Online Supplemental Material

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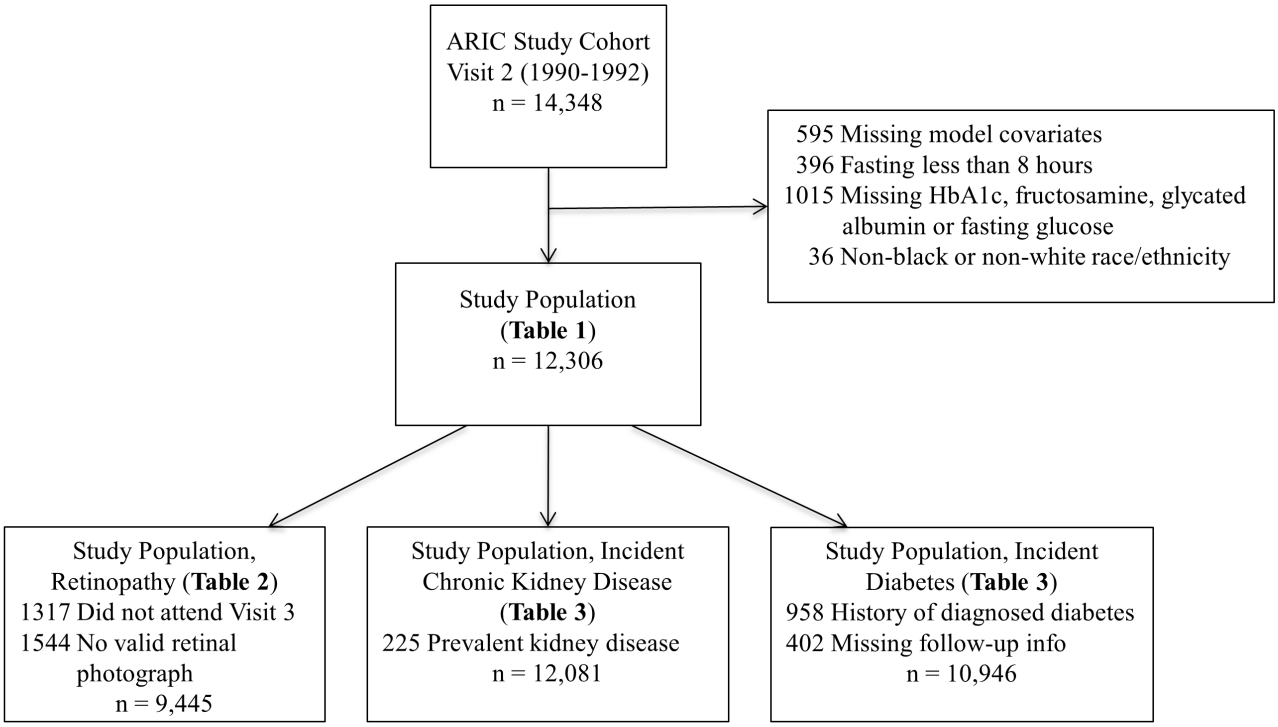
Description of Response Rates in the Atherosclerosis Risk in Communities (ARIC) Study and Flow Diagram of ARIC Study Participants Included in the Analytic Study Populations

The follow-up of persons in the ARIC cohort is high: Visit 1 (1987-89), 60%; Visit 2 (1990-92), 93%; Visit 3 (1993-95), 86%; Visit 4 (1996-98), 80%. For Visit 1, this response rate is the percentage of all those persons sampled from the eligible communities and invited to participate in the ARIC Study who attended the first ARIC clinic visit. For Visits 2 – 4, these response rates are the percentage of all participants who attended the first clinic visit and were still alive who attended the later visits. The response rate for the annual telephone calls varies from year-to-year but is typically >90% (http://www2.cscc.unc.edu/aric/system/files/AFU_Response_Rates.pdf). The baseline for the present study was Visit 2. The flow diagram below (**eFigure 1**) shows the selection of ARIC study participants for each of the analytic study populations in our paper.

eFigure 1. Flow Diagram of ARIC Study Participants Included in the Analytic Study Populations



eTable 1. Study Population Characteristics by Quartiles of Fructosamine and Glycated Albumin at Baseline in Persons with and without a History of Diabetes, N=12,306

