants (associated with higher body fat percentage but lower risk of metabolic diseases (26) showed that metabolically favourable higher adiposity was associated with lower ACR (-0.157 [95%CI: -0.256, -0.057], *P*=0.002; **Figure 3**).

The MR results for higher BMI were not conclusive, although they were directionally consistent with the WHR results.

Results from alternative MR methods (**Table 3**) and the study specific results from the UK Biobank, CKDGen and the one-sample MR results were generally consistent (**Figure 3, Supplementary table 4**). However, there was weak evidence of heterogeneity for BMI (P = 0.013, I-squared 83.9%) and favourable adiposity (P = 0.027, I-squared 79.5%).

Meta-analysis of two sample Mendelian randomization infers a causal role of type 2 diabetes in elevating ACR

MR inferred that genetic liability to type 2 diabetes caused elevated ACR levels, with a two-fold higher genetic liability to type 2 diabetes associated with 0.013 SD [95%CI: 0.007, 0.018] higher ACR levels (**Table 3, Figure 4)**. There was no evidence of a causal relationship between either fasting insulin or fasting glucose and ACR.

Results were consistent when alternative MR methods were used (**Table 3, Supplementary table 4**) and when excluding the fasting insulin SNP that is also associated with ACR. The study specific results from the UK Biobank and CKDGen are presented in **Supplementary table 4, Figure 4.** .

Mendelian randomization confirms causal role of blood pressure in elevating ACR

MR confirmed previous evidence (13) for the causal relationship between higher blood pressure and elevated ACR levels. A 1 mmHg higher systolic and diastolic blood pressure was causally associated with a 0.006 [95%CI: 0.004, 0.008] and 0.009 [95%CI: 0.006, 0.012] SD higher ACR respectively (**Table 3, Figure 5**).

Results were consistent when alternative MR methods were used, although not all reached p<0.05 (**Table 3**). Excluding the one diastolic blood pressure variant that was associated with ACR in an independent study did not alter our findings. Study specific results from the UK Biobank, CKDGen and the one sample MR methods in the UK Biobank were generally consistent (**Figure 5, Supplementary table 4)**, although there was evidence of heterogeneity for systolic blood pressure (*P* = 0.002, I-squared 89.6%).

Discussion

This study used genetic approaches to infer the causal role of 11 metabolic risk factors on ACR, which was considered as a proxy for microvascular dysfunction. Firstly, we confirmed that ACR is a valid proxy for microvascular function, using two gold standard physiological measures of microvascular function in the SUMMIT study – skin endothelial dependent and independent

microvascular function. We then used genetic variants as unconfounded proxies for the 11 metabolic risk factors to infer that 7 of the 11 metabolic risk factors cause elevated levels of ACR and thus cause microvascular dysfunction.

Skin microcirculation is an established model to investigate systemic microvascular function prior to the clinical manifestation of disease (27). Skin microvascular responses have been demonstrated to be reduced in people with type 2 diabetes (18) and associated with coronary microvascular function (28). Results presented here support the use of ACR as a proxy for the systemic microcirculation and not just for renal microcirculation.

In keeping with the clinical data, we inferred a causal role of LDL cholesterol and triglycerides in raising ACR levels, with multivariate lipid analyses strengthening the triglyceride association and attenuating the LDL association. Indeed, the effect of triglycerides on ACR is twice as large as the effect of LDL. This contrasts with available evidence for coronary artery disease (CAD) where LDL levels have a larger effect on CAD risk than triglycerides.

Whilst the effect sizes in our results can be seen as small, they represent clinically meaningful results. For example, previous studies have demonstrated that small changes in LDL cholesterol (e.g. 0.2 magnitude lower LDL in mmol/L) results in a 5 to 10% reduction in the risk of CHD (29). The majority of our analyses look at SD changes in ACR per genetically instrumented SD change in the predictor. For LDL, this equates to approximately a 0.9 mmol/L higher LDL, which in previous studies would equate to a 15 to 40% higher risk of CHD.

These results are consistent with those from clinical trials of cholesterol lowering medication. HMG Co-A reductase inhibitors (statins), predominantly lower LDL cholesterol, and have been demonstrated to reduce CAD risk. These drugs, however, only have a small effect on ACR (30), and a similarly small impact on other manifestations of microvascular dysfunction such as diabetic retinopathy (31). In contrast, PPARα antagonists such as fenofibrate, which act predominantly on triglyceride levels, have been shown to have beneficial effect on diabetic nephropathy and retinopathy (32). Combined statin-fenofibrate therapies can provide additional

endothelial vascular benefits than statin and fenofibrate alone (33) and, according to the recent results of the ACCORD study, it appears to be safe with regards to the risk of myositis or rhabdomyolysis when used in combination with a statin (34). Our results suggest that combined therapies lowering triglyceride as well as LDL levels could provide compound benefits by reducing the atherosclerotic burden, and thus CAD, whilst simultaneously reducing microvascular dysfunction which has a greater impact on the quality of life on patients (35).

We used three complementary measures of body composition to test the role of adiposity and body fat distribution on the ACR. These three measures were BMI, waist hip ratio (adjusted for BMI) as a measure of central adiposity and “favourable adiposity” as a measure of higher fat mass “uncoupled” from its adverse metabolic effects (26). Our MR analyses infer that higher WHR (adjusted for BMI) elevates ACR. In contrast, having more favourable adiposity alleles lowers ACR. The favourable adiposity variants are known to associate with higher subcutaneous fat, but lower liver fat and lower visceral-to-subcutaneous adipose tissue ratio (26). This provides further evidence that body fat distribution may be important in albuminuria and microvascular problems. Previous studies have suggested a role for body fat distribution and visceral fat in albuminuria, although to date, these studies have had low numbers of participants and have only used observational data so are subject to more biases than the genetic approach employed in this study (10; 36; 37). A consistent trend was also noted for BMI, with higher BMI trending towards elevated ACR. These results suggest that adiposity and distribution of fat are important in elevating ACR and suggests a causal role for adiposity and fat distribution in microvascular dysfunction.

Our analyses strengthen previous work demonstrating that higher systolic and diastolic blood pressure cause albuminuria (13). Our results confirmed the direction and magnitude of the MR inferred causal role of systolic and diastolic blood pressure on ACR recently reported (13) and support evidence from clinical trials showing that anti-hypertensive treatments acting on the Renin-angiotensin system reduce ACR (38).

As expected, our MR results confirm that diabetes plays a major role in raising ACR levels. These results add genetic evidence to the large body of data from observational studies and clinical trials clearly showing the role of T2D in causing renal damage. There was no genetic evidence for fasting insulin or fasting glucose levels causing elevated ACR levels. This is in contrast with observational studies showing an association between fasting insulin or fasting glucose and ACR levels (39; 40). This may indicate that these observational associations are driven by confounding factors.

The major strength of this study is the availability of data in the UK Biobank and a large independent GWAS sample for testing the causal relationships using 2-sample MR approaches. Another strength is the use of multiple rigorous MR methods to establish causality in this analysis. MR provides the next best evidence of causality after randomized control trials and allow causal inferences on large scale databases such as those used in study.

We acknowledge, however, some limitations. Firstly, Mendelian randomization studies are not immune from some of the issues that affect observational studies. For example, it is possible that biases such as survival bias could have affected the MR as well as observational studies. If, for example, a high ACR and high LDL-cholesterol level results in a high mortality rate due to microvascular disease (e.g. stroke), then genetic factors that raise LDL-Cholesterol level could be depleted from the study and associations between LDL-cholesterol raising alleles and ACR could be weakened. This type of bias has been pointed out before (41). Secondly, our analyses were restricted to individuals of Caucasian descent and the UK Biobank is restricted to participants born between 1938 and 1971, therefore the generalisability of our findings may be limited. Thirdly, although multivariate MR was utilised to explore the role of the three lipids on ACR, there remains the potential for some residual bias due to the pleiotropic associations of the lipid variants, although more pleiotropy resistant methods generally provided consistent results. Finally, some of our instrumental variables explain only a small percentage of the variability of the outcome variable and therefore we might be underpowered to detect causal association in some of the analysis.

In conclusion, we have utilised a genetic approach to show the causal role of 7 metabolic risk factors on ACR and provided evidence that dyslipidemia, adiposity and distribution of adipose tissue cause elevations in ACR and thus cause microvascular dysfunction.

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Authors' contributions

F.C., T.M.F., J.T. designed the study. F.C., T.M.F., J.T. wrote the manuscript. A.C.S., W.D.S., A.T.H., edited the manuscript and helped interpret the data. F.C., J.T., A.R.W., S.E.J., R.B., H.Y., K.H.G., K. A., F.K. performed data processing, statistical analyses and interpretation. A.C.S., W.D.S, K.M.G, obtained funding for, designed and supervised the SUMMIT study.

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Transparency statement

J.T as the manuscript's guarantor confirms that the manuscript is an honest, accurate, and transparent account of the study being reported and no important aspects of the study have been omitted**.**

Conflict of Interest

The authors report no conflicts of interest.

Table 1. Participants' characteristics. Data are presented as mean (±standard deviation) and median [25th -75th percentile] where not otherwise stated.

	UK Biobank	SUMMIT
N	438,075	743
Age (yrs)	57.27 (± 8.02)	66.16 (± 8.82)
Sex [N males (%)]	237,181 (54.14%)	480 (64.60%)
Height (cm)	168.7 (± 9.2)	169.6 (± 0.09)
BMI	27.38 (± 4.75)	29.55 (± 5.22)
ACR (mg/mml)	1.10 [0.69 - 1.85]	0.70 [0.45 - 1.4]
CAD [N (%)]	36,434 (10.53%)	223 (30.01%)
T2D [N (%)]	13,799 (3.21%)	400 (53.84%)
Systolic BP (mmHg)	144.2 (± 24.0)	136.7 (16.5)
Diastolic BP (mmHg)	86.3 (± 13.5)	76.9 (8.71)

BMI = body mass index, ACR = albumin creatinine ratio, CAD = coronary arterial disease, available in 346,080 participants, T2D = type 2 diabetes, BP = blood pressure.

Table 2. UK Biobank observational association results between investigated traits and ACR for observational data.

Trait	UK Biobank Beta*	UK Biobank SE	UK Biobank P
Diastolic BP	0.113	0.001	< 1.0E-15
Systolic BP	0.155	0.002	< 1.0E-15
HDL cholesterol	0.068	0.002	< 1.0E-15
LDL cholesterol	-0.018	0.002	< 1.0E-15
Triglycerides	-0.047	0.002	< 1.0E-15
BMI	-0.106	0.001	< 1.0E-15
% Body fat	-0.116	0.002	< 1.0E-15
Waist hip ratio (adjusted by BMI)	0.008	0.002	4.30E-07
Fasting glucose	Not available	Not available	Not available
Fasting insulin	Not available	Not available	Not available
T2D	0.353	0.008	< 1.0E-15

*Beta represents the standard deviation change in ACR per unit standard deviation change in continuous traits or change based on case-control status for binary traits. SE = standard error. BP = blood pressure, BMI = body mass index, T2D = type 2 diabetes, BP = blood pressure.

Table 3. ACR results of meta analysis of Mendelian randomization results in UK Biobank and CKDGen. Betas represent standard deviation change in ACR for standard deviation change in metabolic trait, 95% confidence interval in brackets.

	Main MR analysis		**Pleiotropy robust methods**					
Trait	Beta IVW	P IVW	Beta Egger	P Egger	Beta WM	P WM	Beta PWM	P PWM
Diastolic BP	0.009 (0.006, 0.012)	2.0E-09	-0.001 (-0.009, 0.008)	8.3E-01	0.009 (0.006, 0.012)	6.8E-10	0.008 (0.004, 0.011)	1.0E-05
Systolic BP	0.006 (0.004, 0.008)	3.8E-08	0.001 (-0.005, 0.007)	7.6E-01	0.006 (0.004, 0.007)	2.9E-09	0.005 (0.003, 0.008)	1.8E-06
HDL cholesterol	-0.012 (-0.029, 0.006)	1.9E-01	0.012 (-0.013, 0.036)	3.5E-01	0.014 (-0.002, 0.030)	7.7E-01	0.014 (-0.009, 0.037)	2.5E-01
LDL cholesterol	0.026 (0.008, 0.044)	5.0E-03	0.022 (-0.006, 0.049)	1.2E-01	0.030 (0.014, 0.047)	2.6E-04	0.027 (0.009, 0.045)	3.8E-03
Triglycerides	0.062 (0.040, 0.083)	1.3E-08	0.064 (0.033, 0.096)	5.6E-05	0.050 (0.030, 0.070)	7.8E-07	0.054 (0.026, 0.082)	1.3E-04
BMI	0.024 (-0.002, 0.050)	7.3E-02	0.088 (0.031, 0.144)	2.3E-03	0.015 (-0.015, 0.045)	3.2E-01	0.033 (-0.002, 0.068)	6.1E-02
Favourable adiposity*	-0.157 (-0.256, -0.057)	1.9E-03	0.082 (-0.017, 0.334)	5.2E-01	-0.143 (-0.230, -0.560)	1.3E-03	-0.143 (-0.266, -0.021)	2.1E-02
Waist hip ratio (adjusted by BMI)	0.040 (0.020, 0.059)	6.3E-05	0.099 (0.051, 0.146)	4.9E-05	0.050 (0.027, 0.073)	2.0E-05	0.032 (0.008, 0.056)	8.0E-03
Fasting glucose	-0.014 (-0.073, 0.044)	6.3E-01	-0.039 (-0.152, 0.074)	5.0E-01	-0.017 (-0.062, 0.028)	4.5E-01	-0.016 (-0.064, 0.032)	5.0E-01
Fasting insulin	-0.018 (-0.215, 0.179)	8.6E-01	-1.318 (-2.409, -0.227)	1.8E-02	-0.035 (-0.159, 0.089)	5.8E-01	-0.032 (-0.170, 0.106)	6.5E-01
T2D liability	0.013 (0.006, 0.021)	5.2E-04	0.021 (0.006, 0.036)	7.6E-03	0.021 (0.012, 0.031)	1.4E-05	0.023 (0.011, 0.034)	1.1E-04

IVW = inverse variance weighted instrumental variable analysis, WM = weighted median analysis, PWM = penalised weighted median analysis.
BP = blood pressure, BMI = body mass index, T2D = type 2 diabetes.
*Favourable adiposity - represents higher adiposity but lower metabolic disease risk using genetic variants identified in Ji et al (26).

