

**Table 1: Diabetes Complications Phenotype Definitions and Descriptions**

Trait	Lab/Clinical Criteria	Self-report	Medical records	Control group
Type II Diabetes (T2D)	1. Oral glucose tolerance test (OGTT) $\geq 200$ mg/dl AND/OR fasting plasma glucose (FPG) $\geq 126$ mg/dl AND/OR HbA1C $> 6.5\%$ (48 mmol/mol) AND/OR Anti-diabetic medication AND/OR ICD9/10 diabetes codes [Strict T2D Definition] 2. OGTT $\geq 200$ mg/dl AND/OR FPG $\geq 126$ mg/dl AND/OR HbA1C $> 6.5\%$ (48 mmol/mol) AND/OR Self-report (doctors dx, anti-diabetic medication use) [Broad T2D Definition]	Have you ever been diagnosed with diabetes?	Anti-diabetes medications	No T2D on all criteria
ICD/OPCS-4 Codes: ICD-9 codes: 250.XX or ICD-10 codes: (E11.0–11.9)				
Notes: OGTT: Oral glucose tolerance test, FPG: fasting plasma glucose, HbA1C: Hemoglobin A1C				
Trait	Lab/Clinical Criteria	Self-report	Medical records	Control group
Microalbuminuria (micro)	Albumin excretion rate (AER) 20-200 ug/min or 30-300mg/24h OR Albumin-creatinine ratio (ACR) 2.5-25 mg/mmol (men); 3.5-35 mg/mmol (women)			Normal AER/ACR
ICD/OPCS-4 Codes: NA				
Notes: AER: urine albumin excretion rate, ACR: urine albumin-creatinine ratio, NA: Not applicable				
Trait	Lab/Clinical Criteria	Self-report	Medical records	Control group
Macroalbuminuria (macro)	AER $> 200$ ug/min or 300mg/24h or ACR $> 25/35$ mg/mmol (men/women)			Normal AER/ACR
ICD/OPCS-4 Codes: NA				
Notes: AER: urine albumin excretion rate, ACR: urine albumin-creatinine ratio, NA: Not applicable				
Trait	Lab/Clinical Criteria	Self-report	Medical records	Control group
Albuminuria (ALB)	Microalbuminuria or Macroalbuminuria			Normal AER/ACR
ICD/OPCS-4 Codes: NA				
Notes:				
Trait	Lab/Clinical Criteria	Self-report	Medical records	Control group
End-stage renal disease (ESRD vs. control)	eGFR $< 15$ mL/min/1.73 m2 or dialysis or transplant			Normal AER/ACR
ICD/OPCS-4 Codes: ICD-10 codes: (E85.3, N16.5, N18.0, N18.5, Q60.1, T82.4, T86.1, Y60.2, Y60.2, Y61.2, Y62.2, Y84.1, Z49.0, Z49.1, Z49.2, Z94.0, Z99.2); OPCS-4 coded procedures (L74.1, L74.2, L74.3, L74.4, L74.5, L74.6, L74.8, L74.9, M01.2, M01.3, M01.4, M01.5, M01.8, M01.9, M02.3, M08.4, M17.2, M17.4, M17.8, M17.9, X40.1, X40.2, X40.3, X40.4, X40.5, X40.6, X40.7, X40.8, X40.9, X41.1, X41.2, X41.8, X41.9, X42.1, X42.8, X42.9, X43.1) UKBB participants without evidence of a CKD stage indicator are excluded (i.e. those with acute kidney injury are excluded) refer to: <a href="https://biobank.ndph.ox.ac.uk/showcase/showcase/docs/alg_outcome_esrd.pdf">https://biobank.ndph.ox.ac.uk/showcase/showcase/docs/alg_outcome_esrd.pdf</a>				
Notes: ESRD: End-stage renal disease, eGFR: estimated Glomerular filtration rate (using creatinine & Epi-CKD formula), AER: urine albumin excretion rate, ACR: urine albumin-creatinine ratio, NA: Not applicable				