		No Diagnosed Diabetes				Diagnosed Diabetes			
	Total	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Fructosamine									
Range [Min, Max]	[89, 706]	[89, 214]	[215, 226]	[227, 239]	[240, 594]	[158, 252]	[253, 301]	[302, 385]	[386, 706]
Fructosamine, umol/L	237	204	221	233	258	229	275	341	468
Glycated albumin, %	13.4	11.7	12.4	12.9	14.3	13.1	16.6	21.8	31.9
Hemoglobin A1c, %	5.7	5.4	5.4	5.5	5.8	6	7	8.6	10.8
Fasting glucose, mg/dL	112	101	102	103	113	120	155	209	280
Age	56.9	55.9	56.5	57.1	57.6	57.8	58.9	58.3	58.1
Female, %	56.7	58.5	55.4	55.6	56.9	62.5	49.4	55	60.7
Black, %	23.1	14.3	16.8	21.0	34.7	28.8	36.8	42.5	52.7
LDL Cholesterol, mg/dL	134	130	133	134	137	130	137	134	147
HDL Cholesterol, mg/dL	50	48.2	50	51.3	52.6	45.8	42.7	42.1	45.2
Triglycerides, mg/dL	129	131	128	124	123	152	157	167	162
Body mass index, kg/m^2	27.9	29.0	27.8	27.1	27.0	30.8	30.6	31.8	30.0
Obese, %	28.5	34.6	26.3	22.3	23.3	46.3	51.9	57.5	48.1
Hypertension, %	34.9	29.0	30.7	32.3	39.5	50.6	58.4	67.8	57.6
Family history of diabetes, %	24.2	21.6	22.9	21.3	24.8	41.7	38.9	47.1	41.0
Education, %									
Less than high school	20.7	19.3	17.7	18.8	22.4	32.9	38.1	31.3	35.6
High school or equivalent	42.0	45.3	42.1	41.7	39.7	39.6	33.1	44.6	41.0
College or above	37.3	35.5	40.2	39.6	37.9	27.5	28.9	24.2	23.4
Current alcohol use, %	57.1	63.4	62.2	60.6	49.3	47.9	34.7	30.0	28.9
Current smoking status, %	21.7	32.6	23.2	18.4	13.2	28.3	22.6	16.3	12.1
Physical activity index	2.4	2.4	2.5	2.5	2.5	2.3	2.3	2.3	2.2
Glycated Albumin									
Range [Min, Max]	[5.6, 51.5]	[5.6, 11.8]	[11.9, 12.6]	[12.7, 13.5]	[13.6, 42.4]	[7.9, 14.5]	[14.6, 18.5]	[18.6, 25.4]	[25.5, 51.5]
Fructosamine, umol/L	237	212	223	231	250	232	276	341	464
Glycated albumin, %	13.4	11.2	12.2	13.0	14.8	12.8	16.5	21.9	32.2
Hemoglobin A1c, %	5.7	5.4	5.4	5.5	5.8	5.9	7.0	8.6	10.9
Fasting glucose, mg/dL	112	102	102	103	113	119	154	211	281
Age	56.9	56.0	56.5	56.9	57.6	57.9	58.8	58.6	57.9
Female, %	56.7	52.0	53.2	59.4	62.2	59.6	50.0	57.7	60.3
Black, %	23.1	9.9	16.5	21.8	38.8	25.0	36.7	43.9	55.2
LDL Cholesterol, mg/dL	134	135	135	132	132	131	136	134	147
HDL Cholesterol, mg/dL	50	46.8	49.2	52.6	53.5	44.4	43.7	42.5	45.1
Triglycerides, mg/dL	129	144	130	117	114	155	154	171	158
Body mass index, kg/m2	27.9	29.0	27.7	26.9	27.1	30.5	30.6	32.0	30.1
Obese, %	28.5	35.4	25.4	21.1	24.7	44.2	50.4	59.8	49.4
Hypertension, %	34.9	35.1	30.7	29.4	36.3	50.4	57.5	69.3	57.1
Hypertension medication use, %	32.1	32.8	27.1	27.2	32.6	46.7	60.0	66.1	57.3
Family history of diabetes, %	24.2	21.9	20.8	22.0	26.1	39.6	44.6	42.3	42.3
Education, %									
Less than high school	20.7	18.0	18.1	18.6	23.5	30.0	40.4	33.5	33.9
High school or equivalent	42.0	44.9	43.2	42.3	38.4	41.7	32.9	42.3	41.4
College or above	37.3	37.2	38.7	39.2	38.1	28.3	26.7	24.3	24.7
Current alcohol use, %	57.1	66.1	63.1	57.8	48.4	47.5	36.7	29.3	28.0
Current smoking status, %	21.7	28.5	23.5	19.6	15.7	24.6	24.2	16.3	14.2
Physical activity index	2.4	2.5	2.5	2.5	2.4	2.3	2.3	2.2	2.2

To convert glucose to mmol/L, multiply by 0.0555. To convert HDL- and LDL-cholesterol to mmol/L, multiply by 0.0259.

eTable 2. Associations Odds Ratios (95% Confidence Intervals) of Baseline Quartiles of Fructosamine and Glycated Albumin with Prevalent Retinopathy (ETDRS Level 20 or Higher) in Persons without Diabetes and in Persons with a History of Diabetes, N=9,445*

	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)	Model 4 OR (95% CI)
Fructosamine, umol/L				
No Diabetes				
≤214	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)
215 - 226	0.92 (0.58, 1.46)	0.94 (0.59, 1.49)	0.92 (0.58, 1.46)	0.92 (0.58, 1.46)
227 - 239	1.48 (0.97, 2.25)	1.51 (0.98, 2.32)	1.34 (0.86, 2.09)	1.39 (0.90, 2.16)
≥ 240	1.35 (0.52, 3.50)	1.29 (0.50, 3.34)	1.17 (0.45, 3.06)	1.19 (0.46, 3.11)
History of Diabetes				
≤ 252	1.35 (0.52, 3.50)	1.29 (0.50, 3.34)	1.17 (0.45, 3.06)	1.19 (0.46, 3.11)
253 - 301	6.40 (3.62, 11.29)	5.63 (3.15, 10.04)	4.34 (2.34, 8.02)	4.65 (2.53, 8.53)
302 - 385	20.55 (12.94, 32.63)	19.03 (11.70, 30.96)	11.23 (5.96, 21.18)	12.78 (6.91, 23.61)
≥ 386	56.86 (35.17, 91.93)	53.05 (31.93, 88.14)	21.54 (9.17, 50.63)	26.82 (11.89, 60.46)
p-for-trend	< 0.001	< 0.001	< 0.001	< 0.001
Glycated albumin, %				
No Diabetes				
≤ 11.8	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)
11.9 - 12.6	1.01 (0.64, 1.61)	1.07 (0.67, 1.70)	1.06 (0.66, 1.68)	1.06 (0.67, 1.68)
12.7 - 13.5	1.45 (0.94, 2.25)	1.59 (1.02, 2.48)	1.55 (0.99, 2.41)	1.56 (1.00, 2.43)
≥ 13.6	1.39 (0.89, 2.17)	1.50 (0.96, 2.36)	1.38 (0.87, 2.19)	1.42 (0.90, 2.24)
History of Diabetes				
≤ 14.5	0.27 (0.04, 2.01)	0.27 (0.04, 2.00)	0.25 (0.03, 1.87)	0.26 (0.04, 1.91)
14.6 - 18.5	7.38 (4.18, 13.02)	6.87 (3.85, 12.24)	5.67 (3.06, 10.50)	5.91 (3.21, 10.87)
18.6 - 25.4	25.09 (15.63, 40.26)	23.34 (14.28, 38.14)	15.63 (8.06, 30.28)	17.26 (9.25, 32.23)
≥ 25.5	61.70 (37.60, 101.26)	57.91 (34.63, 96.84)	29.46 (11.94, 72.65)	34.79 (15.24, 79.44)
p-for-trend	< 0.001	< 0.001	< 0.001	< 0.001
Hemoglobin A1c, %				
No Diabetes				
≤ 5.2	1.00 (reference)	1.00 (reference)	-	1.00 (reference)
5.3 - 5.4	0.87 (0.56, 1.36)	0.86 (0.55, 1.34)	-	0.86 (0.55, 1.34)
5.5 - 5.7	0.94 (0.61, 1.45)	0.89 (0.57, 1.37)	-	0.87 (0.56, 1.34)
≥ 5.8	1.26 (0.83, 1.90)	1.09 (0.72, 1.67)	-	0.97 (0.63, 1.49)
History of Diabetes				
≤ 6.3	0.77 (0.24, 2.50)	0.64 (0.20, 2.10)	-	0.55 (0.17, 1.81)
6.4 - 7.6	7.42 (4.36, 12.63)	6.55 (3.79, 11.31)	-	4.72 (2.65, 8.41)
7.7 - 9.6	22.89 (14.52, 36.11)	18.77 (11.50, 30.61)	-	9.60 (5.19, 17.73)
≥ 9.7	42.29 (26.48, 67.54)	35.77 (21.78, 58.74)	-	11.84 (5.45, 25.70)
p-for-trend	< 0.001	< 0.001	-	< 0.001