When removing SNPs associated with ACR at genome wide significance the results were consistent with the previous results [Diastolic BP: Beta IVW = 0.069 (-0.050, 0.188), p = 7.5E-10; HDL cholesterol: Beta IVW = 0.069 (-0.050, 0.188), p = 4.1E-02; Triglycerides: Beta IVW = 0.057 (0.037, 0.077). p = 1.5E-08; Fasting Insulin: Beta IVW = 0.014 (-0.153, 0.181), p = 8.7E-01]

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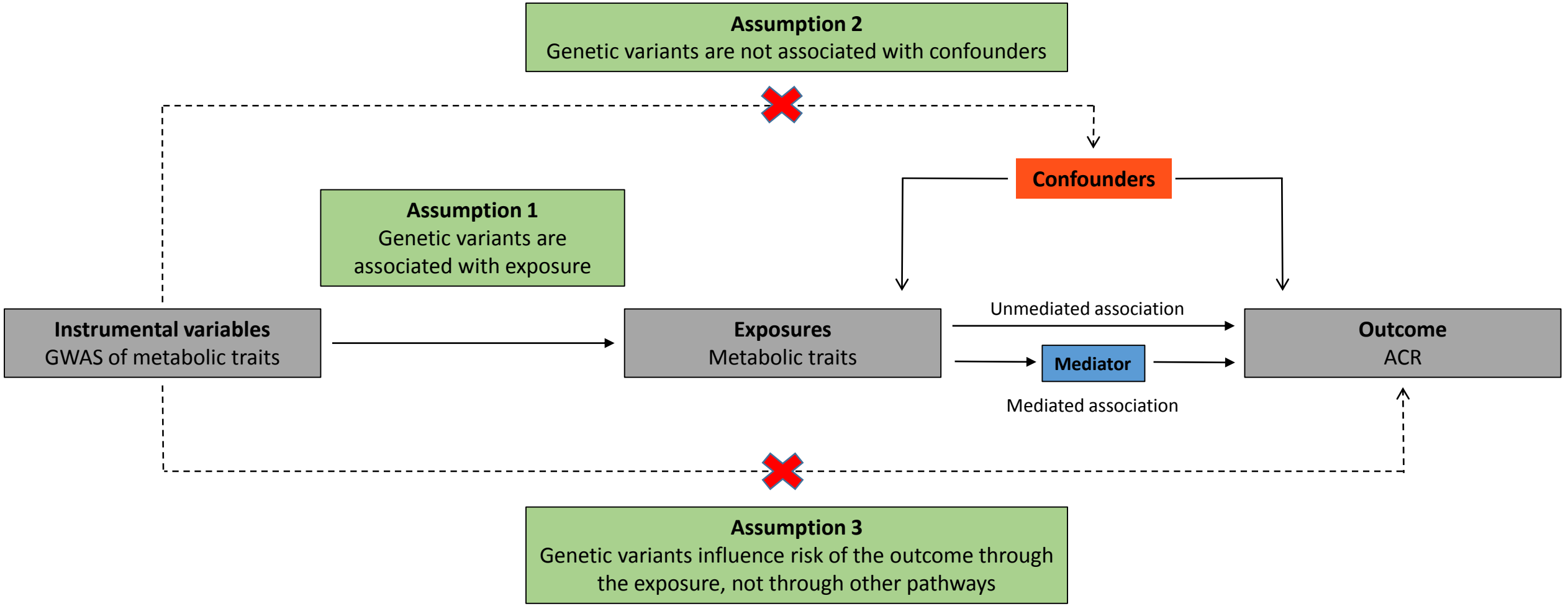
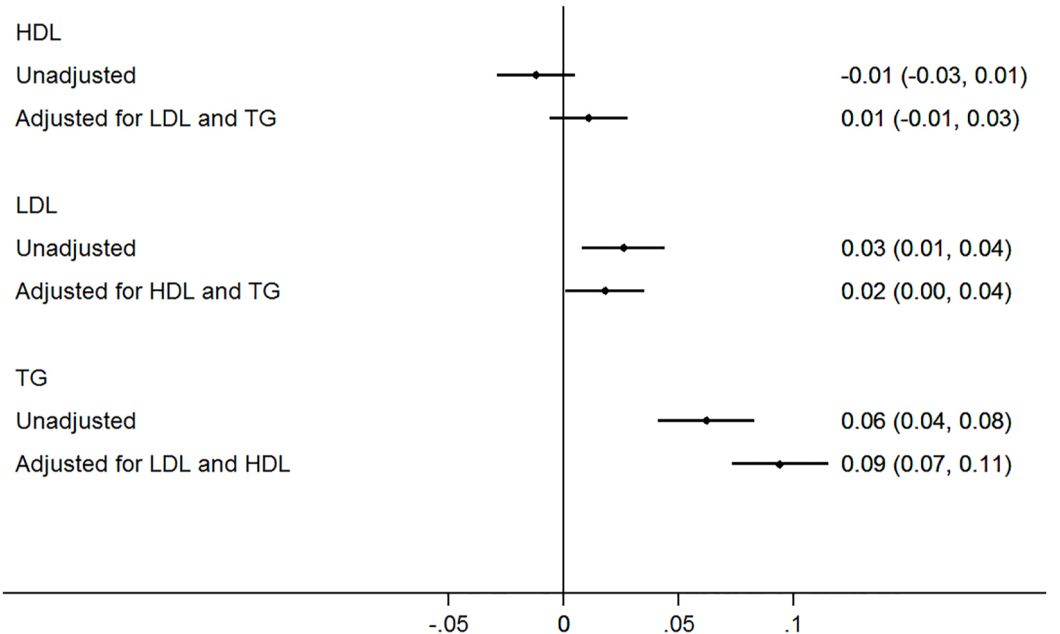
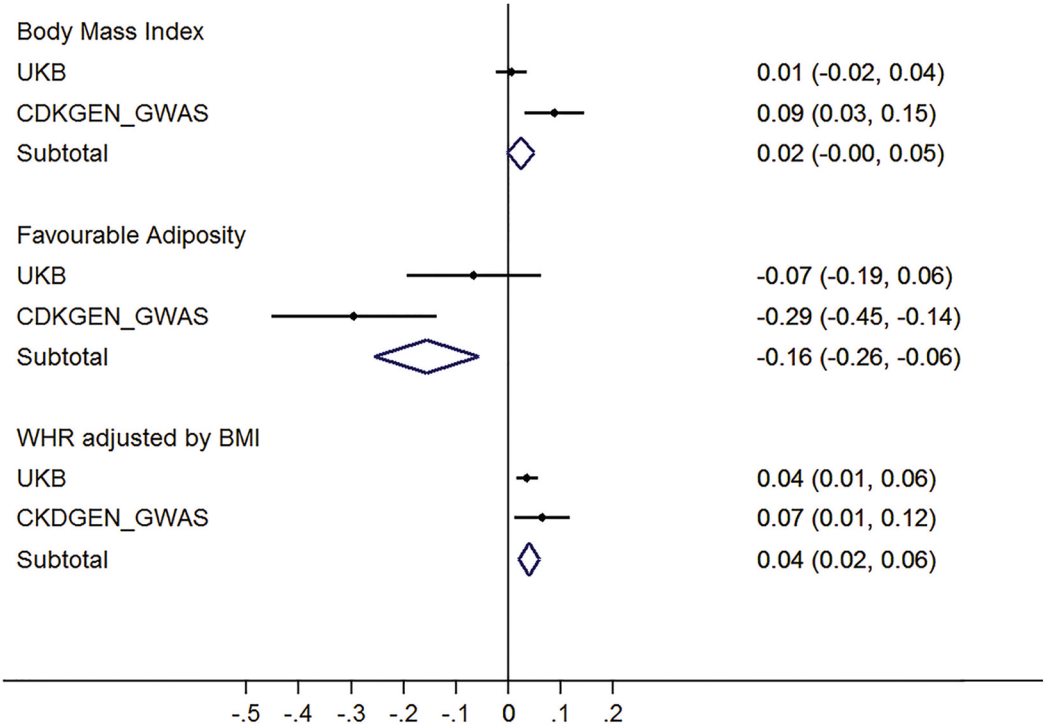

Assumption 2
Genetic variants are not associated with confounders
Confounders
Assumption 1
Genetic variants are associated with exposure
Instrumental variables
GWAS of metabolic traits
Exposures
Metabolic traits
Unmediated association
Mediator
Outcome
ACR
Mediated association
Assumption 3
Genetic variants influence risk of the outcome through the exposure, not through other pathways

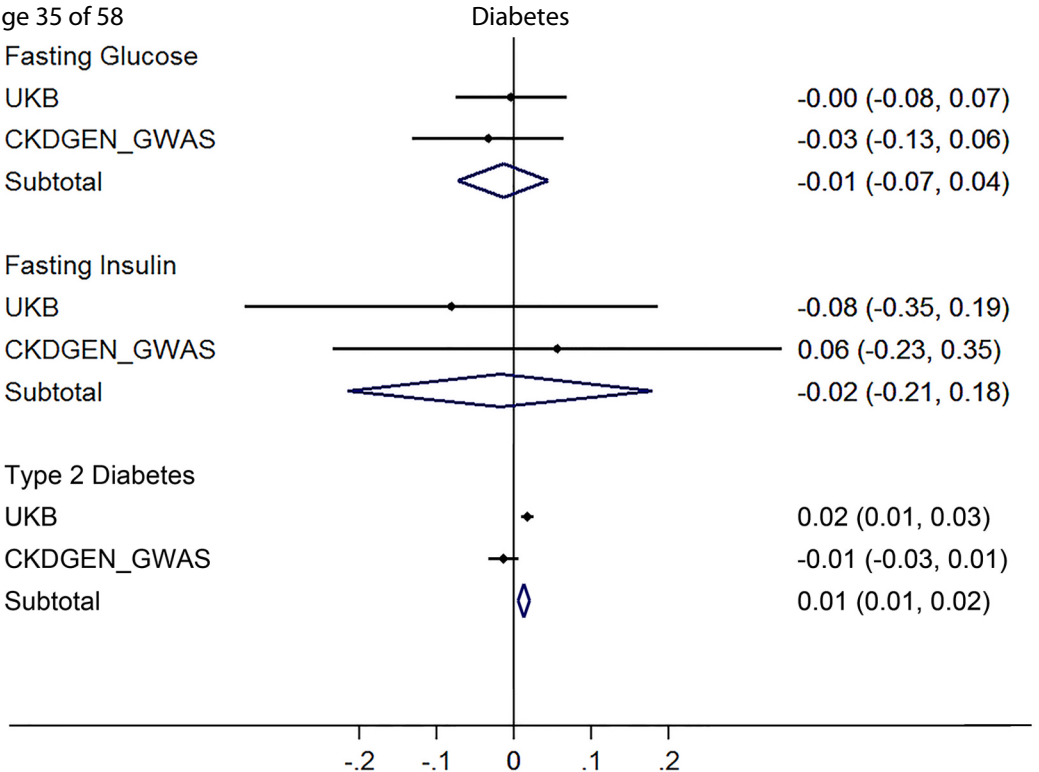


Standard deviation differences in ACR per standard deviation differences in genetically instrumented lipids measures



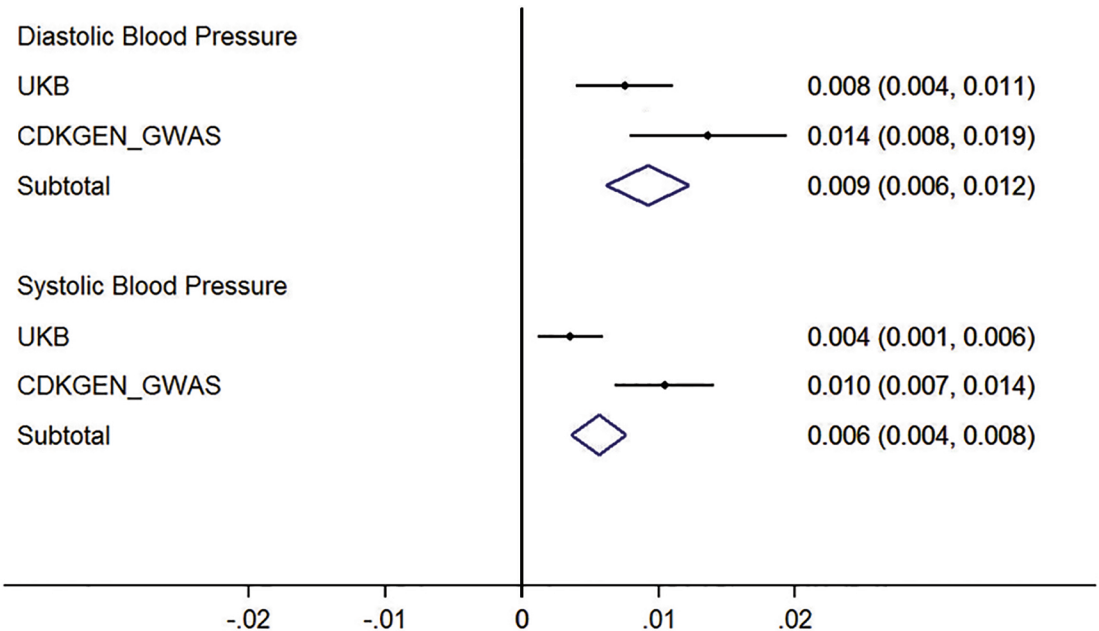
Standard deviation differences in ACR per standard deviation differences in genetically instrumented adiposity measures.

For BMI and favourable adiposity there was evidence of heterogeneity (p = 0.013, I-squared 83.9% and p = 0.027, I-squared 79.5%, respectively). No evidence of heterogeneity were found for WHR adjusted by BMI (p = 0.313, I-square 1.8%).



Standard deviation differences in ACR per standard deviation differences in genetically instrumented glycemic measures.

There was evidence of heterogeneity for type 2 diabetes (p = 0.004, I-squared 87.9%). There was no evidence of heterogeneity for for fasting glucose (p = 0.631, I-squared 0.0%) and fasting insulin (p = 0.496, I-squared 0.0%).



Standard deviation differences in ACR per standard deviation differences in genetically instrumented blood pressure.

There was no evidence of heterogeneity for diastolic blood pressure (p = 0.074, I-square 68.7%). Some evidence of heterogeneity were found for systolic blood pressure (p = 0.002, I-square 89.6%).

Supplementary table 1. Strength of association of genetic instruments with measured exposure exposures.

Trait	% variance	F-statistic	P
Diastolic BP	2.17	9962	< 1.0E-15
Systolic BP	1.74	7966	< 1.0E-15
HDL cholesterol	6.4	26895	< 1.0E-15
LDL cholesterol	4.36	19550	< 1.0E-15
Triglycerides	4.91	22189	< 1.0E-15
BMI	1.6	7295	< 1.0E-15
Favourable adiposity	0.1	468	< 1.0E-15
Waist hip ratio (adjusted by BMI)	1.5	6837	< 1.0E-15
Fasting glucose	Not available	Not available	
Fasting insulin	Not available	Not available	
T2D	0.6	2504	< 1.0E-15

Supplementary table2. Genetic variants utilised in Mendelian randomization analyses. Gene location as reported by the original study (where available).