Trait	Lab/Clinical Criteria	Self-report	Medical records	Control group
Diabetic Nephropathy (DN)	Macro or ESRD			Normal AER/ACR
ICD/OPCS-4 Codes: NA				
Notes: eGFR: estimated Glomerular filtration rate (calculated using creatinine & EPI-CKD formula), AER: urine albumin excretion rate, ACR: urine albumin-creatinine ratio, NA: Not applicable				
Trait	Lab/Clinical Criteria	Self-report	Medical records	Control group
Diabetic Kidney Disease (DKD)	Microalbuminuria, Macroalbuminuria or ESRD			Normal AER/ACR
ICD/OPCS-4 Codes: NA				
Notes: eGFR: estimated Glomerular filtration rate (calculated using creatinine & EPI-CKD formula), AER: urine albumin excretion rate, ACR: urine albumin-creatinine ratio, NA: Not applicable				
Trait	Lab/Clinical Criteria	Self-report	Medical records	Control group
Chronic Kidney Disease (CKD)	eGFR $< 60$ mL/min/1.73 m2			eGFR $\geq 60$ mL/min/1.73 m2
ICD/OPCS-4 Codes: NA				
Notes: eGFR: estimated Glomerular filtration rate (calculated using creatinine & EPI-CKD formula), AER: urine albumin excretion rate, ACR: urine albumin-creatinine ratio, NA: Not applicable				
Trait	Lab/Clinical Criteria	Self-report	Medical records	Control group
CKD-DN	Macroalbuminuria or ESRD and eGFR $< 45$			eGFR $\geq 60$ mL/min/1.73 m2 and Normal AER/ACR
ICD/OPCS-4 Codes: NA				
Notes: eGFR: estimated Glomerular filtration rate (calculated using creatinine & EPI-CKD formula), AER: urine albumin excretion rate, ACR: urine albumin-creatinine ratio, NA: Not applicable				
Trait	Lab/Clinical Criteria	Self-report	Medical records	Control group
CKD-DKD	Microalbuminuria, Macroalbuminuria or ESRD and eGFR $< 45$			eGFR $\geq 60$ mL/min/1.73 m2 and Normal AER/ACR
ICD/OPCS-4 Codes: NA				
Notes: eGFR: estimated Glomerular filtration rate (calculated using creatinine & EPI-CKD formula), AER: urine albumin excretion rate, ACR: urine albumin-creatinine ratio, NA: Not applicable				
Trait	Lab/Clinical Criteria	Self-report	Medical records	Control group
ESRD vs. Macro	eGFR $< 15$ mL/min/1.73 m2 or dialysis or transplant			Macroalbuminuria
ICD/OPCS-4 Codes: ICD-10 codes: (E85.3, N16.5, N18.0, N18.5, Q60.1, T82.4, T86.1, Y60.2, Y60.2, Y61.2, Y62.2, Y84.1, Z49.0, Z49.1, Z49.2, Z94.0, Z99.2); OPCS-4 coded procedures (L74.1, L74.2, L74.3, L74.4, L74.5, L74.6, L74.8, L74.9, M01.2, M01.3, M01.4, M01.5, M01.8, M01.9, M02.3, M08.4, M17.2, M17.4, M17.8, M17.9, X40.1, X40.2, X40.3, X40.4, X40.5, X40.6, X40.7, X40.8, X40.9, X41.1, X41.2, X41.8, X41.9, X42.1, X42.8, X42.9, X43.1) UKBB participants without evidence of a CKD stage indicator are excluded (i.e. those with acute kidney injury are excluded) refer to: <a href="https://biobank.ndph.ox.ac.uk/showcase/showcase/docs/alg_outcome_esrd.pdf">https://biobank.ndph.ox.ac.uk/showcase/showcase/docs/alg_outcome_esrd.pdf</a>				
Notes: ESRD: End-stage renal disease, eGFR: estimated Glomerular filtration rate (using creatinine & Epi-CKD formula), AER: urine albumin excretion rate, ACR: urine albumin-creatinine ratio, NA: Not applicable				