***** Baseline study population limited to persons with valid retinal photographs.
Model 1: age (years), race-center, sex (male, female), body mass index (kg/m^2), $(\text{body mass index})^2$
Model 2: Variables in Model 1 + LDL-cholesterol (mg/dL), HDL-cholesterol (mg/dL), triglycerides (mg/dL), waist-to-hip ratio, systolic blood pressure (mmHg), blood pressure-lowering medication use (yes, no), family history of diabetes (yes, no), education, drinking status(current, former, never), smoking status (current, former, never), physical activity index.
Model 3: Variables in Model 2 + Hemoglobin A1c (%)
Model 4: Variables in Model 2 + fasting glucose (mg/dL)
Abbreviations: AUC, area under curve; CI, confidence interval; OR, odds ratio.

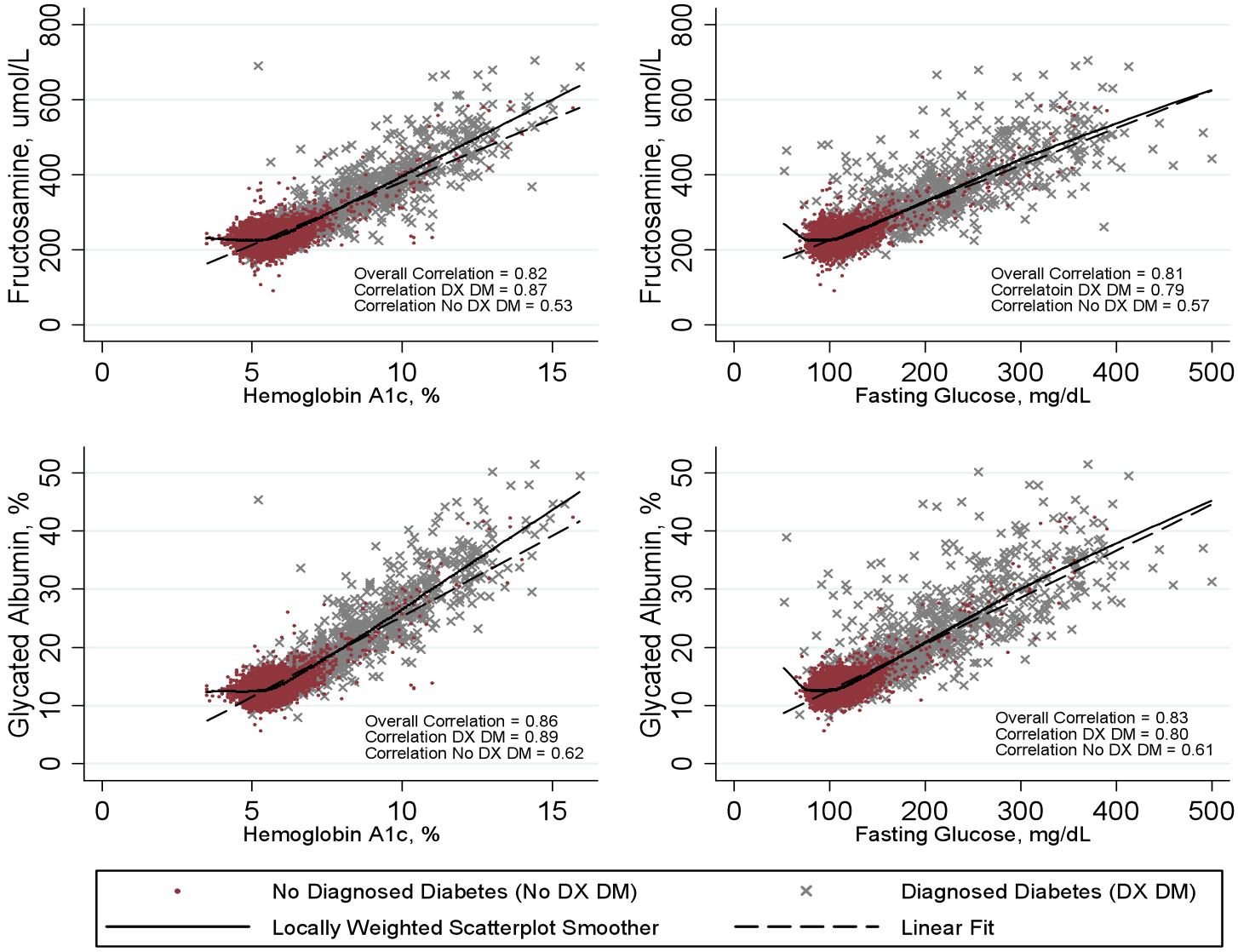
eTable 3. Adjusted Hazard Ratios (95% Confidence Intervals) of Baseline Quartiles of Fructosamine and Glycated Albumin with Incident Chronic Kidney Disease† and Incident Diabetes‡