Trait	Genetic variant	Trait raising allele	Trait lowering allele	Beta from the primary GWAS*	Primary GWAS* reference	Gene Location
BODY MASS INDEX	rs1000940	G	A	0.019	Locke et al., 2014	RABEP1
BODY MASS INDEX	rs10132280	C	A	0.023	Locke et al., 2014	STXBP6
BODY MASS INDEX	rs1016287	T	C	0.023	Locke et al., 2014	FLJ30838
BODY MASS INDEX	rs10182181	G	A	0.031	Locke et al., 2014	ADCY3
BODY MASS INDEX	rs10733682	A	G	0.017	Locke et al., 2014	LMX1B
BODY MASS INDEX	rs10938397	G	A	0.04	Locke et al., 2014	GNPDA2
BODY MASS INDEX	rs10968576	G	A	0.025	Locke et al., 2014	LINGO2
BODY MASS INDEX	rs11057405	G	A	0.031	Locke et al., 2014	CLIP1
BODY MASS INDEX	rs11126666	A	G	0.021	Locke et al., 2014	KCNK3
BODY MASS INDEX	rs11165643	T	C	0.022	Locke et al., 2014	PTBP2
BODY MASS INDEX	rs11191560	C	T	0.031	Locke et al., 2014	NT5C2
BODY MASS INDEX	rs11583200	C	T	0.018	Locke et al., 2014	ELAVL4
BODY MASS INDEX	rs1167827	G	A	0.02	Locke et al., 2014	HIP1
BODY MASS INDEX	rs11688816	G	A	0.017	Locke et al., 2014	EHBP1
BODY MASS INDEX	rs11727676	T	C	0.036	Locke et al., 2014	HHIP
BODY MASS INDEX	rs11847697	T	C	0.049	Locke et al., 2014	PRKD1
BODY MASS INDEX	rs12286929	G	A	0.022	Locke et al., 2014	CADM1
BODY MASS INDEX	rs12401738	A	G	0.021	Locke et al., 2014	FUBP1
BODY MASS INDEX	rs12429545	A	G	0.033	Locke et al., 2014	OLFM4
BODY MASS INDEX	rs12446632	G	A	0.04	Locke et al., 2014	GPRC5B
BODY MASS INDEX	rs12566985	G	A	0.024	Locke et al., 2014	FPGT-TNNI3K
BODY MASS INDEX	rs12885454	C	A	0.021	Locke et al., 2014	PRKD1
BODY MASS INDEX	rs12940622	G	A	0.018	Locke et al., 2014	RPTOR
BODY MASS INDEX	rs13021737	G	A	0.06	Locke et al., 2014	TMEM18
BODY MASS INDEX	rs13078960	G	T	0.03	Locke et al., 2014	CADM2
BODY MASS INDEX	rs13191362	A	G	0.028	Locke et al., 2014	PARK2
BODY MASS INDEX	rs1516725	C	T	0.045	Locke et al., 2014	ETV5
BODY MASS INDEX	rs1528435	T	C	0.018	Locke et al., 2014	UBE2E3
BODY MASS INDEX	rs1558902	A	T	0.082	Locke et al., 2014	FTO
BODY MASS INDEX	rs16851483	T	G	0.048	Locke et al., 2014	RASA2
BODY MASS INDEX	rs16951275	T	C	0.031	Locke et al., 2014	MAP2K5
BODY MASS INDEX	rs17001654	G	C	0.031	Locke et al., 2014	SCARB2
BODY MASS INDEX	rs17024393	C	T	0.066	Locke et al., 2014	GNAT2
BODY MASS INDEX	rs17094222	C	T	0.025	Locke et al., 2014	HIF1AN
BODY MASS INDEX	rs17405819	T	C	0.022	Locke et al., 2014	HNF4G
BODY MASS INDEX	rs17724992	A	G	0.019	Locke et al., 2014	PGPEP1
BODY MASS INDEX	rs1808579	C	T	0.017	Locke et al., 2014	C18orf8
BODY MASS INDEX	rs1928295	T	C	0.019	Locke et al., 2014	TLR4

BODY MASS INDEX	rs2033529	G	A	0.019	Locke et al., 2014	TDRG1
BODY MASS INDEX	rs2033732	C	T	0.019	Locke et al., 2014	RALYL
BODY MASS INDEX	rs205262	G	A	0.022	Locke et al., 2014	C6orf106
BODY MASS INDEX	rs2075650	A	G	0.026	Locke et al., 2014	TOMM40
BODY MASS INDEX	rs2112347	T	G	0.026	Locke et al., 2014	POC5
BODY MASS INDEX	rs2121279	T	C	0.025	Locke et al., 2014	LRP1B
BODY MASS INDEX	rs2176598	T	C	0.02	Locke et al., 2014	HSD17B12
BODY MASS INDEX	rs2207139	G	A	0.045	Locke et al., 2014	TFAP2B
BODY MASS INDEX	rs2245368	C	T	0.032	Locke et al., 2014	PMS2L11
BODY MASS INDEX	rs2287019	C	T	0.036	Locke et al., 2014	QPCTL
BODY MASS INDEX	rs2365389	C	T	0.02	Locke et al., 2014	FHIT
BODY MASS INDEX	rs2650492	A	G	0.021	Locke et al., 2014	SBK1
BODY MASS INDEX	rs2820292	C	A	0.02	Locke et al., 2014	NAV1
BODY MASS INDEX	rs29941	G	A	0.018	Locke et al., 2014	KCTD15
BODY MASS INDEX	rs3101336	C	T	0.033	Locke et al., 2014	NEGR1
BODY MASS INDEX	rs3736485	A	G	0.018	Locke et al., 2014	DMXL2
BODY MASS INDEX	rs3810291	A	G	0.028	Locke et al., 2014	ZC3H4
BODY MASS INDEX	rs3817334	T	C	0.026	Locke et al., 2014	MTCH2
BODY MASS INDEX	rs3849570	A	C	0.019	Locke et al., 2014	GBE1
BODY MASS INDEX	rs4256980	G	C	0.021	Locke et al., 2014	TRIM66
BODY MASS INDEX	rs4740619	T	C	0.018	Locke et al., 2014	C9orf93
BODY MASS INDEX	rs543874	G	A	0.048	Locke et al., 2014	SEC16B
BODY MASS INDEX	rs6477694	C	T	0.017	Locke et al., 2014	EPB41L4B
BODY MASS INDEX	rs6567160	C	T	0.056	Locke et al., 2014	MC4R
BODY MASS INDEX	rs657452	A	G	0.023	Locke et al., 2014	AGBL4
BODY MASS INDEX	rs6804842	G	A	0.019	Locke et al., 2014	RARB
BODY MASS INDEX	rs7138803	A	G	0.032	Locke et al., 2014	BCDIN3D
BODY MASS INDEX	rs7141420	T	C	0.024	Locke et al., 2014	NRXN3
BODY MASS INDEX	rs7243357	T	G	0.022	Locke et al., 2014	GRP
BODY MASS INDEX	rs758747	T	C	0.023	Locke et al., 2014	NLRC3
BODY MASS INDEX	rs7599312	G	A	0.022	Locke et al., 2014	ERBB4
BODY MASS INDEX	rs7899106	G	A	0.04	Locke et al., 2014	GRID1
BODY MASS INDEX	rs9400239	C	T	0.019	Locke et al., 2014	FOXO3
BODY MASS INDEX	rs9581854	T	C	0.03	Locke et al., 2014	MTIF3
BODY MASS INDEX	rs9925964	A	G	0.019	Locke et al., 2014	KAT8
DIASTOLIC BLOOD PRESSURE	rs10850411	T	C	0.253	Ehret et al. 2011	TBX3
DIASTOLIC BLOOD PRESSURE	rs1173771	G	A	0.261	Ehret et al. 2011	C5orf23, NPR3
DIASTOLIC BLOOD PRESSURE	rs13082711	C	T	0.238	Ehret et al. 2011	SLC4A7
DIASTOLIC BLOOD PRESSURE	rs13139571	C	A	0.26	Ehret et al. 2011	GUCY1A3, GUCY1B3
DIASTOLIC BLOOD PRESSURE	rs1813353	T	C	0.415	Ehret et al. 2011	CACNB2
DIASTOLIC BLOOD PRESSURE	rs381815	T	C	0.348	Ehret et al. 2011	PLEKHA7
DIASTOLIC BLOOD PRESSURE	rs419076	T	C	0.241	Ehret et al. 2011	MECOM
DIASTOLIC BLOOD PRESSURE	rs4373814	C	G	0.218	Ehret et al. 2011	CACNB2
DIASTOLIC BLOOD PRESSURE	rs4590817	G	C	0.419	Ehret et al. 2011	C10orf107
DIASTOLIC BLOOD PRESSURE	rs6015450	G	A	0.557	Ehret et al. 2011	EDN3, GNAS
DIASTOLIC BLOOD PRESSURE	rs10077885	C	A	0.174	Ehret et al. 2016	TRIM36
DIASTOLIC BLOOD PRESSURE	rs11128722	G	A	0.173	Ehret et al. 2016	FGD5
DIASTOLIC BLOOD PRESSURE	rs11556924	C	T	0.214	Ehret et al. 2016	ZC3HC1
DIASTOLIC BLOOD PRESSURE	rs11953630	C	T	0.281	Ehret et al. 2016	EBF1
DIASTOLIC BLOOD PRESSURE	rs12627651	A	G	0.204	Ehret et al. 2016	CRYAA, SIK1
DIASTOLIC BLOOD PRESSURE	rs12940887	T	C	0.27	Ehret et al. 2016	ZNF652
DIASTOLIC BLOOD PRESSURE	rs12958173	A	C	0.179	Ehret et al. 2016	SETBP1
DIASTOLIC BLOOD PRESSURE	rs13107325	C	T	0.684	Ehret et al. 2016	SLC39A8
DIASTOLIC BLOOD PRESSURE	rs1327235	G	A	0.308	Ehret et al. 2016	JAG1
DIASTOLIC BLOOD PRESSURE	rs1361831	C	T	0.271	Ehret et al. 2016	RSPO3
DIASTOLIC BLOOD PRESSURE	rs1371182	C	T	0.252	Ehret et al. 2016	FIGN, GRB14
DIASTOLIC BLOOD PRESSURE	rs1450271	T	C	0.199	Ehret et al. 2016	ADM
DIASTOLIC BLOOD PRESSURE	rs1458038	T	C	0.457	Ehret et al. 2016	FGF5
DIASTOLIC BLOOD PRESSURE	rs1620668	G	A	0.285	Ehret et al. 2016	ST7L, CAPZA1, MOV10
DIASTOLIC BLOOD PRESSURE	rs17080093	C	T	0.411	Ehret et al. 2016	PLEKHG1
DIASTOLIC BLOOD PRESSURE	rs17638167	C	T	0.348	Ehret et al. 2016	ELAVL3
DIASTOLIC BLOOD PRESSURE	rs1799945	G	C	0.457	Ehret et al. 2016	HFE
DIASTOLIC BLOOD PRESSURE	rs1975487	G	A	0.16	Ehret et al. 2016	PNPT1

DIASTOLIC BLOOD PRESSURE	rs2187668	C	T	0.372	Ehret et al. 2016	BAT2, BAT5
DIASTOLIC BLOOD PRESSURE	rs2291435	C	T	0.156	Ehret et al. 2016	TBC1D1, FLJ13197
DIASTOLIC BLOOD PRESSURE	rs2493134	C	T	0.275	Ehret et al. 2016	AGT
DIASTOLIC BLOOD PRESSURE	rs2521501	T	A	0.359	Ehret et al. 2016	FURIN, FES
DIASTOLIC BLOOD PRESSURE	rs2586886	C	T	0.254	Ehret et al. 2016	KCNK3
DIASTOLIC BLOOD PRESSURE	rs2891546	G	A	0.38	Ehret et al. 2016	TBX5, TBX3
DIASTOLIC BLOOD PRESSURE	rs2969070	G	A	0.182	Ehret et al. 2016	CHST12, LFNG
DIASTOLIC BLOOD PRESSURE	rs3184504	T	C	0.448	Ehret et al. 2016	SH2B3
DIASTOLIC BLOOD PRESSURE	rs3735533	C	T	0.445	Ehret et al. 2016	HOTTIP, EVX
DIASTOLIC BLOOD PRESSURE	rs3752728	A	G	0.319	Ehret et al. 2016	PDE3A
DIASTOLIC BLOOD PRESSURE	rs4245739	A	C	0.243	Ehret et al. 2016	MDM4
DIASTOLIC BLOOD PRESSURE	rs4247374	C	T	0.385	Ehret et al. 2016	INSR
DIASTOLIC BLOOD PRESSURE	rs592373	A	G	0.282	Ehret et al. 2016	LSP1, TNNT3
DIASTOLIC BLOOD PRESSURE	rs6271	C	T	0.465	Ehret et al. 2016	DBH
DIASTOLIC BLOOD PRESSURE	rs633185	C	G	0.328	Ehret et al. 2016	FLJ32810, TMEM133
DIASTOLIC BLOOD PRESSURE	rs6442101	T	C	0.303	Ehret et al. 2016	MAP4
DIASTOLIC BLOOD PRESSURE	rs6891344	A	G	0.231	Ehret et al. 2016	CSNK1G3
DIASTOLIC BLOOD PRESSURE	rs7103648	G	A	0.241	Ehret et al. 2016	RAPSN, PSMC3, SLC39A13
DIASTOLIC BLOOD PRESSURE	rs740746	A	G	0.32	Ehret et al. 2016	ADRB1
DIASTOLIC BLOOD PRESSURE	rs751984	T	C	0.376	Ehret et al. 2016	LRRC10B
DIASTOLIC BLOOD PRESSURE	rs772178	G	A	0.208	Ehret et al. 2016	NCAPH
DIASTOLIC BLOOD PRESSURE	rs880315	C	T	0.257	Ehret et al. 2016	CASZ1
DIASTOLIC BLOOD PRESSURE	rs918466	G	A	0.182	Ehret et al. 2016	ADAMTS9
DIASTOLIC BLOOD PRESSURE	rs932764	G	A	0.224	Ehret et al. 2016	PLCE1
DIASTOLIC BLOOD PRESSURE	rs943037	C	T	0.482	Ehret et al. 2016	CYP17A1, NT5C2
DIASTOLIC BLOOD PRESSURE	rs1060105	C	T	0.182	Surendram et al.	SBNO1
DIASTOLIC BLOOD PRESSURE	rs10995311	C	G	0.21	Surendram et al.	ADO
DIASTOLIC BLOOD PRESSURE	rs110419	A	G	0.159	Surendram et al.	LMO1
DIASTOLIC BLOOD PRESSURE	rs1126464	C	G	0.275	Surendram et al.	DPEP1
DIASTOLIC BLOOD PRESSURE	rs12521868	G	T	0.191	Surendram et al.	C5orf56
DIASTOLIC BLOOD PRESSURE	rs1378942	C	A	0.416	Surendram et al.	CYP1A1-ULK3
DIASTOLIC BLOOD PRESSURE	rs16851397	G	A	0.375	Surendram et al.	ZBTB38
DIASTOLIC BLOOD PRESSURE	rs17249754	G	A	0.522	Surendram et al.	ATP2B1
DIASTOLIC BLOOD PRESSURE	rs17367504	A	G	0.547	Surendram et al.	MTHFR, NPPB
DIASTOLIC BLOOD PRESSURE	rs2304130	G	A	0.292	Surendram et al.	ZNF101
DIASTOLIC BLOOD PRESSURE	rs2972146	T	G	0.172	Surendram et al.	Intergenic
DIASTOLIC BLOOD PRESSURE	rs3774372	C	T	0.367	Surendram et al.	ULK4
DIASTOLIC BLOOD PRESSURE	rs6095241	G	A	0.168	Surendram et al.	PREX1
DIASTOLIC BLOOD PRESSURE	rs687621	A	G	0.188	Surendram et al.	ABO
DIASTOLIC BLOOD PRESSURE	rs7302981	A	G	0.249	Surendram et al.	CERS5
DIASTOLIC BLOOD PRESSURE	rs805303	G	A	0.228	Surendram et al.	BAT2, BAT5
DIASTOLIC BLOOD PRESSURE	rs8068318	T	C	0.262	Surendram et al.	TBX2
DIASTOLIC BLOOD PRESSURE	rs867186	A	G	0.265	Surendram et al.	PROCR
DIASTOLIC BLOOD PRESSURE	rs10078021	G	T	0.164	Warren et al. 2017	POC5
DIASTOLIC BLOOD PRESSURE	rs1063281	C	T	0.2	Warren et al. 2017	TNS1
DIASTOLIC BLOOD PRESSURE	rs11030119	G	A	0.163	Warren et al. 2017	BDNF
DIASTOLIC BLOOD PRESSURE	rs12374077	C	G	0.163	Warren et al. 2017	SENP2
DIASTOLIC BLOOD PRESSURE	rs12405515	G	T	0.165	Warren et al. 2017	DNM3
DIASTOLIC BLOOD PRESSURE	rs12408022	T	C	0.198	Warren et al. 2017	GPATCH2
DIASTOLIC BLOOD PRESSURE	rs12906962	C	T	0.221	Warren et al. 2017	chr15mb95
DIASTOLIC BLOOD PRESSURE	rs12921187	G	T	0.174	Warren et al. 2017	PPL
DIASTOLIC BLOOD PRESSURE	rs13205180	T	C	0.168	Warren et al. 2017	PKHD1
DIASTOLIC BLOOD PRESSURE	rs143112823	G	A	0.403	Warren et al. 2017	RP11- 439C8.2
DIASTOLIC BLOOD PRESSURE	rs1438896	T	C	0.234	Warren et al. 2017	TEX41
DIASTOLIC BLOOD PRESSURE	rs2306374	C	T	0.184	Warren et al. 2017	SCAF4
DIASTOLIC BLOOD PRESSURE	rs2760061	A	T	0.23	Warren et al. 2017	WNT3A
DIASTOLIC BLOOD PRESSURE	rs2978098	A	C	0.165	Warren et al. 2017	SNX31
DIASTOLIC BLOOD PRESSURE	rs36022378	C	T	0.202	Warren et al. 2017	CAMKV, ACTBP13
DIASTOLIC BLOOD PRESSURE	rs4308	A	G	0.213	Warren et al. 2017	ACE
DIASTOLIC BLOOD PRESSURE	rs4364717	G	A	0.175	Warren et al. 2017	MTAP
DIASTOLIC BLOOD PRESSURE	rs4952611	C	T	0.157	Warren et al. 2017	SLC8A1
DIASTOLIC BLOOD PRESSURE	rs55701159	T	G	0.285	Warren et al. 2017	ADCY3