Trait	Lab/Clinical Criteria	Self-report	Medical records	Control group
ESRD vs. No ESRD	eGFR $< 15$ mL/min/1.73 m2 or dialysis or transplant			Non-ESRD
ICD/OPCS-4 Codes: ICD-10 codes: (E85.3, N16.5, N18.0, N18.5, Q60.1, T82.4, T86.1, Y60.2, Y60.2, Y61.2, Y62.2, Y84.1, Z49.0, Z49.1, Z49.2, Z94.0, Z99.2); OPCS-4 coded procedures (L74.1, L74.2, L74.3, L74.4, L74.5, L74.6, L74.8, L74.9, M01.2, M01.3, M01.4, M01.5, M01.8, M01.9, M02.3, M08.4, M17.2, M17.4, M17.8, M17.9, X40.1, X40.2, X40.3, X40.4, X40.5, X40.6, X40.7, X40.8, X40.9, X41.1, X41.2, X41.8, X41.9, X42.1, X42.8, X42.9, X43.1) UKBB participants without evidence of a CKD stage indicator are excluded (i.e. those with acute kidney injury are excluded) refer to: <a href="https://biobank.ndph.ox.ac.uk/showcase/showcase/docs/alg_outcome_esrd.pdf">https://biobank.ndph.ox.ac.uk/showcase/showcase/docs/alg_outcome_esrd.pdf</a>				
Notes: ESRD: End-stage renal disease, eGFR: estimated Glomerular filtration rate (using creatinine & Epi-CKD formula), AER: urine albumin excretion rate, ACR: urine albumin-creatinine ratio, NA: Not applicable				
Trait	Lab/Clinical Criteria	Self-report	Medical records	Control group
CKD-Extreme vs eGFR $\geq 60$ (ESRD vs. CKD-Control)	eGFR $< 15$ mL/min/1.73 m2 or dialysis or transplant			eGFR $\geq 60$ mL/min/1.73 m2
ICD/OPCS-4 Codes: ICD-10 codes: (E85.3, N16.5, N18.0, N18.5, Q60.1, T82.4, T86.1, Y60.2, Y60.2, Y61.2, Y62.2, Y84.1, Z49.0, Z49.1, Z49.2, Z94.0, Z99.2); OPCS-4 coded procedures (L74.1, L74.2, L74.3, L74.4, L74.5, L74.6, L74.8, L74.9, M01.2, M01.3, M01.4, M01.5, M01.8, M01.9, M02.3, M08.4, M17.2, M17.4, M17.8, M17.9, X40.1, X40.2, X40.3, X40.4, X40.5, X40.6, X40.7, X40.8, X40.9, X41.1, X41.2, X41.8, X41.9, X42.1, X42.8, X42.9, X43.1) UKBB participants without evidence of a CKD stage indicator are excluded (i.e. those with acute kidney injury are excluded) refer to: <a href="https://biobank.ndph.ox.ac.uk/showcase/showcase/docs/alg_outcome_esrd.pdf">https://biobank.ndph.ox.ac.uk/showcase/showcase/docs/alg_outcome_esrd.pdf</a>				
Notes: ESRD: End-stage renal disease, eGFR: estimated Glomerular filtration rate (using creatinine & Epi-CKD formula), AER: urine albumin excretion rate, ACR: urine albumin-creatinine ratio, NA: Not applicable				
Trait	Lab/Clinical Criteria	Self-report	Medical records	Control group
Diabetic Retinopathy (DRET)	Fundus exam: Early Treatment in Diabetic Retinopathy Study (ETDRS) 1. Absent/ present	Hx of retinopathy Ex. Have you been told that you have diabetic eye disease?	ICD code: Retinopathy	No Hx of retinopathy Absent retinopathy on fundus exam
ICD/OPCS-4 Codes: ICD-9 codes (362.0); ICD-10 code: (H36.0, E10.3, E11.3, E12.3, E13.3, E14.3)				
Notes: ETDRS Early Treatment in Diabetic Retinopathy Study				