Outcome	Model 1 HR (95% CI)	Model 2 HR (95% CI)	Model 3 HR (95% CI)	Model 4 HR (95% CI)
Incident Chronic Kidney Disease				
Fructosamine, umol/L				
No Diabetes				
≤ 214	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)
215 - 226	0.97 (0.82, 1.14)	1.03 (0.88, 1.22)	1.02 (0.86, 1.20)	1.03 (0.87, 1.22)
227 - 239	0.99 (0.84, 1.17)	1.11 (0.94, 1.31)	1.07 (0.91, 1.26)	1.10 (0.93, 1.30)
≥ 240	1.07 (0.91, 1.26)	1.15 (0.98, 1.36)	1.03 (0.87, 1.22)	1.13 (0.95, 1.34)
History of Diabetes				
≤ 252	1.75 (1.27, 2.40)	1.56 (1.13, 2.14)	1.42 (1.03, 1.95)	1.53 (1.11, 2.10)
253 - 301	2.61 (2.01, 3.40)	2.27 (1.74, 2.97)	1.76 (1.33, 2.33)	2.15 (1.62, 2.85)
302 - 385	3.14 (2.44, 4.05)	2.75 (2.12, 3.56)	1.61 (1.17, 2.21)	2.43 (1.75, 3.38)
≥ 386	6.04 (4.80, 7.60)	5.67 (4.47, 7.20)	2.17 (1.45, 3.25)	4.58 (2.98, 7.04)
p-for-trend	< 0.001	< 0.001	< 0.001	< 0.001
Glycated albumin, %				
No Diabetes				
≤ 11.8	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)
11.9 - 12.6	0.84 (0.71, 0.98)	0.92 (0.78, 1.08)	0.89 (0.76, 1.05)	0.91 (0.77, 1.07)
12.7 - 13.5	0.91 (0.77, 1.07)	1.09 (0.92, 1.28)	1.03 (0.88, 1.22)	1.07 (0.91, 1.27)
≥ 13.6	0.94 (0.80, 1.11)	1.11 (0.94, 1.31)	0.95 (0.80, 1.13)	1.07 (0.90, 1.27)
History of Diabetes				
≤ 14.5	1.61 (1.19, 2.19)	1.52 (1.12, 2.06)	1.36 (1.00, 1.85)	1.47 (1.08, 2.01)
14.6 - 18.5	2.46 (1.89, 3.20)	2.21 (1.69, 2.88)	1.66 (1.26, 2.20)	2.03 (1.53, 2.69)
18.6 - 25.4	3.05 (2.38, 3.91)	2.76 (2.14, 3.55)	1.50 (1.09, 2.05)	2.30 (1.66, 3.19)
≥ 25.5	5.21 (4.12, 6.58)	5.12 (4.02, 6.50)	1.76 (1.17, 2.66)	3.76 (2.45, 5.76)
p-for-trend	< 0.001	< 0.001	0.002	< 0.001
Hemoglobin A1c, %				
No Diabetes				
≤ 5.2	1.00 (reference)	1.00 (reference)	-	1.00 (reference)
5.3 - 5.4	1.13 (0.94, 1.35)	1.09 (0.91, 1.31)	-	1.09 (0.91, 1.31)
5.5 - 5.7	1.13 (0.95, 1.36)	1.06 (0.88, 1.27)	-	1.06 (0.88, 1.27)
≥ 5.8	1.61 (1.35, 1.92)	1.37 (1.14, 1.63)	-	1.36 (1.13, 1.63)
History of Diabetes				
≤ 6.3	2.37 (1.71, 3.30)	1.96 (1.40, 2.73)	-	1.94 (1.39, 2.72)
6.4 - 7.6	3.32 (2.49, 4.44)	2.62 (1.95, 3.51)	-	2.56 (1.88, 3.51)
7.7 - 9.6	4.17 (3.17, 5.50)	3.12 (2.35, 4.15)	-	3.00 (2.11, 4.27)
≥ 9.7	5.69 (4.38, 7.41)	4.46 (3.39, 5.86)	-	4.16 (2.65, 6.53)
p-for-trend	< 0.001	< 0.001	-	< 0.001
Incident Diagnosed Diabetes				
Fructosamine, umol/L				
≤ 214	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)
215 - 226	1.26 (1.13, 1.42)	1.33 (1.18, 1.49)	1.25 (1.11, 1.40)	1.26 (1.13, 1.42)
227 - 239	1.57 (1.40, 1.76)	1.74 (1.55, 1.95)	1.54 (1.38, 1.73)	1.58 (1.41, 1.77)
≥ 240	2.86 (2.57, 3.19)	3.24 (2.90, 3.63)	2.44 (2.18, 2.74)	2.34 (2.09, 2.63)
p-for-trend	< 0.001	< 0.001	< 0.001	< 0.001
Glycated albumin, %				
≤ 11.8	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)
11.9 - 12.6	1.25 (1.12, 1.40)	1.39 (1.24, 1.55)	1.32 (1.18, 1.47)	1.31 (1.17, 1.46)
12.7 - 13.5	1.48 (1.32, 1.66)	1.88 (1.67, 2.11)	1.66 (1.48, 1.87)	1.69 (1.51, 1.90)
≥ 13.6	2.73 (2.44, 3.05)	3.50 (3.13, 3.91)	2.51 (2.24, 2.82)	2.53 (2.25, 2.84)
p-for-trend	< 0.001	< 0.001	< 0.001	< 0.001
Hemoglobin A1c, %				
≤ 5.2	1.00 (reference)	1.00 (reference)	-	1.00 (reference)
5.3 - 5.4	1.46 (1.28, 1.66)	1.42 (1.24, 1.62)	-	1.38 (1.21, 1.57)
5.5 - 5.7	2.05 (1.81, 2.31)	1.97 (1.74, 2.23)	-	1.86 (1.64, 2.10)
≥ 5.8	6.26 (5.58, 7.03)	5.43 (4.83, 6.11)	-	4.36 (3.87, 4.92)
p-for-trend	< 0.001	< 0.001	-	< 0.001