DIASTOLIC BLOOD PRESSURE	rs6108168	C	A	0.211	Warren et al. 2017	PLCB1
DIASTOLIC BLOOD PRESSURE	rs62012628	C	T	0.238	Warren et al. 2017	ADAMTS7
DIASTOLIC BLOOD PRESSURE	rs62104477	T	G	0.177	Warren et al. 2017	CCNE1
DIASTOLIC BLOOD PRESSURE	rs62524579	G	A	0.175	Warren et al. 2017	RP11-273G15.2
DIASTOLIC BLOOD PRESSURE	rs6686889	T	C	0.185	Warren et al. 2017	chr1mb25
DIASTOLIC BLOOD PRESSURE	rs66887589	C	T	0.215	Warren et al. 2017	PDE5A
DIASTOLIC BLOOD PRESSURE	rs67330701	C	T	0.367	Warren et al. 2017	MYEOV
DIASTOLIC BLOOD PRESSURE	rs7178615	G	A	0.179	Warren et al. 2017	RP11-321F6.1
DIASTOLIC BLOOD PRESSURE	rs72799341	A	G	0.185	Warren et al. 2017	FBXL19
DIASTOLIC BLOOD PRESSURE	rs72812846	T	A	0.209	Warren et al. 2017	CPEB4
DIASTOLIC BLOOD PRESSURE	rs743757	C	G	0.245	Warren et al. 2017	CACNA2D2
DIASTOLIC BLOOD PRESSURE	rs745821	T	G	0.189	Warren et al. 2017	MAPK4
DIASTOLIC BLOOD PRESSURE	rs7592578	G	T	0.24	Warren et al. 2017	TMEM194B
DIASTOLIC BLOOD PRESSURE	rs76326501	A	C	0.419	Warren et al. 2017	AC016735.1
DIASTOLIC BLOOD PRESSURE	rs79146658	C	NA	0.311	Warren et al. 2017	CCDC141
DIASTOLIC BLOOD PRESSURE	rs8059962	C	T	0.17	Warren et al. 2017	CMIP
DIASTOLIC BLOOD PRESSURE	rs9372498	A	T	0.334	Warren et al. 2017	SLC35F1
DIASTOLIC BLOOD PRESSURE	rs953492	A	G	0.22	Warren et al. 2017	SDCCAG8
DIASTOLIC BLOOD PRESSURE	rs9827472	C	T	0.177	Warren et al. 2017	FAM208A
FASTING GLUCOSE	rs11715915	C	T	0.012	Scott et al. 2012	AMT
FASTING GLUCOSE	rs7651090	G	A	0.013	Scott et al. 2012	IGF2BP2
FASTING GLUCOSE	rs10747083	A	G	0.013	Scott et al. 2012	P2RX2
FASTING GLUCOSE	rs340874	C	T	0.013	Scott et al. 2012	PROX1
FASTING GLUCOSE	rs9368222	A	C	0.014	Scott et al. 2012	CDKAL1
FASTING GLUCOSE	rs2302593	C	G	0.014	Scott et al. 2012	GIPR
FASTING GLUCOSE	rs6943153	T	C	0.015	Scott et al. 2012	GRB10
FASTING GLUCOSE	rs10814916	C	A	0.016	Scott et al. 2012	
FASTING GLUCOSE	rs6072275	A	G	0.016	Scott et al. 2012	TOP1
FASTING GLUCOSE	rs576674	G	A	0.017	Scott et al. 2012	KL
FASTING GLUCOSE	rs3783347	G	T	0.017	Scott et al. 2012	WARS
FASTING GLUCOSE	rs3829109	G	A	0.017	Scott et al. 2012	DNLZ
FASTING GLUCOSE	rs4869272	T	C	0.018	Scott et al. 2012	PCSK1
FASTING GLUCOSE	rs11603334	G	A	0.019	Scott et al. 2012	ARAP1
FASTING GLUCOSE	rs11619319	G	A	0.02	Scott et al. 2012	PDX1
FASTING GLUCOSE	rs174576	C	A	0.02	Scott et al. 2012	
FASTING GLUCOSE	rs11607883	G	A	0.021	Scott et al. 2012	CRY2
FASTING GLUCOSE	rs7903146	T	C	0.022	Scott et al. 2012	TCF7L2
FASTING GLUCOSE	rs4502156	T	C	0.022	Scott et al. 2012	VPS13C/C2CD4A/B
FASTING GLUCOSE	rs11708067	A	G	0.023	Scott et al. 2012	ADCY5
FASTING GLUCOSE	rs11039182	T	C	0.023	Scott et al. 2012	MADD
FASTING GLUCOSE	rs10811661	T	C	0.024	Scott et al. 2012	CDKN2B
FASTING GLUCOSE	rs983309	T	G	0.026	Scott et al. 2012	PPP1R3B
FASTING GLUCOSE	rs1280	T	C	0.026	Scott et al. 2012	SLC2A2
FASTING GLUCOSE	rs780094	C	T	0.027	Scott et al. 2012	GCKR
FASTING GLUCOSE	rs11558471	A	G	0.029	Scott et al. 2012	
FASTING GLUCOSE	rs2191349	T	G	0.029	Scott et al. 2012	DGKB/TMEM195
FASTING GLUCOSE	rs11195502	C	T	0.032	Scott et al. 2012	ADRA2A
FASTING GLUCOSE	rs6113722	G	A	0.035	Scott et al. 2012	FOXA2
FASTING GLUCOSE	rs16913693	T	G	0.043	Scott et al. 2012	IKBKAP
FASTING GLUCOSE	rs2908289	A	G	0.057	Scott et al. 2012	
FASTING GLUCOSE	rs560887	C	T	0.071	Scott et al. 2012	G6PC2
FASTING GLUCOSE	rs10830963	G	C	0.078	Scott et al. 2012	MTNR1B
FASTING INSULIN	rs2972143	G	A	0.014	Scott et al. 2012	IRS1
FASTING INSULIN	rs2745353	T	C	0.014	Scott et al. 2012	RSPO3
FASTING INSULIN	rs1530559	A	G	0.015	Scott et al. 2012	YSK4
FASTING INSULIN	rs731839	G	A	0.015	Scott et al. 2012	PEPD
FASTING INSULIN	rs4865796	A	G	0.015	Scott et al. 2012	ARL15
FASTING INSULIN	rs2820436	C	A	0.015	Scott et al. 2012	LYPLAL1
FASTING INSULIN	rs1167800	A	G	0.016	Scott et al. 2012	HIP1
FASTING INSULIN	rs10195252	T	C	0.016	Scott et al. 2012	GRB14
FASTING INSULIN	rs9884482	C	T	0.017	Scott et al. 2012	TET2
FASTING INSULIN	rs860598	A	G	0.018	Scott et al. 2012	
FASTING INSULIN	rs7903146	C	T	0.018	Scott et al. 2012	TCF7L2

FASTING INSULIN	rs780094	C	T	0.019	Scott et al. 2012	GCKR
FASTING INSULIN	rs1421085	C	T	0.02	Scott et al. 2012	FTO
FASTING INSULIN	rs983309	T	G	0.029	Scott et al. 2012	PPP1R3B
Favourable Adiposity	rs11045172	C	A	0.012	Ji et al. 2019	EBP2-PDE3A
Favourable Adiposity	rs11118306	A	G	0.023	Ji et al. 2019	LYPLAL1-SLC30A10
Favourable Adiposity	rs13389219	T	C	0.023	Ji et al. 2019	GRB14-COBLL1
Favourable Adiposity	rs1801282	G	C	0.031	Ji et al. 2019	PPARG
Favourable Adiposity	rs2267373	C	T	0.025	Ji et al. 2019	MAFF
Favourable Adiposity	rs2276936	A	C	0.016	Ji et al. 2019	FAM13A
Favourable Adiposity	rs2943653	C	T	0.032	Ji et al. 2019	NYAP2-IRS1
Favourable Adiposity	rs2980888	C	T	0.006	Ji et al. 2019	TRIB1--[
Favourable Adiposity	rs40271	C	T	0.021	Ji et al. 2019	ANKRD55-MAP3K1
Favourable Adiposity	rs632057	G	T	0.009	Ji et al. 2019	CITED2
Favourable Adiposity	rs7133378	A	G	0.026	Ji et al. 2019	DNAH10
Favourable Adiposity	rs7258937	T	C	0.015	Ji et al. 2019	PEPD
Favourable Adiposity	rs972283	A	G	0.017	Ji et al. 2019	KLF14-MKLN1
Favourable Adiposity	rs998584	C	A	0.016	Ji et al. 2019	VEGFA-C6orf223
HDL CHOLESTEROL	rs1011731	A	G	0.015	Liu et al.	DNM3:Intron
HDL CHOLESTEROL	rs1037378	G	A	0.015	Liu et al.	PDE3B:Intron
HDL CHOLESTEROL	rs10483776	A	G	0.02	Liu et al.	FUT8:Intron
HDL CHOLESTEROL	rs10861661	A	C	0.017	Liu et al.	RIC8B:Intron
HDL CHOLESTEROL	rs10968576	A	G	0.017	Liu et al.	LINGO2:Intron
HDL CHOLESTEROL	rs11553746	T	C	0.015	Liu et al.	ACP1:Thr95Ile
HDL CHOLESTEROL	rs12055786	C	T	0.021	Liu et al.	RGS17:Intron
HDL CHOLESTEROL	rs13379043	C	T	0.017	Liu et al.	C14orf43:Intron
HDL CHOLESTEROL	rs146179438	C	A	0.063	Liu et al.	CDC25A:Gln25His
HDL CHOLESTEROL	rs16928809	G	A	0.029	Liu et al.	SLC22A18:Intron
HDL CHOLESTEROL	rs17189743	A	G	0.04	Liu et al.	TSPYL6:Arg246Cys
HDL CHOLESTEROL	rs2074158	T	C	0.02	Liu et al.	DHX58:Gln425Arg
HDL CHOLESTEROL	rs2303108	T	C	0.015	Liu et al.	ZC3H4:Intron
HDL CHOLESTEROL	rs2785990	C	T	0.015	Liu et al.	LYPLAL1:Intergenic
HDL CHOLESTEROL	rs28932178	C	T	0.02	Liu et al.	NSD1:Ser457Pro
HDL CHOLESTEROL	rs35169799	C	T	0.039	Liu et al.	PLCB3:Ser778Leu
HDL CHOLESTEROL	rs4871137	G	T	0.022	Liu et al.	KCND3:Intergenic
HDL CHOLESTEROL	rs4976033	A	G	0.015	Liu et al.	IGFN1:Intergenic
HDL CHOLESTEROL	rs622082	A	G	0.017	Liu et al.	IGHMBP2:Thr671Ala
HDL CHOLESTEROL	rs7076938	T	C	0.019	Liu et al.	PLOD1:Intergenic
HDL CHOLESTEROL	rs7136716	G	A	0.021	Liu et al.	AVPR1B:Intergenic
HDL CHOLESTEROL	rs746463	C	T	0.017	Liu et al.	ZC3H12C:Intron
HDL CHOLESTEROL	rs76116020	A	G	0.041	Liu et al.	TMED6:Phe6Leu
HDL CHOLESTEROL	rs78074706	G	A	0.053	Liu et al.	ANKS3:Arg286Trp
HDL CHOLESTEROL	rs8099014	A	C	0.015	Liu et al.	VPS13D:Intergenic
HDL CHOLESTEROL	rs900399	G	A	0.019	Liu et al.	SEMA4A:Intergenic
HDL CHOLESTEROL	rs9816226	T	A	0.028	Liu et al.	B4GALT3:Intergenic
HDL CHOLESTEROL	rs10019888	A	G	0.027	Willer et al. 2013	C4orf52
HDL CHOLESTEROL	rs1047891	C	C	0.027	Willer et al. 2013	CPS1
HDL CHOLESTEROL	rs1121980	G	A	0.02	Willer et al. 2013	FTO
HDL CHOLESTEROL	rs11246602	C	T	0.034	Willer et al. 2013	OR4C46
HDL CHOLESTEROL	rs11613352	T	C	0.028	Willer et al. 2013	LRP1
HDL CHOLESTEROL	rs11869286	C	G	0.032	Willer et al. 2013	STARD3
HDL CHOLESTEROL	rs12145743	G	T	0.02	Willer et al. 2013	HDGF, PMVK
HDL CHOLESTEROL	rs12328675	C	T	0.045	Willer et al. 2013	COBLL1
HDL CHOLESTEROL	rs12678919	G	A	0.155	Willer et al. 2013	LPL
HDL CHOLESTEROL	rs12748152	C	T	0.051	Willer et al. 2013	PIGV, NR0B2
HDL CHOLESTEROL	rs12801636	A	G	0.024	Willer et al. 2013	KAT5
HDL CHOLESTEROL	rs12967135	G	A	0.026	Willer et al. 2013	MC4R
HDL CHOLESTEROL	rs13076253	A	C	0.028	Willer et al. 2013	CPNE4
HDL CHOLESTEROL	rs13107325	C	T	0.071	Willer et al. 2013	SLC39A8
HDL CHOLESTEROL	rs13326165	A	G	0.029	Willer et al. 2013	STAB1
HDL CHOLESTEROL	rs1532085	A	G	0.107	Willer et al. 2013	LIPC
HDL CHOLESTEROL	rs1689800	A	G	0.034	Willer et al. 2013	ZNF648
HDL CHOLESTEROL	rs16942887	A	G	0.083	Willer et al. 2013	LCAT
HDL CHOLESTEROL	rs17145738	T	C	0.041	Willer et al. 2013	MLXIPL