Trait	Lab/Clinical Criteria	Self-report	Medical records	Control group
Non-alcoholic fatty liver disease (NAFLD)	Abdominal CT-scan (Liver/Spleen attenuation ratio < 1)		ICD code: Non-alcoholic fatty liver disease	No evidence of NAFLD on imaging Normal AST/ALT No NAFLD diagnosis
<b>ICD/OPCS-4 Codes:</b> ICD-9 codes (571.5, 571.8, 571.9); ICD-10 codes (K75.8, K76.0, K74.0, K74.6, K76.9)				
<b>Notes:</b> AST: Aspartate transaminase, ALT: alanine aminotransferase, significant alcohol consumption is defined as >21 standard drinks per week in men and >14 standard drinks per week in women over a 2-year period preceding baseline liver				

Trait	Lab/Clinical Criteria	Self-report	Medical records	Control group
Peripheral artery disease (PAD)	Ankle brachial index (ABI) values <0.9 or Intermittent claudication	History of PAD	ICD code: Peripheral artery disease	ABI between 1.0 and 1.4
<b>ICD/OPCS-4 Codes:</b> ICD-9 codes: (440.0, 440.2, 443.8, 443.9); ICD-10 codes (I70.0, I70.2, I70.8, I70.9, I73.8, I73.9); OPCS-4 coded procedures (X09.3, X09.4, X09.5, L21.6, L51.3, L51.6, L51.8, L52.1, L52.2, L54.1, L54.4, L54.8, L59.1, L59.2, L59.3,				
<b>Notes:</b> ABI: Ankle brachial index				

Trait	Lab/Clinical Criteria	Self-report	Medical records	Control group
Coronary Heart Disease (CHD)	Myocardial infarction (MI) or revascularization procedure	History MI or revascularization or CHD	ICD9/ICD10 MI or revascularization	No hx CHD for all criteria
<b>ICD/OPCS-4 Codes:</b> ICD-9 codes: (410-412.9, 414) or OPCS-4 coded procedure: (K40-K46, K49-K50, and K75); ICD-10 codes: (I21-I25.9)				
<b>Notes:</b> revasc: revascularization, MI: Myocardial infarction, CHD: coronary heart disease				

Trait	Lab/Clinical Criteria	Self-report	Medical records	Control group
STROKE	Any Stroke (not including TIA)	History of stroke	ICD9/ICD10 stroke	No hx stroke for all criteria
<b>ICD/OPCS-4 Codes:</b> ICD-9 codes: (430, 431, 434, 436); ICD-10 codes: (I60-64)				
<b>Notes:</b> TIA: Transient ischemic attack				

Trait	Lab/Clinical Criteria	Self-report	Medical records	Control group
Cardiovascular Disease (CVD)	CHD or STROKE or AFIB or Heart Failure	History of CVD	ICD9/ICD10 CVD (Angina not included)	No hx CVD for all criteria
<b>ICD/OPCS-4 Codes:</b> Heart Failure ICD-9 codes: (428.0, 428.9); ICD-10 codes: (I50, I110, I130, I132); CHD: ICD-10 codes: (I21-I25.9) or ICD-9 codes: (410-412.9, 414) or OPCS-4 coded procedure: (K40-K46, K49-K50, and K75); Stroke: ICD-10 codes: (I60-64) or ICD-9 codes: (430, 431, 434, 436)				
<b>Notes:</b> CHD: coronary heart disease, AFIB: atrial fibrillation, CVD: Cardiovascular Disease				