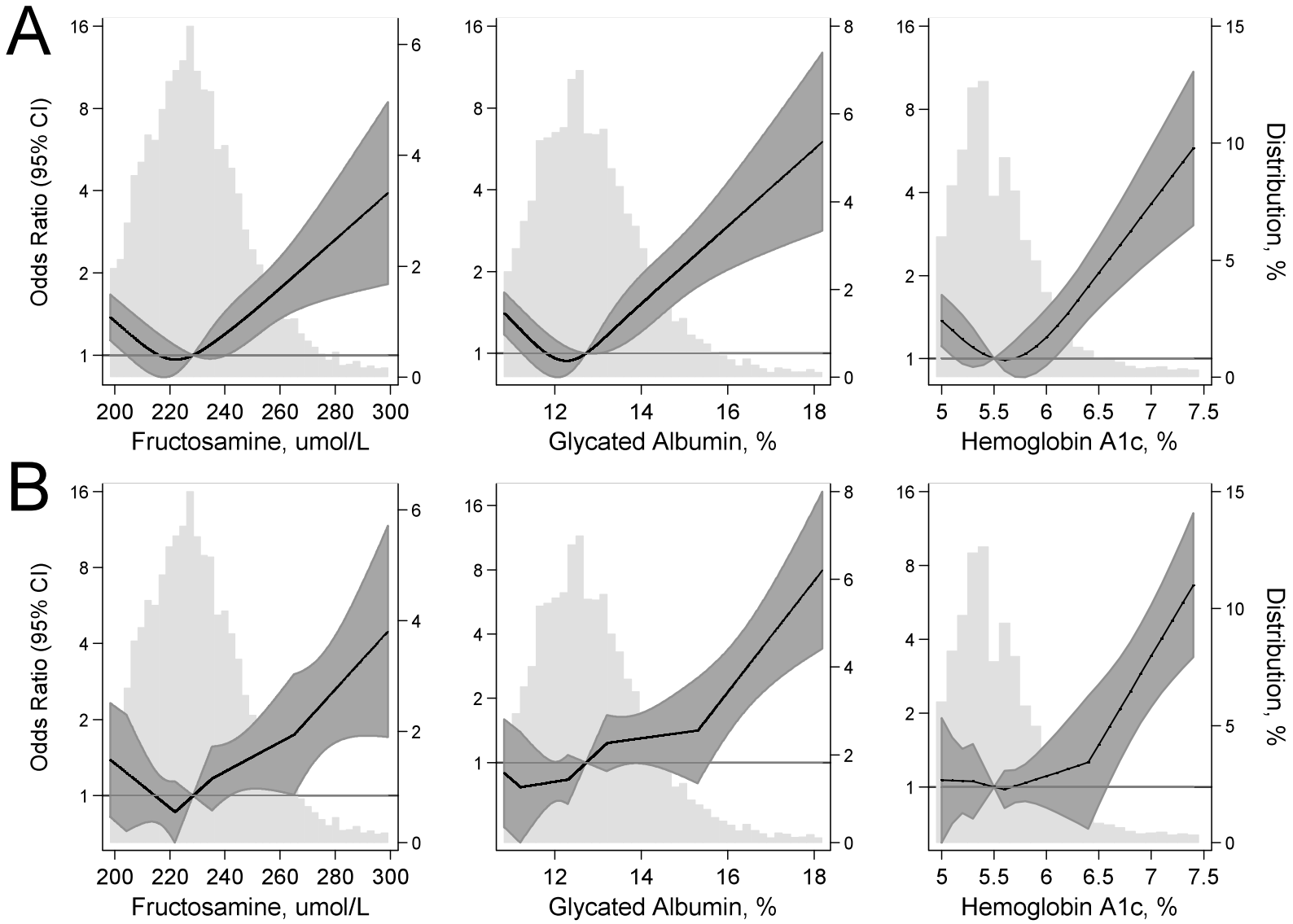
***** Fructosamine and glycated albumin were divided into categories defined by the <75th, 75-95th, >95th percentiles in persons without diabetes and by the <33rd, 33rd-67th, >67th percentiles in persons with a history of diabetes.

† Baseline study population was limited to persons with normal kidney function (estimated glomerular filtration rate ≥60 ml/min/1.73 m^2), N=11,932.
‡ Baseline study population was limited to persons without a history of diabetes, N=10,946.
Model 1: age (years), race-center, sex (male, female), body mass index (kg/m^2), (body mass index)^2
Model 2: Variables in Model 1 + LDL-cholesterol (mg/dL), HDL-cholesterol (mg/dL), triglycerides (mg/dL), waist-to-hip ratio, systolic blood pressure (mmHg), blood pressure-lowering medication use (yes, no), family history of diabetes (yes, no), education (less than high school, high school or equivalent, more than high school), drinking status (current, former, never), smoking status (current, former, never), physical activity index.
Model 3: Variables in Model 2 + Hemoglobin A1c (%)
Model 4: Variables in Model 2 + fasting glucose (mg/dL)
Abbreviations: CI, confidence interval; HR, hazard ratio.