HDL CHOLESTEROL	rs17173637	T	C	0.036	Willer et al. 2013	TMEM176A
HDL CHOLESTEROL	rs174546	C	T	0.039	Willer et al. 2013	FADS1, FADS2, FADS3
HDL CHOLESTEROL	rs17695224	G	A	0.029	Willer et al. 2013	HAS1
HDL CHOLESTEROL	rs1800961	C	T	0.127	Willer et al. 2013	HNF4A
HDL CHOLESTEROL	rs181362	C	T	0.038	Willer et al. 2013	UBE2L3
HDL CHOLESTEROL	rs1883025	C	T	0.07	Willer et al. 2013	ABCA1
HDL CHOLESTEROL	rs1936800	C	T	0.02	Willer et al. 2013	RSPO3
HDL CHOLESTEROL	rs2013208	T	C	0.025	Willer et al. 2013	RBM5
HDL CHOLESTEROL	rs2290547	G	A	0.03	Willer et al. 2013	SETD2
HDL CHOLESTEROL	rs2293889	G	T	0.031	Willer et al. 2013	TRPS1
HDL CHOLESTEROL	rs2602836	A	G	0.019	Willer et al. 2013	ADH5
HDL CHOLESTEROL	rs2606736	C	T	0.025	Willer et al. 2013	ATG7
HDL CHOLESTEROL	rs2652834	G	A	0.029	Willer et al. 2013	LACTB
HDL CHOLESTEROL	rs2923084	A	G	0.026	Willer et al. 2013	AMPD3
HDL CHOLESTEROL	rs2925979	C	T	0.035	Willer et al. 2013	CMIP
HDL CHOLESTEROL	rs2954029	T	A	0.04	Willer et al. 2013	TRIB1
HDL CHOLESTEROL	rs2972146	G	T	0.032	Willer et al. 2013	IRS1
HDL CHOLESTEROL	rs3136441	C	T	0.055	Willer et al. 2013	LRP4
HDL CHOLESTEROL	rs3764261	A	C	0.241	Willer et al. 2013	CETP
HDL CHOLESTEROL	rs3822072	G	A	0.025	Willer et al. 2013	FAM13A
HDL CHOLESTEROL	rs386000	C	G	0.048	Willer et al. 2013	LILRA3
HDL CHOLESTEROL	rs4129767	A	G	0.024	Willer et al. 2013	PGS1
HDL CHOLESTEROL	rs4142995	G	T	0.026	Willer et al. 2013	SNX13
HDL CHOLESTEROL	rs4148008	C	G	0.028	Willer et al. 2013	ABCA8
HDL CHOLESTEROL	rs4420638	A	G	0.067	Willer et al. 2013	APOE
HDL CHOLESTEROL	rs4650994	G	A	0.021	Willer et al. 2013	ANGPTL1
HDL CHOLESTEROL	rs4660293	A	G	0.035	Willer et al. 2013	PABPC4
HDL CHOLESTEROL	rs4731702	T	C	0.029	Willer et al. 2013	KLF14
HDL CHOLESTEROL	rs4759375	T	C	0.056	Willer et al. 2013	SBNO1
HDL CHOLESTEROL	rs4765127	T	G	0.032	Willer et al. 2013	ZNF664
HDL CHOLESTEROL	rs4846914	A	G	0.048	Willer et al. 2013	GALNT2
HDL CHOLESTEROL	rs4917014	G	T	0.022	Willer et al. 2013	IKZF1
HDL CHOLESTEROL	rs4983559	G	A	0.02	Willer et al. 2013	ZBTB42, AKT1
HDL CHOLESTEROL	rs499974	C	A	0.026	Willer et al. 2013	MOGAT2, DGAT2
HDL CHOLESTEROL	rs581080	C	G	0.042	Willer et al. 2013	TTC39B
HDL CHOLESTEROL	rs605066	T	C	0.028	Willer et al. 2013	CITED2
HDL CHOLESTEROL	rs6065906	T	C	0.059	Willer et al. 2013	PLTP
HDL CHOLESTEROL	rs6450176	G	A	0.025	Willer et al. 2013	ARL15
HDL CHOLESTEROL	rs6805251	T	C	0.02	Willer et al. 2013	GSK3B
HDL CHOLESTEROL	rs702485	G	A	0.024	Willer et al. 2013	DAGLB
HDL CHOLESTEROL	rs7134375	A	C	0.021	Willer et al. 2013	PDE3A
HDL CHOLESTEROL	rs7134594	T	C	0.035	Willer et al. 2013	MVK
HDL CHOLESTEROL	rs7241918	T	G	0.09	Willer et al. 2013	LIPG
HDL CHOLESTEROL	rs7255436	A	C	0.032	Willer et al. 2013	ANGPTL4
HDL CHOLESTEROL	rs731839	A	G	0.022	Willer et al. 2013	PEPD
HDL CHOLESTEROL	rs737337	T	C	0.057	Willer et al. 2013	ANGPTL8
HDL CHOLESTEROL	rs7941030	C	T	0.028	Willer et al. 2013	UBASH3B
HDL CHOLESTEROL	rs838880	C	T	0.048	Willer et al. 2013	SCARB1
HDL CHOLESTEROL	rs964184	C	G	0.107	Willer et al. 2013	APOA1
HDL CHOLESTEROL	rs970548	C	A	0.026	Willer et al. 2013	MARCH8, ALOX5
HDL CHOLESTEROL	rs998584	C	A	0.026	Willer et al. 2013	VEGFA
HDL CHOLESTEROL	rs9987289	G	A	0.082	Willer et al. 2013	PPP1R3B
LDL CHOLESTEROL	rs1016988	T	C	0.02	Liu et al.	CD101:Intergenic
LDL CHOLESTEROL	rs10885997	G	A	0.015	Liu et al.	PNLIPRP2:Gln387Arg
LDL CHOLESTEROL	rs11080150	A	G	0.019	Liu et al.	NF1:Intron
LDL CHOLESTEROL	rs13146272	C	A	0.015	Liu et al.	CYP4V2:Gln259Lys
LDL CHOLESTEROL	rs13379043	T	C	0.018	Liu et al.	C14orf43:Intron
LDL CHOLESTEROL	rs147032017	C	T	0.091	Liu et al.	ZFPM1:Asp91Asp
LDL CHOLESTEROL	rs1891110	A	G	0.021	Liu et al.	FAM24B:Pro2Leu
LDL CHOLESTEROL	rs201148465	C	A	0.21	Liu et al.	HIST1H1B:Ala6Ala
LDL CHOLESTEROL	rs201596848	C	T	0.255	Liu et al.	ZNF574:Arg734Cys
LDL CHOLESTEROL	rs2076674	C	T	0.018	Liu et al.	SLC25A17:Intron
LDL CHOLESTEROL	rs2125345	T	C	0.024	Liu et al.	UNK:Intron

LDL CHOLESTEROL	rs2239619	A	C	0.018	Liu et al.	HSPG2:Intergenic
LDL CHOLESTEROL	rs28929474	T	C	0.081	Liu et al.	SERPINA1:Glu366Lys
LDL CHOLESTEROL	rs351855	G	A	0.018	Liu et al.	FGFR4:Gly388Arg
LDL CHOLESTEROL	rs3812594	G	A	0.018	Liu et al.	SEC16A:Arg1039Cys
LDL CHOLESTEROL	rs4745	A	T	0.015	Liu et al.	EFNA1:Asp137Val
LDL CHOLESTEROL	rs4809330	A	G	0.015	Liu et al.	ZGPAT:Intron
LDL CHOLESTEROL	rs6062343	G	A	0.014	Liu et al.	TCEA2:Intron
LDL CHOLESTEROL	rs61754230	T	C	0.057	Liu et al.	RAB21:Ser224Phe
LDL CHOLESTEROL	rs635634	T	C	0.069	Liu et al.	IL6R:Intergenic
LDL CHOLESTEROL	rs67710536	C	A	0.028	Liu et al.	RPS6:Utr3
LDL CHOLESTEROL	rs6818397	T	G	0.022	Liu et al.	RGS12:Intron
LDL CHOLESTEROL	rs704	A	G	0.021	Liu et al.	VTN:Thr400Met
LDL CHOLESTEROL	rs77375493	G	T	0.3	Liu et al.	JAK2
LDL CHOLESTEROL	rs9646133	G	T	0.019	Liu et al.	FLAD1:Intergenic
LDL CHOLESTEROL	rs976002	G	A	0.023	Liu et al.	TMPRSS11E:Tyr303Cys
LDL CHOLESTEROL	rs10102164	A	G	0.032	Willer et al. 2013	SOX17
LDL CHOLESTEROL	rs10401969	T	C	0.118	Willer et al. 2013	CILP2
LDL CHOLESTEROL	rs10490626	G	A	0.051	Willer et al. 2013	INSIG2
LDL CHOLESTEROL	rs11065987	A	G	0.027	Willer et al. 2013	BRAP
LDL CHOLESTEROL	rs11136341	G	A	0.045	Willer et al. 2013	PLEC1
LDL CHOLESTEROL	rs11220462	A	G	0.059	Willer et al. 2013	ST3GAL4
LDL CHOLESTEROL	rs11563251	T	C	0.035	Willer et al. 2013	UGT1A1
LDL CHOLESTEROL	rs1169288	C	A	0.038	Willer et al. 2013	HNF1A
LDL CHOLESTEROL	rs12027135	T	A	0.03	Willer et al. 2013	LDLRAP1
LDL CHOLESTEROL	rs1250229	C	T	0.024	Willer et al. 2013	FN1
LDL CHOLESTEROL	rs12670798	C	T	0.034	Willer et al. 2013	DNAH11
LDL CHOLESTEROL	rs12748152	T	C	0.05	Willer et al. 2013	PIGV, NR0B2
LDL CHOLESTEROL	rs12916	C	T	0.073	Willer et al. 2013	HMGCR
LDL CHOLESTEROL	rs1367117	A	G	0.119	Willer et al. 2013	APOB
LDL CHOLESTEROL	rs1564348	C	T	0.048	Willer et al. 2013	LPA
LDL CHOLESTEROL	rs17404153	G	T	0.034	Willer et al. 2013	ACAD11
LDL CHOLESTEROL	rs174546	C	T	0.051	Willer et al. 2013	FADS1, FADS2, FADS3
LDL CHOLESTEROL	rs1800562	G	A	0.062	Willer et al. 2013	HFE
LDL CHOLESTEROL	rs1801689	C	A	0.103	Willer et al. 2013	APOH, PRXCA
LDL CHOLESTEROL	rs2000999	A	G	0.065	Willer et al. 2013	HPR
LDL CHOLESTEROL	rs2030746	T	C	0.021	Willer et al. 2013	LOC84931
LDL CHOLESTEROL	rs2072183	C	G	0.039	Willer et al. 2013	NPC1L1
LDL CHOLESTEROL	rs2081687	T	C	0.031	Willer et al. 2013	CYP7A1
LDL CHOLESTEROL	rs2131925	T	G	0.049	Willer et al. 2013	ANGPTL3
LDL CHOLESTEROL	rs2255141	A	G	0.03	Willer et al. 2013	GPAM
LDL CHOLESTEROL	rs2328223	C	A	0.03	Willer et al. 2013	SNX5
LDL CHOLESTEROL	rs2479409	G	A	0.064	Willer et al. 2013	PCSK9
LDL CHOLESTEROL	rs2642442	T	C	0.036	Willer et al. 2013	MOSC1
LDL CHOLESTEROL	rs267733	A	G	0.033	Willer et al. 2013	ANXA9, CERS2
LDL CHOLESTEROL	rs2710642	A	G	0.024	Willer et al. 2013	EHBP1
LDL CHOLESTEROL	rs2902940	A	G	0.027	Willer et al. 2013	MAFB
LDL CHOLESTEROL	rs2954029	A	T	0.056	Willer et al. 2013	TRIB1
LDL CHOLESTEROL	rs314253	T	C	0.024	Willer et al. 2013	DLG4
LDL CHOLESTEROL	rs3177928	A	G	0.045	Willer et al. 2013	HLA
LDL CHOLESTEROL	rs364585	G	A	0.025	Willer et al. 2013	SPTLC3
LDL CHOLESTEROL	rs3757354	C	T	0.038	Willer et al. 2013	MYLIP
LDL CHOLESTEROL	rs3764261	C	A	0.053	Willer et al. 2013	CETP
LDL CHOLESTEROL	rs3780181	A	G	0.045	Willer et al. 2013	VLDLR
LDL CHOLESTEROL	rs4253776	G	A	0.031	Willer et al. 2013	PPARA
LDL CHOLESTEROL	rs4299376	G	T	0.081	Willer et al. 2013	ABCG5, ABCG58
LDL CHOLESTEROL	rs4420638	G	A	0.225	Willer et al. 2013	APOE
LDL CHOLESTEROL	rs4530754	A	G	0.028	Willer et al. 2013	CSNK1G3
LDL CHOLESTEROL	rs4722551	C	T	0.039	Willer et al. 2013	MIR148A
LDL CHOLESTEROL	rs4942486	T	C	0.024	Willer et al. 2013	BRCA2
LDL CHOLESTEROL	rs514230	T	A	0.036	Willer et al. 2013	IRF2BP2
LDL CHOLESTEROL	rs5763662	T	C	0.077	Willer et al. 2013	MTMR3
LDL CHOLESTEROL	rs6029526	A	T	0.044	Willer et al. 2013	TOP1
LDL CHOLESTEROL	rs629301	T	G	0.167	Willer et al. 2013	SORT1

LDL CHOLESTEROL	rs6511720	G	T	0.221	Willer et al. 2013	LDLR
LDL CHOLESTEROL	rs6882076	C	T	0.046	Willer et al. 2013	TIMD4
LDL CHOLESTEROL	rs7206971	A	G	0.029	Willer et al. 2013	OSBPL7
LDL CHOLESTEROL	rs7640978	C	T	0.039	Willer et al. 2013	CMTM6
LDL CHOLESTEROL	rs8017377	A	G	0.03	Willer et al. 2013	NYNRIN
LDL CHOLESTEROL	rs9488822	A	T	0.031	Willer et al. 2013	FRK
LDL CHOLESTEROL	rs964184	G	C	0.086	Willer et al. 2013	APOA1
LDL CHOLESTEROL	rs9987289	G	A	0.071	Willer et al. 2013	PPP1R3B
SYSTOLIC BLOOD PRESSURE	rs1813353	T	C	0.569	Ehret et al. 2011	CACNB2
SYSTOLIC BLOOD PRESSURE	rs2932538	G	A	0.388	Ehret et al. 2011	MOV10
SYSTOLIC BLOOD PRESSURE	rs381815	T	C	0.575	Ehret et al. 2011	PLEKHA7
SYSTOLIC BLOOD PRESSURE	rs4373814	C	G	0.373	Ehret et al. 2011	CACNB2
SYSTOLIC BLOOD PRESSURE	rs4590817	G	C	0.646	Ehret et al. 2011	C10orf107
SYSTOLIC BLOOD PRESSURE	rs6015450	G	A	0.896	Ehret et al. 2011	EDN3, GNAS
SYSTOLIC BLOOD PRESSURE	rs7129220	A	G	0.619	Ehret et al. 2011	ADM
SYSTOLIC BLOOD PRESSURE	rs10077885	C	A	0.284	Ehret et al. 2016	TRIM36
SYSTOLIC BLOOD PRESSURE	rs10760117	T	G	0.283	Ehret et al. 2016	PSMD5
SYSTOLIC BLOOD PRESSURE	rs11128722	G	A	0.31	Ehret et al. 2016	FGD5
SYSTOLIC BLOOD PRESSURE	rs11556924	C	T	0.271	Ehret et al. 2016	ZC3HC1
SYSTOLIC BLOOD PRESSURE	rs1156725	C	T	0.447	Ehret et al. 2016	PLEKHA7
SYSTOLIC BLOOD PRESSURE	rs11953630	C	T	0.412	Ehret et al. 2016	EBF1
SYSTOLIC BLOOD PRESSURE	rs12247028	G	A	0.364	Ehret et al. 2016	SYNPO2L
SYSTOLIC BLOOD PRESSURE	rs12627651	A	G	0.391	Ehret et al. 2016	CRYAA, SIK1
SYSTOLIC BLOOD PRESSURE	rs12656497	C	T	0.487	Ehret et al. 2016	NPR3, C5orf23
SYSTOLIC BLOOD PRESSURE	rs12705390	A	G	0.619	Ehret et al. 2016	PIK3C
SYSTOLIC BLOOD PRESSURE	rs12940887	T	C	0.362	Ehret et al. 2016	ZNF652
SYSTOLIC BLOOD PRESSURE	rs12958173	A	C	0.361	Ehret et al. 2016	SETBP1
SYSTOLIC BLOOD PRESSURE	rs13107325	C	T	0.837	Ehret et al. 2016	SLC39A8
SYSTOLIC BLOOD PRESSURE	rs1327235	G	A	0.395	Ehret et al. 2016	JAG1
SYSTOLIC BLOOD PRESSURE	rs1361831	C	T	0.482	Ehret et al. 2016	RSPO3
SYSTOLIC BLOOD PRESSURE	rs1371182	C	T	0.444	Ehret et al. 2016	FIGN, GRB14
SYSTOLIC BLOOD PRESSURE	rs1458038	T	C	0.659	Ehret et al. 2016	FGF5
SYSTOLIC BLOOD PRESSURE	rs1620668	G	A	0.535	Ehret et al. 2016	ST7L, CAPZA1, MOV10
SYSTOLIC BLOOD PRESSURE	rs17010957	C	T	0.498	Ehret et al. 2016	ARHGAP24
SYSTOLIC BLOOD PRESSURE	rs17037390	G	A	0.908	Ehret et al. 2016	MTHFR, NPPB
SYSTOLIC BLOOD PRESSURE	rs17608766	C	T	0.658	Ehret et al. 2016	GOSR2
SYSTOLIC BLOOD PRESSURE	rs1799945	G	C	0.627	Ehret et al. 2016	HFE
SYSTOLIC BLOOD PRESSURE	rs2291435	C	T	0.344	Ehret et al. 2016	TBC1D1, FLJ13197
SYSTOLIC BLOOD PRESSURE	rs2493134	C	T	0.413	Ehret et al. 2016	AGT
SYSTOLIC BLOOD PRESSURE	rs2521501	T	A	0.65	Ehret et al. 2016	FURIN, FES
SYSTOLIC BLOOD PRESSURE	rs2586886	C	T	0.404	Ehret et al. 2016	KCNK3
SYSTOLIC BLOOD PRESSURE	rs2594992	C	A	0.334	Ehret et al. 2016	HRH1, ATG7
SYSTOLIC BLOOD PRESSURE	rs2898290	T	C	0.377	Ehret et al. 2016	BLK, GATA4
SYSTOLIC BLOOD PRESSURE	rs2969070	G	A	0.298	Ehret et al. 2016	CHST12, LFNG
SYSTOLIC BLOOD PRESSURE	rs3184504	T	C	0.598	Ehret et al. 2016	SH2B3
SYSTOLIC BLOOD PRESSURE	rs3735533	C	T	0.798	Ehret et al. 2016	HOTTIP, EVX
SYSTOLIC BLOOD PRESSURE	rs3741378	C	T	0.486	Ehret et al. 2016	SIPA1
SYSTOLIC BLOOD PRESSURE	rs4247374	C	T	0.593	Ehret et al. 2016	INSR
SYSTOLIC BLOOD PRESSURE	rs4691707	G	A	0.349	Ehret et al. 2016	GUCY1A3, GUCY1B3
SYSTOLIC BLOOD PRESSURE	rs592373	A	G	0.484	Ehret et al. 2016	LSP1, TNNT3
SYSTOLIC BLOOD PRESSURE	rs6271	C	T	0.591	Ehret et al. 2016	DBH
SYSTOLIC BLOOD PRESSURE	rs633185	C	G	0.565	Ehret et al. 2016	FLJ32810, TMEM133
SYSTOLIC BLOOD PRESSURE	rs6442101	T	C	0.396	Ehret et al. 2016	MAP4
SYSTOLIC BLOOD PRESSURE	rs6779380	C	T	0.439	Ehret et al. 2016	MECOM
SYSTOLIC BLOOD PRESSURE	rs6919440	G	A	0.337	Ehret et al. 2016	ZNF318, ABCC10
SYSTOLIC BLOOD PRESSURE	rs7103648	G	A	0.335	Ehret et al. 2016	RAPSN, PSMC3, SLC39A13
SYSTOLIC BLOOD PRESSURE	rs711737	A	C	0.334	Ehret et al. 2016	SLC4A7
SYSTOLIC BLOOD PRESSURE	rs7213273	G	A	0.413	Ehret et al. 2016	PLCD3
SYSTOLIC BLOOD PRESSURE	rs740746	A	G	0.486	Ehret et al. 2016	ADRB1
SYSTOLIC BLOOD PRESSURE	rs7515635	T	C	0.307	Ehret et al. 2016	HIVEP3
SYSTOLIC BLOOD PRESSURE	rs751984	T	C	0.407	Ehret et al. 2016	LRRC10B
SYSTOLIC BLOOD PRESSURE	rs880315	C	T	0.475	Ehret et al. 2016	CASZ1
SYSTOLIC BLOOD PRESSURE	rs932764	G	A	0.495	Ehret et al. 2016	PLCE1

SYSTOLIC BLOOD PRESSURE	rs943037	C	T	1.133	Ehret et al. 2016	CYP17A1, NT5C2
SYSTOLIC BLOOD PRESSURE	rs1008058	A	G	0.554	Surendram et al.	PRDM6
SYSTOLIC BLOOD PRESSURE	rs11229457	C	T	0.312	Surendram et al.	OR5B12
SYSTOLIC BLOOD PRESSURE	rs1378942	C	A	0.613	Surendram et al.	CYP1A1-ULK3
SYSTOLIC BLOOD PRESSURE	rs17249754	G	A	0.928	Surendram et al.	ATP2B1
SYSTOLIC BLOOD PRESSURE	rs34591516	T	C	0.636	Surendram et al.	GPR20
SYSTOLIC BLOOD PRESSURE	rs35529250	C	T	1.537	Surendram et al.	RBM47
SYSTOLIC BLOOD PRESSURE	rs4387287	A	C	0.338	Surendram et al.	OBFC1
SYSTOLIC BLOOD PRESSURE	rs4728142	G	A	0.224	Surendram et al.	Intergenic
SYSTOLIC BLOOD PRESSURE	rs61760904	T	C	1.499	Surendram et al.	RRAS
SYSTOLIC BLOOD PRESSURE	rs7406910	C	T	0.456	Surendram et al.	HOXB7
SYSTOLIC BLOOD PRESSURE	rs805303	G	A	0.376	Surendram et al.	BAT2, BAT5
SYSTOLIC BLOOD PRESSURE	rs9349379	A	G	0.289	Surendram et al.	PHACTR1
SYSTOLIC BLOOD PRESSURE	rs10059921	G	T	0.526	Warren et al. 2017	TMEM161B
SYSTOLIC BLOOD PRESSURE	rs10922502	G	A	0.382	Warren et al. 2017	GTF2B
SYSTOLIC BLOOD PRESSURE	rs112184198	G	A	0.659	Warren et al. 2017	PAX2
SYSTOLIC BLOOD PRESSURE	rs11643209	G	T	0.339	Warren et al. 2017	CFDP1
SYSTOLIC BLOOD PRESSURE	rs12941318	C	T	0.269	Warren et al. 2017	CRK
SYSTOLIC BLOOD PRESSURE	rs13112725	C	G	0.435	Warren et al. 2017	NPNT
SYSTOLIC BLOOD PRESSURE	rs13238550	A	G	0.331	Warren et al. 2017	MKLN1
SYSTOLIC BLOOD PRESSURE	rs13420463	A	G	0.356	Warren et al. 2017	PRKD3
SYSTOLIC BLOOD PRESSURE	rs2467099	C	T	0.307	Warren et al. 2017	ACOX1
SYSTOLIC BLOOD PRESSURE	rs35199222	A	G	0.322	Warren et al. 2017	ABHD17C
SYSTOLIC BLOOD PRESSURE	rs3820068	A	G	0.425	Warren et al. 2017	CELA2A
SYSTOLIC BLOOD PRESSURE	rs55780018	C	T	0.391	Warren et al. 2017	METTL21A,
SYSTOLIC BLOOD PRESSURE	rs6487543	A	G	0.3	Warren et al. 2017	SSPN/ITPR2
SYSTOLIC BLOOD PRESSURE	rs6595838	A	G	0.344	Warren et al. 2017	FBN2
SYSTOLIC BLOOD PRESSURE	rs6911827	T	C	0.296	Warren et al. 2017	CASC15
SYSTOLIC BLOOD PRESSURE	rs7562	T	C	0.263	Warren et al. 2017	FOSL2
SYSTOLIC BLOOD PRESSURE	rs78648104	C	T	0.481	Warren et al. 2017	TFAP2D
SYSTOLIC BLOOD PRESSURE	rs8016306	A	G	0.335	Warren et al. 2017	PPP2R5E
SYSTOLIC BLOOD PRESSURE	rs894344	G	A	0.258	Warren et al. 2017	ZFAT
SYSTOLIC BLOOD PRESSURE	rs9549328	T	C	0.318	Warren et al. 2017	MCF2L
SYSTOLIC BLOOD PRESSURE	rs9888615	C	T	0.318	Warren et al. 2017	FERMT2
TRIGLYCERIDES	rs1011731	G	A	0.015	Liu et al.	DNM3:Intron
TRIGLYCERIDES	rs10861661	C	A	0.019	Liu et al.	RIC8B:Intron
TRIGLYCERIDES	rs138358301	G	A	0.15	Liu et al.	SLC25A30:Phe280Leu
TRIGLYCERIDES	rs26008	T	C	0.028	Liu et al.	FNIP1:Gln620Arg
TRIGLYCERIDES	rs2785990	T	C	0.016	Liu et al.	LYPLAL1:Intergenic
TRIGLYCERIDES	rs35169799	T	C	0.038	Liu et al.	PLCB3:Ser778Leu
TRIGLYCERIDES	rs35665085	A	G	0.032	Liu et al.	CECR5:Thr149Met
TRIGLYCERIDES	rs3769823	G	A	0.017	Liu et al.	CASP8:Lys14Arg
TRIGLYCERIDES	rs3803357	C	A	0.017	Liu et al.	BAHD1:Gln298Lys
TRIGLYCERIDES	rs3927680	T	A	0.018	Liu et al.	OR6P1:Intergenic
TRIGLYCERIDES	rs3947	A	G	0.024	Liu et al.	CTSB:Utr3
TRIGLYCERIDES	rs41274050	T	C	0.1	Liu et al.	A1CF:Gly398Ser
TRIGLYCERIDES	rs41302559	G	A	0.154	Liu et al.	PCK1:Arg483Gln
TRIGLYCERIDES	rs4976033	G	A	0.018	Liu et al.	IGFN1:Intergenic
TRIGLYCERIDES	rs6062343	G	A	0.018	Liu et al.	TCEA2:Intron
TRIGLYCERIDES	rs7157785	T	G	0.023	Liu et al.	NPR1:Intergenic
TRIGLYCERIDES	rs7901016	C	T	0.042	Liu et al.	CCDC109A:Intron
TRIGLYCERIDES	rs7946	C	T	0.016	Liu et al.	PEMT:Val212Met
TRIGLYCERIDES	rs797486	A	C	0.02	Liu et al.	ADAR:Intergenic
TRIGLYCERIDES	rs900399	A	G	0.014	Liu et al.	SEMA4A:Intergenic
TRIGLYCERIDES	rs10401969	T	C	0.121	Willer et al. 2013	CILP2
TRIGLYCERIDES	rs10761731	A	T	0.031	Willer et al. 2013	JMJD1C
TRIGLYCERIDES	rs11613352	C	T	0.028	Willer et al. 2013	LRP1
TRIGLYCERIDES	rs11649653	C	G	0.027	Willer et al. 2013	CTF1
TRIGLYCERIDES	rs11776767	C	G	0.022	Willer et al. 2013	PINX1
TRIGLYCERIDES	rs1260326	T	C	0.115	Willer et al. 2013	GCKR
TRIGLYCERIDES	rs12678919	A	G	0.17	Willer et al. 2013	LPL
TRIGLYCERIDES	rs12748152	T	C	0.037	Willer et al. 2013	PIGV, NR0B2
TRIGLYCERIDES	rs13238203	C	T	0.059	Willer et al. 2013	TYW1B

TRIGLYCERIDES	rs1495741	G	A	0.04	Willer et al. 2013	NAT2
TRIGLYCERIDES	rs1532085	A	G	0.031	Willer et al. 2013	LIPC
TRIGLYCERIDES	rs17145738	C	T	0.115	Willer et al. 2013	MLXIPL
TRIGLYCERIDES	rs174546	T	C	0.045	Willer et al. 2013	FADS1, FADS2, FADS3
TRIGLYCERIDES	rs1832007	A	G	0.033	Willer et al. 2013	AKR1C4
TRIGLYCERIDES	rs1936800	T	C	0.018	Willer et al. 2013	RSPO3
TRIGLYCERIDES	rs2068888	G	A	0.024	Willer et al. 2013	CYP26A1
TRIGLYCERIDES	rs2131925	T	G	0.066	Willer et al. 2013	ANGPTL3
TRIGLYCERIDES	rs2247056	C	T	0.038	Willer et al. 2013	HLA-B
TRIGLYCERIDES	rs2412710	A	G	0.099	Willer et al. 2013	CAPN3
TRIGLYCERIDES	rs2929282	T	A	0.073	Willer et al. 2013	FRMD5
TRIGLYCERIDES	rs2954029	A	T	0.076	Willer et al. 2013	TRIB1
TRIGLYCERIDES	rs2972146	T	G	0.028	Willer et al. 2013	IRS1
TRIGLYCERIDES	rs3198697	C	T	0.02	Willer et al. 2013	PDXDC1
TRIGLYCERIDES	rs3764261	C	A	0.04	Willer et al. 2013	CETP
TRIGLYCERIDES	rs38855	A	G	0.019	Willer et al. 2013	MET
TRIGLYCERIDES	rs442177	T	G	0.031	Willer et al. 2013	KLHL8
TRIGLYCERIDES	rs4719841	G	A	0.023	Willer et al. 2013	MIR148A
TRIGLYCERIDES	rs4765127	G	T	0.029	Willer et al. 2013	ZNF664
TRIGLYCERIDES	rs4846914	G	A	0.04	Willer et al. 2013	GALNT2
TRIGLYCERIDES	rs5756931	T	C	0.02	Willer et al. 2013	PLA2G6
TRIGLYCERIDES	rs6065906	C	T	0.053	Willer et al. 2013	PLTP
TRIGLYCERIDES	rs645040	T	G	0.029	Willer et al. 2013	MSL2L1
TRIGLYCERIDES	rs6831256	G	A	0.026	Willer et al. 2013	LRPAP1
TRIGLYCERIDES	rs6882076	C	T	0.029	Willer et al. 2013	TIMD4
TRIGLYCERIDES	rs7248104	G	A	0.022	Willer et al. 2013	INSR
TRIGLYCERIDES	rs731839	G	A	0.022	Willer et al. 2013	PEPD
TRIGLYCERIDES	rs8077889	C	A	0.025	Willer et al. 2013	MPP3
TRIGLYCERIDES	rs964184	G	C	0.234	Willer et al. 2013	APOA1
TRIGLYCERIDES	rs9686661	T	C	0.038	Willer et al. 2013	MAP3K1
TRIGLYCERIDES	rs9930333	G	T	0.021	Willer et al. 2013	FTO
TRIGLYCERIDES	rs998584	A	C	0.029	Willer et al. 2013	VEGFA
TRIGLYCERIDES	rs6054	T	C	0.14	Liu et al.	FGB:Pro206Leu
TYPE 2 DIABETES	rs17867832	T	G	0.086177696	Cho et al. 2011	GRM8
TYPE 2 DIABETES	rs3734621	C	A	0.067658648	Cho et al. 2011	KIF6
TYPE 2 DIABETES	rs3786897	A	G	0.029558802	Cho et al. 2011	PEPD
TYPE 2 DIABETES	rs831571	C	T	0.029558802	Cho et al. 2011	PSMD6
TYPE 2 DIABETES	rs9470794	T	C	0.009950331	Cho et al. 2011	ZFND3
TYPE 2 DIABETES	rs2233580	T	C	0.58221562	Fuchsberger et al. 2016	PAX4
TYPE 2 DIABETES	rs6813195	C	T	0.086177696	Harder et al. 2015	TMEM154
TYPE 2 DIABETES	rs10278336	A	G	0.067658648	Kong et al. 2009	MOB2
TYPE 2 DIABETES	rs12242953	G	A	0.067658648	Kooner et al. 2011	SRGN
TYPE 2 DIABETES	rs16861329	C	T	0.029558802	Kooner et al. 2011	ST6GAL1
TYPE 2 DIABETES	rs2007084	G	A	0.019802627	Kooner et al. 2011	ANPEP
TYPE 2 DIABETES	rs4812829	A	G	0.058268908	Kooner et al. 2011	HNF4A
TYPE 2 DIABETES	rs10401969	C	T	0.122217633	Morris et al. 2012	CILP2
TYPE 2 DIABETES	rs10758593	A	G	0.058268908	Morris et al. 2012	GLIS3
TYPE 2 DIABETES	rs10811661	T	C	0.165514438	Morris et al. 2012	CDKN2A/B
TYPE 2 DIABETES	rs10830963	G	C	0.09531018	Morris et al. 2012	MTNR1B
TYPE 2 DIABETES	rs10842994	C	T	0.09531018	Morris et al. 2012	KLHDC5
TYPE 2 DIABETES	rs10923931	T	G	0.076961041	Morris et al. 2012	NOTCH2
TYPE 2 DIABETES	rs1111875	C	T	0.104360015	Morris et al. 2012	HHEX, IDE
TYPE 2 DIABETES	rs11257655	T	C	0.067658648	Morris et al. 2012	CDC123/CAMK1D
TYPE 2 DIABETES	rs11634397	G	A	0.048790164	Morris et al. 2012	ZFAND6
TYPE 2 DIABETES	rs11651052	A	G	0.09531018	Morris et al. 2012	HNF1B
TYPE 2 DIABETES	rs11717195	T	C	0.104360015	Morris et al. 2012	ADCY5
TYPE 2 DIABETES	rs12427353	G	C	0.076961041	Morris et al. 2012	HNF1A
TYPE 2 DIABETES	rs12571751	A	G	0.076961041	Morris et al. 2012	ZMIZ1
TYPE 2 DIABETES	rs12899811	G	A	0.076961041	Morris et al. 2012	PRC1
TYPE 2 DIABETES	rs12970134	A	G	0.076961041	Morris et al. 2012	MC4R
TYPE 2 DIABETES	rs13389219	C	T	0.067658648	Morris et al. 2012	GRB14
TYPE 2 DIABETES	rs1359790	G	A	0.076961041	Morris et al. 2012	SPRY2
TYPE 2 DIABETES	rs1496653	A	G	0.086177696	Morris et al. 2012	UBE2E2