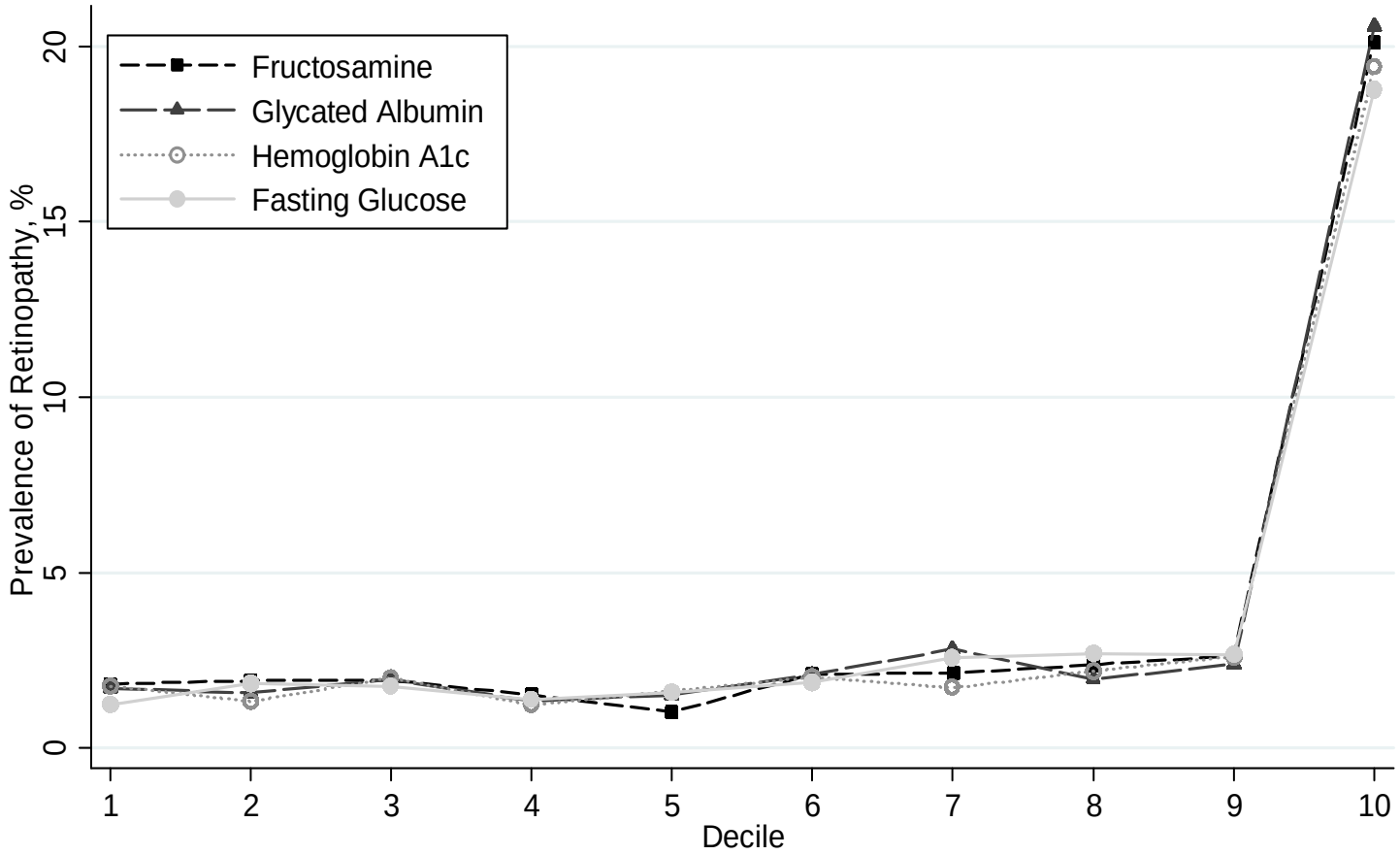
eFigure 2. Scatterplots of Fructosamine and Glycated Albumin with Hemoglobin A1c and Fasting Glucose According to Diagnosed Diabetes Status at Baseline



eFigure 3. Adjusted Hazard Ratios (95% Confidence Intervals) with Restricted Cubic (Panel A) and Linear Splines (Panel B) for the Associations of Fructosamine, Glycated Albumin, and Hemoglobin A1c with Retinopathy



eFigure 4. Prevalence of Retinopathy by Deciles of Fructosamine, Glycated Albumin, Hemoglobin A1c, and Fasting Glucose



Fructosamine, umol/L										
Mean	195.4	208.6	215.5	220.9	225.9	230.8	236.3	243.1	254.3	335.1
[Min, Max]	[89, 204]	[205, 212]	[213, 218]	[219, 223]	[224, 228]	[229, 233]	[234, 239]	[240, 247]	[248, 264]	[264, 706]
Glycated Albumin, %										
Mean	10.7	11.5	11.9	12.2	12.6	12.9	13.3	13.7	14.5	21.1
[Min, Max]	[5.6, 11.2]	[11.2, 11.7]	[11.7, 12.1]	[12.1, 12.4]	[12.4, 12.7]	[12.7, 13.1]	[13.1, 13.5]	[13.5, 14.1]	[14.1, 15.2]	[15.2, 51.5]
Hemoglobin A1c										
Mean	4.8	5.0	5.2	5.3	5.3	5.4	5.6	5.7	6.0	8.2
[Min, Max]	[3.5, 4.9]	[5.0, 5.0]	[5.1, 5.2]	[5.3, 5.3]	[5.3, 5.3]	[5.4, 5.5]	[5.6, 5.6]	[5.7, 5.8]	5.9, 6.3	[6.4, 15.9]
Fasting glucose, mg/dL										
Mean	86.6	92.1	95.0	98.0	100.5	103.4	106.9	111.6	121.2	193.5
[Min, Max]	[52, 90]	[91, 93]	[94, 96]	[97, 99]	[100, 101]	[102, 105]	[106, 108]	[109, 115]	116/129	[130, 500]

Summary of Results Comparing Different Definitions of Incident Diabetes

Although self-reported diabetes is highly specific and widely used in epidemiologic studies, its limited sensitivity creates the possibility for misclassification. During the first 6 years of follow-up (from Visit 2 to Visit 4) of ARIC Study participants, we have data on blood glucose, recorded medication bottles at each clinic visit, and self-reported history of a physician diagnosis of diabetes. During long-term (up to 20 years) of follow-up after visit 4 (1996-1998), we have access to self-reported data on diabetes from annual telephone calls to all participants. During these telephone calls participants were asked whether they had received a diagnosis of diabetes from a physician and whether they were currently taking medications for diabetes. In the main analyses presented in the paper, we identified incident cases of diabetes on the basis of a self-reported diabetes diagnosis or use of diabetes medications during the ARIC visits and subsequent annual telephone calls for a maximum of approximately 20 years of follow-up. We present here results (**eTable 4**) using two additional definitions of incident diabetes incorporating the glucose measurements at the two subsequent ARIC visits occurring after baseline:

1) Visit-based Diabetes Definition: cases were defined based on an elevated glucose concentration, physician diagnosis, or diabetes medication use identified at the two subsequent clinic visits (~6 years of total follow-up), N=9,691.
2) Combined Visit-based and Self-reported Diabetes Definition: cases were defined based on an elevated glucose concentration, self-reported physician diagnosis or diabetes medication use at the subsequent clinic visits and self-reported diagnosis or medication use during the annual telephone follow-up calls (~20 years of total follow-up), N=10,164.