TYPE 2 DIABETES	rs1552224	A	C	0.104360015	Morris et al. 2012	ARAP1
TYPE 2 DIABETES	rs163184	G	T	0.086177696	Morris et al. 2012	KCNQ1
TYPE 2 DIABETES	rs17168486	T	C	0.104360015	Morris et al. 2012	DGKB
TYPE 2 DIABETES	rs17791513	A	G	0.113328685	Morris et al. 2012	TLE4
TYPE 2 DIABETES	rs1801282	C	G	0.122217633	Morris et al. 2012	PPARG
TYPE 2 DIABETES	rs2075423	G	T	0.067658648	Morris et al. 2012	PROX1
TYPE 2 DIABETES	rs2261181	T	C	0.122217633	Morris et al. 2012	HMGA2
TYPE 2 DIABETES	rs243088	T	A	0.067658648	Morris et al. 2012	BCL11A
TYPE 2 DIABETES	rs2796441	G	A	0.067658648	Morris et al. 2012	TLE1
TYPE 2 DIABETES	rs2943640	C	A	0.09531018	Morris et al. 2012	IRS1
TYPE 2 DIABETES	rs3802177	G	A	0.131028262	Morris et al. 2012	SLC30A8
TYPE 2 DIABETES	rs4402960	T	G	0.122217633	Morris et al. 2012	IGF2BP2
TYPE 2 DIABETES	rs4458523	G	T	0.09531018	Morris et al. 2012	WFS1
TYPE 2 DIABETES	rs4502156	T	C	0.058268908	Morris et al. 2012	C2CD4A
TYPE 2 DIABETES	rs459193	G	A	0.076961041	Morris et al. 2012	ANKRD55
TYPE 2 DIABETES	rs516946	C	T	0.086177696	Morris et al. 2012	ANK1
TYPE 2 DIABETES	rs5215	C	T	0.067658648	Morris et al. 2012	KCNJ11
TYPE 2 DIABETES	rs6795735	C	T	0.076961041	Morris et al. 2012	ADAMTS9
TYPE 2 DIABETES	rs6878122	G	A	0.09531018	Morris et al. 2012	ZBED3
TYPE 2 DIABETES	rs7177055	A	G	0.076961041	Morris et al. 2012	HMG20A
TYPE 2 DIABETES	rs7202877	T	G	0.113328685	Morris et al. 2012	BCAR1
TYPE 2 DIABETES	rs7756992	G	A	0.157003749	Morris et al. 2012	CDKAL1
TYPE 2 DIABETES	rs7845219	T	C	0.058268908	Morris et al. 2012	TP53INP1
TYPE 2 DIABETES	rs7903146	T	C	0.329303747	Morris et al. 2012	TCF7L2
TYPE 2 DIABETES	rs7955901	C	T	0.067658648	Morris et al. 2012	TSPAN8, LGR5
TYPE 2 DIABETES	rs8108269	G	T	0.067658648	Morris et al. 2012	GIPR
TYPE 2 DIABETES	rs849135	G	A	0.104360015	Morris et al. 2012	JAZF1
TYPE 2 DIABETES	rs9936385	C	T	0.122217633	Morris et al. 2012	FTO
TYPE 2 DIABETES	rs2334499	T	C	0.039220713	PMID: 20016592	
TYPE 2 DIABETES	rs7593730	C	T	0.104360015	Qi et al. 2010	RBMS1/ITGB6
TYPE 2 DIABETES	rs76895963	T	G	0.634878032	Steinthorsdottir et al. 2014	CCND2
TYPE 2 DIABETES	rs16927668	T	C	0.039220713	Tsai et al. 2010	PTPRD
TYPE 2 DIABETES	rs2447090	A	G	0.039220713	Tsai et al. 2010	MNT
TYPE 2 DIABETES	rs13233731	G	A	0.048790164	Voight et al. 2010	KLF14
WAIST HIP RATIO (ADJUSTED BY BMI)	rs10049088	C	miss	0.029	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs10054063	T	miss	0.027	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs10055995	C	miss	0.011	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs10100423	T	miss	0.042	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs10100533	A	miss	0.014	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs10249651	C	miss	0.015	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs1029472	G	miss	0.025	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs1029645	G	miss	0.013	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs1035942	A	miss	0.014	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs1045241	C	miss	0.019	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs10462028	A	miss	0.019	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs10463416	A	miss	0.014	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs10502148	C	miss	0.023	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs10507524	C	miss	0.018	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs1051684	A	miss	0.013	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs1057119	C	miss	0.013	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs10745659	G	miss	0.013	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs10778504	T	miss	0.016	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs10799424	T	miss	0.013	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs10808546	C	miss	0.016	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs10817896	T	miss	0.013	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs10820747	A	miss	0.027	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs10827226	T	miss	0.02	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs10842707	T	miss	0.034	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs10843804	T	miss	0.015	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs10878367	A	miss	0.019	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs10880823	C	miss	0.013	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs10887759	A	miss	0.017	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs10913257	G	miss	0.011	Pulit et al. 2019	Not available

WAIST HIP RATIO (ADJUSTED BY BMI)	rs10919388	C	miss	0.033	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs10923724	T	miss	0.035	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs10963067	C	miss	0.021	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs10980797	G	miss	0.018	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs11042077	A	miss	0.012	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs1105881	G	miss	0.016	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs11074934	T	miss	0.012	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs11078594	G	miss	0.015	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs11082430	C	miss	0.013	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs11085744	T	miss	0.011	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs11088991	T	miss	0.013	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs1111875	C	miss	0.011	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs11129657	C	miss	0.015	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs11134029	T	miss	0.014	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs11187537	C	miss	0.016	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs11204762	A	miss	0.014	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs11205773	T	miss	0.019	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs11235	C	miss	0.022	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs112907088	G	miss	0.041	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs1139653	A	miss	0.018	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs1144	C	miss	0.015	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs114760566	A	miss	0.093	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs11574514	C	miss	0.029	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs11592754	C	miss	0.022	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs11670056	C	miss	0.024	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs11722554	G	miss	0.033	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs11724804	G	miss	0.017	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs11746028	C	miss	0.014	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs11747001	A	miss	0.017	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs11757455	G	miss	0.022	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs11770285	C	miss	0.031	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs11786566	G	miss	0.011	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs11897119	C	miss	0.014	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs1190982	T	miss	0.016	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs12138803	T	miss	0.025	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs1223581	T	miss	0.011	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs12325187	C	miss	0.013	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs12419064	G	miss	0.014	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs12435790	A	miss	0.021	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs12441543	G	miss	0.019	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs12442323	C	miss	0.015	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs12454712	T	miss	0.017	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs12459350	A	miss	0.014	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs12494105	G	miss	0.012	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs1250259	T	miss	0.016	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs12527712	T	miss	0.034	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs12543555	G	miss	0.014	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs12608426	A	miss	0.025	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs12608504	A	miss	0.026	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs12684047	T	miss	0.015	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs12686771	T	miss	0.022	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs12692387	C	miss	0.013	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs12694042	T	miss	0.012	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs12774134	C	miss	0.019	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs12823266	A	miss	0.013	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs12828318	A	miss	0.017	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs1294432	T	miss	0.025	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs13010546	T	miss	0.014	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs13107325	C	miss	0.031	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs13137905	T	miss	0.013	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs13198178	C	miss	0.031	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs13223034	C	miss	0.013	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs13234914	G	miss	0.013	Pulit et al. 2019	Not available

WAIST HIP RATIO (ADJUSTED BY BMI)	rs13256367	A	miss	0.018	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs1328757	T	miss	0.014	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs1334576	G	miss	0.017	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs13379794	A	miss	0.011	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs1345203	T	miss	0.026	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs1364422	T	miss	0.016	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs1385167	G	miss	0.027	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs139271800	A	miss	0.239	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs140201358	G	miss	0.085	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs1406948	G	miss	0.016	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs144033177	C	miss	0.053	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs1440372	C	miss	0.016	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs144926207	T	miss	0.032	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs145878042	A	miss	0.081	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs146182298	T	miss	0.031	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs1481801	A	miss	0.012	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs1485745	T	miss	0.012	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs1494204	C	miss	0.015	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs149921263	A	miss	0.04	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs150841499	C	miss	0.02	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs1511022	T	miss	0.017	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs1522811	C	miss	0.013	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs1541681	G	miss	0.012	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs1561	T	miss	0.022	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs1569135	A	miss	0.021	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs1635853	T	miss	0.016	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs16907277	G	miss	0.023	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs16976826	T	miss	0.02	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs16978854	G	miss	0.033	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs17067999	C	miss	0.016	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs17101456	G	miss	0.025	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs17154889	C	miss	0.016	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs17289035	A	miss	0.014	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs17311057	T	miss	0.015	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs17326656	T	miss	0.015	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs17369710	C	miss	0.012	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs17417407	T	miss	0.014	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs174829	G	miss	0.014	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs17509001	C	miss	0.016	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs17511102	T	miss	0.02	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs1757471	T	miss	0.015	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs17703354	C	miss	0.02	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs17703883	C	miss	0.015	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs17764730	C	miss	0.016	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs1800978	C	miss	0.026	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs1805740	G	miss	0.018	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs180958337	T	miss	0.088	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs1893781	A	miss	0.018	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs1979527	A	miss	0.013	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs1997833	C	miss	0.014	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs2012485	C	miss	0.029	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs2027982	C	miss	0.012	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs2028386	G	miss	0.013	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs2047937	C	miss	0.015	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs2061708	C	miss	0.016	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs2075665	A	miss	0.011	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs2124307	C	miss	0.013	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs2145272	G	miss	0.025	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs2158828	G	miss	0.014	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs2167750	T	miss	0.027	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs2200155	G	miss	0.014	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs2222543	G	miss	0.015	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs2236519	A	miss	0.03	Pulit et al. 2019	Not available

WAIST HIP RATIO (ADJUSTED BY BMI)	rs2272790	G	miss	0.013	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs2277339	G	miss	0.022	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs227733	A	miss	0.013	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs2279469	C	miss	0.013	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs2294239	A	miss	0.024	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs2294823	T	miss	0.012	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs2299253	T	miss	0.012	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs2373078	T	miss	0.022	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs2376585	C	miss	0.018	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs2387280	A	miss	0.018	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs2398893	A	miss	0.015	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs2503100	G	miss	0.025	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs2524163	T	miss	0.024	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs2526886	T	miss	0.014	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs2529411	G	miss	0.011	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs2595004	C	miss	0.016	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs2602680	T	miss	0.012	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs2603229	T	miss	0.012	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs2701523	A	miss	0.013	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs270960	A	miss	0.011	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs2786198	A	miss	0.013	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs2791550	G	miss	0.037	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs2836141	T	miss	0.015	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs28408682	G	miss	0.012	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs28451064	A	miss	0.018	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs2898237	A	miss	0.012	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs2925979	T	miss	0.027	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs2970332	A	miss	0.016	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs299615	G	miss	0.015	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs2997447	G	miss	0.014	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs3110697	A	miss	0.012	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs3218121	A	miss	0.022	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs322396	A	miss	0.012	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs332105	G	miss	0.014	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs34000	T	miss	0.014	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs34312154	A	miss	0.019	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs34905952	A	miss	0.021	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs352300	C	miss	0.011	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs35344256	A	miss	0.014	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs35419826	G	miss	0.016	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs35710478	C	miss	0.012	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs357438	G	miss	0.011	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs3731861	C	miss	0.011	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs3741378	C	miss	0.022	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs3757298	C	miss	0.021	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs3761706	A	miss	0.032	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs3786897	G	miss	0.028	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs3792751	T	miss	0.014	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs3803042	A	miss	0.027	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs3807947	T	miss	0.014	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs3851294	G	miss	0.026	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs3936510	T	miss	0.03	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs402294	A	miss	0.014	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs41277978	A	miss	0.073	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs4293945	A	miss	0.012	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs4371408	A	miss	0.016	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs4372913	G	miss	0.016	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs4420638	A	miss	0.023	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs4474021	T	miss	0.012	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs4489410	C	miss	0.012	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs4558863	C	miss	0.021	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs4646342	G	miss	0.017	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs4684857	C	miss	0.021	Pulit et al. 2019	Not available

WAIST HIP RATIO (ADJUSTED BY BMI)	rs4686696	A	miss	0.015	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs4773173	A	miss	0.015	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs4789261	C	miss	0.029	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs4794033	G	miss	0.019	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs4902630	A	miss	0.012	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs4951588	C	miss	0.012	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs4964058	A	miss	0.011	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs4964656	G	miss	0.016	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs541091	G	miss	0.02	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs55747707	G	miss	0.024	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs55920843	T	miss	0.086	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs56185013	G	miss	0.017	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs56196860	C	miss	0.036	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs56271783	C	miss	0.059	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs598104	T	miss	0.014	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs59888683	T	miss	0.014	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs6018291	G	miss	0.014	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs6040229	G	miss	0.011	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs6047259	T	miss	0.01	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs6054471	T	miss	0.012	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs62012773	G	miss	0.017	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs62070804	T	miss	0.047	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs62271373	A	miss	0.041	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs62621197	C	miss	0.036	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs634869	T	miss	0.023	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs6426912	T	miss	0.019	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs6432188	T	miss	0.014	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs6480914	A	miss	0.013	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs6556301	T	miss	0.021	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs664532	T	miss	0.013	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs6658424	T	miss	0.014	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs6688233	T	miss	0.021	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs6705646	A	miss	0.025	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs6721459	G	miss	0.018	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs6752964	C	miss	0.019	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs6795831	A	miss	0.035	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs6853254	T	miss	0.017	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs6859752	T	miss	0.012	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs6867518	C	miss	0.018	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs6872807	T	miss	0.011	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs6905288	A	miss	0.044	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs6932767	T	miss	0.015	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs6940715	A	miss	0.022	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs6985478	A	miss	0.015	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs699370	C	miss	0.013	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs7003062	C	miss	0.012	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs7020604	A	miss	0.013	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs7070749	A	miss	0.014	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs7086377	T	miss	0.012	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs7102	C	miss	0.012	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs711076	C	miss	0.012	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs711869	G	miss	0.019	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs7119797	C	miss	0.013	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs71439172	G	miss	0.023	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs71511786	A	miss	0.023	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs715300	T	miss	0.014	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs717795	C	miss	0.02	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs7198287	C	miss	0.014	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs7213608	C	miss	0.012	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs7225453	C	miss	0.015	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs7235010	A	miss	0.019	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs7252102	G	miss	0.014	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs727428	T	miss	0.016	Pulit et al. 2019	Not available

WAIST HIP RATIO (ADJUSTED BY BMI)	rs7279347	G	miss	0.012	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs72823057	C	miss	0.029	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs72877579	C	miss	0.035	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs72959041	A	miss	0.162	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs73001065	C	miss	0.022	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs73094710	T	miss	0.02	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs7350438	C	miss	0.012	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs73858966	A	miss	0.024	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs73942938	C	miss	0.015	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs7395513	G	miss	0.021	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs740838	C	miss	0.043	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs747249	A	miss	0.011	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs7492628	G	miss	0.023	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs7521902	C	miss	0.013	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs7530102	A	miss	0.012	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs7554947	C	miss	0.015	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs755643	G	miss	0.012	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs757081	G	miss	0.011	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs757608	A	miss	0.019	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs7585974	C	miss	0.019	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs7680787	T	miss	0.014	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs7708285	G	miss	0.013	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs7721054	T	miss	0.017	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs7744833	A	miss	0.012	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs7795371	A	miss	0.017	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs7798002	T	miss	0.032	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs780159	G	miss	0.016	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs7827182	G	miss	0.017	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs7854560	T	miss	0.012	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs7903146	T	miss	0.018	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs7932891	A	miss	0.014	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs7945962	A	miss	0.011	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs79664277	A	miss	0.021	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs797486	A	miss	0.037	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs7993238	C	miss	0.012	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs801593	G	miss	0.012	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs8024294	A	miss	0.018	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs8054299	C	miss	0.015	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs805768	T	miss	0.018	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs8066985	A	miss	0.023	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs8074638	A	miss	0.016	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs8080903	C	miss	0.015	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs8103017	G	miss	0.02	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs8126001	C	miss	0.016	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs8142329	G	miss	0.017	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs821100	G	miss	0.016	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs848286	T	miss	0.012	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs863750	T	miss	0.037	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs889129	T	miss	0.02	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs905938	T	miss	0.024	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs910071	C	miss	0.017	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs910382	G	miss	0.019	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs917191	C	miss	0.014	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs917681	T	miss	0.012	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs930653	A	miss	0.011	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs9341990	A	miss	0.015	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs9388766	C	miss	0.017	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs9415106	A	miss	0.014	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs9435732	C	miss	0.013	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs951252	G	miss	0.019	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs9644033	A	miss	0.022	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs9647379	G	miss	0.015	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs9678859	A	miss	0.019	Pulit et al. 2019	Not available

WAIST HIP RATIO (ADJUSTED BY BMI)	rs975385	C	miss	0.011	Pulit et al. 2019	Not available
WAIST HIP RATIO (ADJUSTED BY BMI)	rs9909443	C	miss	0.014	Pulit et al. 2019	Not available

Supplementary table 3. ACR results of meta analysis of multivariate Mendelian randomization results for lipids adjusted by other lipids' betas in UK Biobank and CKDGen and in the two studies individually. 95% confidence intervals in brackets.

Meta analysis

Trait	Beta IVW	P IVW	Beta Egger	P Egger	Beta WM	P WM	Beta PWM	P PWM
TRIGLYCERIDES adjusted by LDL CHOLESTEROL and HDL CHOLESTEROL	0.094 (0.073, 0.115)	< 1 x E-15	0.112 (0.081, 0.144)	1.3E-02	0.052 (0.033, 0.071)	1.1E-07	0.048 (0.029, 0.068)	1.1E-06
HDL CHOLESTEROL adjusted by TRIGLYCERIDES and LDL CHOLESTEROL	0.011 (-0.005, 0.028)	1.7E-01	0.029 (0.006, 0.052)	1.3E-02	0.008 (-0.007, 0.024)	3.0E-01	-0.008 (-0.028, 0.012)	4.3E-01
LDL CHOLESTEROL adjusted by HDL CHOLESTEROL and TRIGLYCERIDES	0.018 (0.001, 0.035)	3.4E-02	0.014 (-0.012, 0.040)	3.0E-01	0.029 (0.014, 0.045)	1.8E-04	0.032 (0.016, 0.048)	9.6E-05

UK Biobank

Trait	Beta IVW	P IVW	Beta Egger	P Egger	Beta WM	P WM	Beta PWM	P PWM
TRIGLYCERIDES adjusted by LDL CHOLESTEROL and HDL CHOLESTEROL	0.069 (0.040, 0.098)	2.1E-05	0.092 (0.049, 0.134)	1.1E-04	0.048 (0.027, 0.070)	1.0E-05	0.044 (0.022, 0.066)	8.5E-05
HDL CHOLESTEROL adjusted by TRIGLYCERIDES and LDL CHOLESTEROL	0.003 (-0.018, 0.024)	7.6E-01	0.017 (-0.014, 0.048)	2.8E-01	0.002 (-0.016, 0.019)	8.6E-01	-0.035 (-0.060, -0.009)	8.6E-03
LDL CHOLESTEROL adjusted by HDL CHOLESTEROL and TRIGLYCERIDES	0.015 (-0.004, 0.034)	1.2E-01	0.026 (-0.004, 0.055)	9.1E-02	0.032 (0.016, 0.048)	1.1E-04	0.033 (0.016, 0.050)	1.5E-04

CKDGen

Trait	Beta IVW	P IVW	Beta Egger	P Egger	Beta WM	P WM	Beta PWM	0.07
TRIGLYCERIDES adjusted by LDL CHOLESTEROL and HDL CHOLESTEROL	0.123 (0.092, 0.154)	4.6E-10	0.136 (0.091, 0.181)	3.6E-07	0.064 (0.023, 0.106)	2.5E-03	0.064 (0.022, 0.106)	2.8E-03

HDL CHOLESTEROL adjusted by TRIGLYCERIDES and LDL CHOLESTEROL	0.024 (-0.002, 0.049)	7.8E-02	0.044 (0.010, 0.079)	1.4E-02	0.031 (-0.002, 0.063)	6.4E-02	0.031 (0.000, 0.062)	5.4E-02
LDL CHOLESTEROL adjusted by HDL CHOLESTEROL and TRIGLYCERIDES	0.028 (-0.007, 0.064)	1.2E-01	-0.031 (-0.012, 0.040)	3.0E-01	0.029 (-0.047, 0.056)	8.6E-01	0.026 (-0.027, 0.080)	3.4E-01

IVW = inverse variance weighted instrumental variable analysis, WM = weighted median analysis, PWM = penalised weighted median analysis.

Supplementary Table 4. UK Biobank and CKDGen grs and two sample Mendelian randomization results between investigated traits and ACR.

UK Biobank

Trait	Beta grs	SE grs	P grs	Beta IVW	SE IVW	P IVW	Beta Egger	SE Egger	P Egger	Egger int p	Beta WM	SE WM	P WM	Beta PWM	SE PWM	P PWM
Diastolic BP	0.0839	0.0105	1.4E-15	0.0075	0.0018	7.6E-05	0.0011	0.0051	8.3E-01	1.83E-01	0.0080	0.0016	1.0E-06	0.0057	0.0021	5.9E-03
Systolic BP	0.0835	0.0115	4.7E-13	0.0035	0.0012	5.1E-03	0.0035	0.0038	3.6E-01	9.98E-01	0.0046	0.0010	6.2E-06	0.0037	0.0014	6.5E-03
HDL cholesterol	-0.0198	0.0065	2.4E-03	-0.0133	0.0122	2.8E-01	-0.0041	0.0179	8.2E-01	4.84E-01	0.0087	0.0091	3.4E-01	-0.0058	0.0171	7.4E-01
LDL cholesterol	0.0204	0.0059	4.9E-04	0.0271	0.0157	1.3E-02	0.0361	0.0160	2.8E-02	4.53E-01	0.0334	0.0088	1.4E-04	0.0270	0.0099	6.5E-03
Triglycerides	0.0568	0.0070	3.6E-16	0.0548	0.0149	6.1E-04	0.0581	0.0220	1.1E-02	8.37E-01	0.0460	0.0116	7.0E-05	0.0460	0.0188	1.5E-02
BMI	0.0260	0.0126	3.9E-02	0.0068	0.0149	6.5E-01	0.0916	0.0313	4.2E-03	2.76E-03	0.0093	0.0161	7.8E-01	0.0286	0.0194	1.4E-01
% Body fat	-0.0758	0.0440	8.5E-02	-0.0661	0.0652	7.2E-01	0.2180	0.1532	9.0E-01	7.31E-02	-0.1170	0.0477	5.7E-01	-0.0753	0.0744	7.7E-01
Waist hip ratio (adjusted by BMI)	0.0391	0.0077	3.7E-07	0.0357	0.0106	8.8E-04	0.0936	0.0255	2.7E-04	1.28E-02	0.0503	0.0122	3.6E-05	0.0321	0.0127	1.1E-02
Fasting glucose	-0.0005	0.0004	1.7E-01	-0.0038	0.0370	9.2E-01	-0.0074	0.0727	9.2E-01	9.54E-01	-0.0143	0.0253	5.7E-01	-0.0125	0.0274	6.5E-01
Fasting insulin	0.0000	0.0006	9.9E-01	-0.0810	0.1364	5.7E-01	-0.8563	0.7542	2.9E-01	3.21E-01	-0.0415	0.0725	5.7E-01	-0.0394	0.0844	6.4E-01
T2D	0.0010	0.0003	6.4E-04	0.0176	0.0041	5.53£-05	0.0232	0.0082	6.5E-03	4.4E-01	0.0233	0.0051	5.2E-06	0.0260	0.0063	3.28E-05

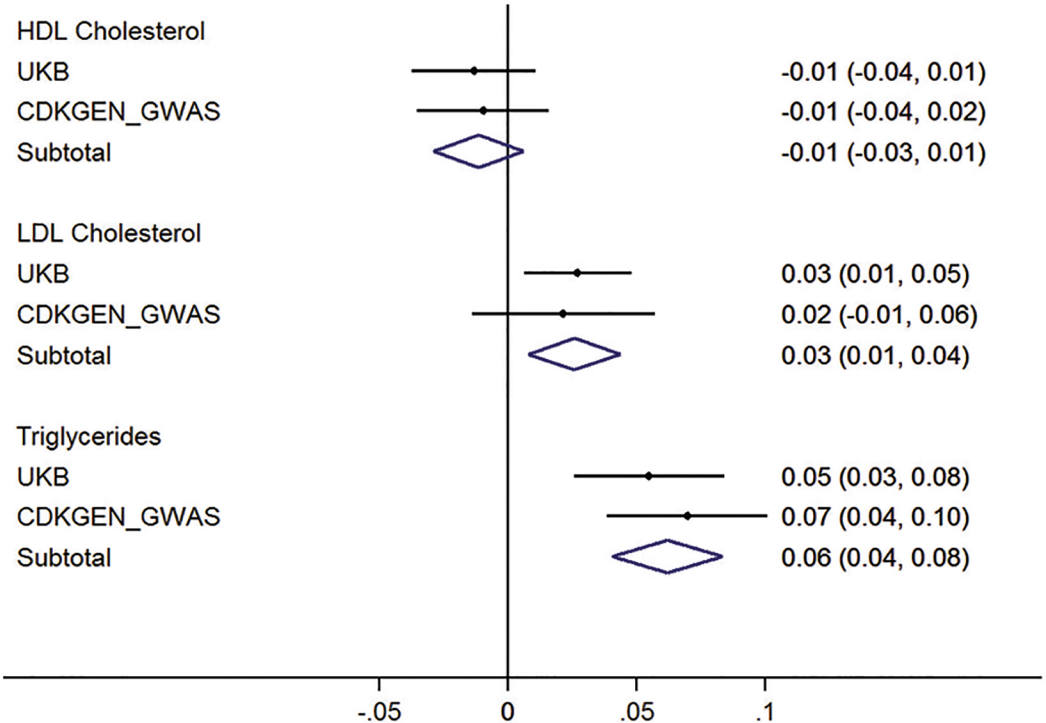
Grs= genetic risk score, IVW = inverse variance weighted instrumental variable analysis, WM = weighted median analysis, PWM = penalised weighted median analysis, Egger int p = Egger p for intercept.

CKDGen

Trait	Beta grs	SE grs	P grs	Beta IVW	SE IVW	P IVW	Beta Egger	SE Egger	P Egger	Egger int p	Beta WM	SE WM	P WM	Beta PWM	SE PWM	P PWM
Diastolic BP	Not available	Not available	Not available	0.0136	0.0029	1.3E-05	-0.0062	0.0082	4.5E-01	1.1E-02	0.0143	0.0035	4.0E-05	0.0143	0.0035	5.6E-05
Systolic BP	Not available	Not available	Not available	0.0104	0.0019	3.7E-07	-0.0043	0.0055	4.3E-01	5.5E-03	0.0097	0.0022	1.1E-05	0.0098	0.0021	4.4E-06

HDL cholesterol	Not available	Not available	Not available	-0.0098	0.0131	4.6E-01	0.0269	0.0175	1.3E-01	3.0E-03	0.0307	0.0161	5.7E-02	0.0307	0.0161	5.7E-02
LDL cholesterol	Not available	Not available	Beta grs	SE grs	P grs	2.4E-01	-0.0262	0.0292	3.7E-01	4.3E-02	0.0029	0.0265	9.1E-01	0.0253	0.0259	3.3E-01
Triglycerides	Not available	Not available	Not available	0.0697	0.0159	6.0E-05	0.0713	0.0231	3.4E-03	9.3E-01	0.0641	0.0212	2.5E-03	0.0641	0.0214	2.7E-03
BMI	Not available	Not available	Not available	0.0885	0.0292	3.4E-03	0.0662	0.0717	3.6E-01	3.9E-03	0.0559	0.0434	2.0E-01	0.0562	0.0434	2.0E-01
% Body fat	Not available	Not available	Not available	-0.2947	0.0804	2.9E-03	-0.2399	0.2355	3.3E-01	8.0E-01	-0.3053	0.1197	1.1E-02	-0.3053	0.1147	7.8E-03
Waist hip ratio (adjusted by BMI)	Not available	Not available	Not available	0.0651	0.0271	1.7E-02	0.1478	0.0805	6.8E-02	2.8E-01	0.0435	0.0398	2.7E-01	0.0305	0.0407	4.5E-01
Fasting glucose	Not available	Not available	Not available	-0.0337	0.0499	5.1E-01	-0.0921	0.0940	3.4E-01	4.7E-01	-0.0321	0.0560	5.7E-01	-0.0321	0.0551	5.6E-01
Fasting insulin	Not available	Not available	Not available	0.0561	0.1483	7.1E-01	-1.8712	0.8257	4.3E-02	2.9E-02	-0.0150	0.1282	9.1E-01	-0.0150	0.1287	9.1E-01
T2D	Not available	Not available	Not available	-0.0133	0.0100	1.9E-01	0.0022	0.0216	9.2E-01	4.2E-01	-0.0009	0.0164	9.5-01	-0.0009	0.0164	9.5E-01

Grs= genetic risk score, IVW = inverse variance weighted instrumental variable analysis, WM = weighted median analysis, PWM = penalised weighted median analysis, Egger int p = Egger p for intercept.



Standard deviation differences in ACR per standard deviation differences in genetically instrumented lipids measures.

No evidence of heterogeneity was noted between the MR estimates for the two different studies for HDL ($p = 0.844$, I-square 0.0%), LDL ($p = 0.788$, I-square 0.0%) and triglycerides ($p = 0.494$, I-squared 0.0%).