The study population in both of these analyses was limited to persons with fasting glucose <126 mg/dL and no history of diabetes at baseline. In comparing our results using self-reported cases to the additional definitions of incident diabetes incorporating the glucose measurements at two subsequent ARIC visits, we find that our results are quite similar to the main analysis. Baseline categories of fructosamine and glycated albumin were strongly associated with subsequent risk of diabetes, even after multivariable adjustment (eTable 4, Model 2). These associations remained significant, even after further adjustment for HbA1c (Model 3) or fasting glucose (Model 4).

eTable 4. Adjusted Hazard Ratios (95% Confidence Intervals) of Baseline Categories (<75th, 75-95th, >95th percentiles) of Fructosamine and Glycated Albumin with Incident Diabetes, Comparing Diabetes Case Definitions*

Outcome	Model 1	Model 2	Model 3	Model 4
Visit-based diabetes (~6 years follow-up)				
Fructosamine categories, umol/L				
< 241	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
241 - 264	2.49 (2.08, 2.99)	2.71 (2.25, 3.26)	2.56 (2.12, 3.08)	1.92 (1.59, 2.32)
> 264	4.89 (3.55, 6.74)	4.28 (3.09, 5.92)	3.53 (2.54, 4.91)	2.76 (1.99, 3.83)
p-for-trend	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Glycated albumin categories, %				
< 13.6	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
13.6 - 15.2	2.43 (2.01, 2.93)	2.87 (2.37, 3.48)	2.23 (1.83, 2.71)	2.14 (1.76, 2.60)
> 15.2	4.83 (3.47, 6.71)	5.68 (4.07, 7.93)	4.16 (2.98, 5.81)	3.34 (2.38, 4.68)
p-for-trend	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Hemoglobin A1c categories, %				
< 5.7	1.00 (ref)	1.00 (ref)	-	1.00 (ref)
5.7 - 6.4	6.93 (5.82, 8.26)	6.20 (5.18, 7.41)	-	4.31 (3.59, 5.17)
> 6.4	34.96 (25.92, 47.16)	31.93 (23.52, 43.35)	-	16.25 (11.88, 22.22)
p-for-trend	< 0.0001	< 0.0001	-	< 0.0001
Combined visit-based and self-reported diabetes (~20 years of follow-up)				
Fructosamine categories, umol/L				
< 241	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
241 - 264	1.54 (1.39, 1.71)	1.71 (1.54, 1.90)	1.62 (1.46, 1.79)	1.41 (1.27, 1.57)
> 264	2.31 (1.87, 2.86)	2.23 (1.80, 2.77)	2.02 (1.63, 2.50)	1.76 (1.42, 2.18)
p-for-trend	< 0.0001	< 0.001	< 0.001	< 0.001
Glycated albumin categories, %				
< 13.6	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
13.6 - 15.2	1.40 (1.26, 1.55)	1.62 (1.45, 1.80)	1.40 (1.25, 1.56)	1.39 (1.24, 1.54)
> 15.2	2.20 (1.78, 2.72)	2.59 (2.09, 3.22)	2.21 (1.78, 2.74)	1.95 (1.57, 2.42)
p-for-trend	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Hemoglobin A1c categories, %				
< 5.7	1.00 (ref)	1.00 (ref)	-	1.00 (ref)
5.7 - 6.4	3.21 (2.92, 3.53)	2.86 (2.60, 3.15)	-	2.33 (2.11, 2.57)
> 6.4	12.21 (9.63, 15.49)	11.40 (8.96, 14.50)	-	7.70 (6.03, 9.82)
p-for-trend	< 0.0001	< 0.0001	-	< 0.0001

* Visit-based diabetes cases were defined based on an elevated glucose concentration, physician diagnosis, or diabetes medication use identified at the two subsequent clinic visits (~6 years of total follow-up), N=9,691. Combined visit-based and self-reported diabetes cases were defined based on an elevated glucose concentration, self-reported physician diagnosis or diabetes medication use at the subsequent clinic visits and self-reported diagnosis or medication use during the annual telephone follow-up calls (~20 years of total follow-up), N=10,164. The study population in both analyses was limited to persons with fasting glucose <126 mg/dL and no history of diabetes at baseline.

Model 1: age (years), race-center, sex (male, female), body mass index (kg/m^2), (body mass index)^2
Model 2: Variables in Model 1 + LDL-cholesterol (mg/dL), HDL-cholesterol (mg/dL), triglycerides (mg/dL), waist-to-hip ratio, systolic blood pressure (mmHg), blood pressure-lowering medication use (yes, no), family history of diabetes (yes, no), education (less than high school, high school or equivalent, more than high school), drinking status (current, former, never), smoking status (current, former, never), physical activity index.
Model 3: Variables in Model 2 + Hemoglobin A1c (%)
Model 4: Variables in Model 2 + fasting glucose (mg/dL)

eTable 5. Net-reclassification Index (NRI) and Integrated Discrimination Improvement (IDI) Statistics

	NRI						IDI	
Prevalent Retinopathy	**event**	**event p-value**	**non-event**	**non-event p-value**	**overall**	**overall p-value**	**IDI**	**p-value**
Model 1	(ref)							
Model 1 + HbA1c	0.0542	0.3232	0.6750	< 0.0001	0.7292	< 0.0001	0.1253	< 0.0001
Model 1 + FA	0.1687	0.0020	0.5979	< 0.0001	0.7666	< 0.0001	0.1283	< 0.0001
Model 1 + GA	0.1506	0.0060	0.6148	< 0.0001	0.7654	< 0.0001	0.1387	< 0.0001
Model 1 + HbA1c + FA	0.1084	0.0482	0.6515	< 0.0001	0.7599	< 0.0001	0.1345	< 0.0001
Model 1 + HbA1c + GA	0.1325	0.0157	0.6576	< 0.0001	0.7902	< 0.0001	0.1403	< 0.0001
Model 1 + HbA1c + FA + GA	0.1446	0.0084	0.6603	< 0.0001	0.8048	< 0.0001	0.1407	< 0.0001
Model 2	0.1145	0.0370	0.3699	< 0.0001	0.4844	< 0.0001	0.1151	< 0.0001
Model 2 + HbA1c	0.1807	0.0010	0.4443	< 0.0001	0.6250	< 0.0001	0.1289	< 0.0001
Model 2 + FA	0.1807	0.0010	0.4360	< 0.0001	0.6167	< 0.0001	0.1297	< 0.0001
Model 2 + GA	0.1566	0.0043	0.4228	< 0.0001	0.5794	< 0.0001	0.1183	< 0.0001
Model 2 + HbA1c + FA	0.1867	0.0007	0.4390	< 0.0001	0.6258	< 0.0001	0.1299	< 0.0001
Model 2 + HbA1c + GA	0.1386	0.0116	0.4101	< 0.0001	0.5486	< 0.0001	0.1236	< 0.0001
Model 2 + HbA1c + FA + GA	0.1145	0.0370	0.3699	< 0.0001	0.4844	< 0.0001	0.1151	< 0.0001

	NRI						IDI	
Incident Chronic Kidney Disease	**event**	**event p-value**	**non-event**	**non-event p-value**	**overall**	**overall p-value**	**IDI**	**p-value**
Model 1	(ref)							
Model 1 + HbA1c	-0.1116	0.0016	0.4060	< 0.0001	0.2945	< 0.0001	0.2756	< 0.0001
Model 1 + FA	-0.2534	< 0.0001	0.3820	< 0.0001	0.1286	< 0.0001	0.1564	< 0.0001
Model 1 + GA	-0.3183	< 0.0001	0.4382	< 0.0001	0.1199	0.0022	0.1630	< 0.0001
Model 1 + HbA1c + FA	-0.0955	0.0014	0.3807	< 0.0001	0.2852	< 0.0001	0.2880	< 0.0001
Model 1 + HbA1c + GA	-0.0420	0.2409	0.3667	< 0.0001	0.3247	< 0.0001	0.2890	< 0.0001
Model 1 + HbA1c + FA + GA	-0.0633	0.0576	0.3697	< 0.0001	0.3063	< 0.0001	0.3009	< 0.0001
Model 2	(ref)							
Model 2 + HbA1c	-0.1598	< 0.0001	0.2486	< 0.0001	0.0888	0.0030	0.1052	< 0.0001
Model 2 + FA	-0.2240	< 0.0001	0.2854	< 0.0001	0.0614	0.0911	0.0721	0.0008
Model 2 + GA	-0.3185	< 0.0001	0.2949	< 0.0001	-0.0236	0.4077	0.0767	0.0004
Model 2 + HbA1c + FA	-0.1541	< 0.0001	0.2506	< 0.0001	0.0965	< 0.0001	0.0030	< 0.0001
Model 2 + HbA1c + GA	-0.1529	< 0.0001	0.2581	< 0.0001	0.1052	< 0.0001	0.1074	< 0.0001
Model 2 + HbA1c + FA + GA	-0.1621	< 0.0001	0.2594	< 0.0001	0.0973	< 0.0001	0.1135	< 0.0001

	NRI						IDI	
Incident Diabetes	**event**	**event p-value**	**non-event**	**non-event p-value**	**overall**	**overall p-value**	**IDI**	**p-value**
Model 1	(ref)							
Model 1 + HbA1c	0.1038	0.0107	0.5449	< 0.0001	0.6486	< 0.0001	0.4624	< 0.0001
Model 1 + FA	-0.0083	0.8527	0.3977	< 0.0001	0.3894	< 0.0001	0.1521	< 0.0001
Model 1 + GA	-0.1064	0.0156	0.3677	< 0.0001	0.2612	0.0004	0.1313	< 0.0001
Model 1 + HbA1c + FA	0.0904	0.0091	0.5353	< 0.0001	0.6257	< 0.0001	0.4814	< 0.0001
Model 1 + HbA1c + GA	0.0817	0.0196	0.5374	< 0.0001	0.6192	< 0.0001	0.1521	< 0.0001
Model 1 + HbA1c + FA + GA	0.0849	0.0178	0.5378	< 0.0001	0.6227	< 0.0001	0.4768	< 0.0001
Model 2	(ref)							
Model 2 + HbA1c	0.0762	0.0374	0.4913	< 0.0001	0.5675	< 0.0001	0.2290	< 0.0001
Model 2 + FA	0.0274	0.5882	0.3650	< 0.0001	0.3924	< 0.0001	0.0829	< 0.0001
Model 2 + GA	-0.0766	0.1290	0.3282	< 0.0001	0.2516	0.0014	0.0956	< 0.0001
Model 2 + HbA1c + FA	0.1091	0.0011	0.4845	< 0.0001	0.5936	< 0.0001	0.2391	< 0.0001
Model 2 + HbA1c + GA	0.0809	0.0299	0.4569	< 0.0001	0.5377	< 0.0001	0.2350	< 0.0001
Model 2 + HbA1c + FA + GA	0.0906	0.0064	0.4704	< 0.0001	0.5609	< 0.0001	0.2371	< 0.0001

Model 1: age (years), race-center, sex (male, female), body mass index (kg/m^2), (body mass index)^2
Model 2: Variables in Model 1 + LDL-cholesterol (mg/dL), HDL-cholesterol (mg/dL), triglycerides (mg/dL), waist-to-hip ratio, systolic blood pressure (mmHg), blood pressure-lowering medication use (yes, no), family history of

diabetes (yes, no), education (less than high school, high school or equivalent, more than high school), drinking status (current, former, never), smoking status (current, former, never), physical activity index.