

ONLINE SUPPLEMENTARY MATERIALS

Title: Continuous glucose monitoring and use of alternative markers to assess glycemia in chronic kidney disease

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Supplemental Table 1: Baseline characteristics of analytic population by CKD stage (N = 104)

	eGFR < 30 mL/min/1.73m² (N = 22)	eGFR 30-44 mL/min/1.73m² (N = 30)	eGFR 45-59 mL/min/1.73m² (N = 28)	eGFR ≥ 60 mL/min/1.73m² (N = 24)
Age (years)	65.1 (11.7)	70.2 (8.0)	69.1 (9.1)	64.3 (10.3)
Male	15 (68)	17 (57)	20 (71)	15 (62)
Race				
White	15 (68)	24 (80)	21 (75)	20 (83)
Black	5 (23)	3 (10)	3 (11)	2 (8)
Other	2 (9)	3 (10)	4 (14)	2 (8)
Hispanic ethnicity	4 (18)	2 (7)	2 (7)	3 (12)
History of MI	2 (9)	8 (27)	3 (11)	1 (4)
History of CHF	5 (23)	8 (27)	5 (18)	1 (4)
History of stroke	1 (5)	5 (17)	5 (18)	1 (4)
Duration of diabetes (years)	17.0 (11.1)	23.2 (11.5)	18.6 (7.5)	15.9 (8.4)
BMI (kg/m ²)	33.9 (4.9)	33.0 (6.2)	34.2 (5.6)	32.4 (6.2)
Systolic blood pressure (mmHg)	139 (21)	132 (22)	127 (20)	136 (17)
Diastolic blood pressure (mmHg)	71 (14)	71 (14)	74 (12)	78 (12)
eGFR (CKD-EPI) (mL/min/1.73m ²)	19 (8)	38 (4)	52 (5)	83 (11)
Urine albumin-creatinine ratio (mg/g), median	988 (194-3456)	127 (39-434)	63 (9-196)	15 (8-37)
> 1000 mg/g	10 (46)	4 (13)	0 (0)	2 (8)
Hemoglobin (g/dL)	11.3 (1.9)	12.0 (1.3)	13.1 (1.4)	13.1 (2.0)
Serum albumin (g/dL)	3.4 (0.5)	3.7 (0.3)	3.8 (0.3)	3.7 (0.4)
Serum iron (µg/dL)	58 (15)	67 (29)	67 (21)	68 (23)
Transferrin saturation (%)	27 (9)	29 (14)	27 (9)	27 (11)
Mean CGM glucose (mg/dL)	181 (44)	160 (28)	173 (46)	158 (30)
GMI (%)	7.6 (1.0)	7.1 (0.7)	7.4 (1.1)	7.1 (0.7)
HbA1c (%)	7.8 (1.5)	7.5 (1.0)	7.9 (1.7)	7.7 (1.3)
Glycated albumin (%)	19.8 (6.3)	18.3 (4.4)	19.3 (4.7)	17.6 (3.6)
Fructosamine (µmol/L)	312 (74)	300 (53)	321 (59)	285 (49)

Entries are mean (SD) for continuous variables and N (%) for categorical variables.

Supplemental Table 2: Pearson correlation of mean CGM glucose and alternative markers of glycemia

	CGM mean blood glucose	HbA1c	Glycated albumin	Fructosamine	CV glucose	TIR	TBR
CGM mean blood glucose	1.00	0.75	0.77	0.71	-0.03	-0.90	-0.39
HbA1c		1.00	0.70	0.68	0.08	-0.67	-0.23
Glycated albumin			1.00	0.91	-0.03	-0.67	-0.22
Fructosamine				1.00	-0.10	-0.65	-0.26
CV% glucose					1.00	-0.02	0.53
TIR						1.00	0.35
TBR							1.00

Abbreviations: CGM, continuous glucose monitoring; CV%, coefficient of variation (%); TIR, time in range (70-180 mg/dL); TBR, time below range (<70 mg/dL). Correlations exclude one participant with an implausible HbA1c to mean CGM glucose relationship.

Supplemental Table 3: Measures of correlation, variability, and accuracy of glycemia markers for mean CGM glucose, by CKD stage

	eGFR < 30 (N = 22)			eGFR 30-44 (N = 30)			eGFR 45-59 (N = 28)			eGFR ≥ 60 (N = 24)		
	HbA1c	Glycated albumin	Fructosamine	HbA1c	Glycated albumin	Fructosamine	HbA1c	Glycated albumin	Fructosamine	HbA1c	Glycated albumin	Fructosamine
Metric												
Pearson r	0.61	0.77	0.6	0.91	0.7	0.76	0.85	0.86	0.83	0.76	0.72	0.63
Spearman r	0.61	0.72	0.57	0.77	0.57	0.65	0.84	0.75	0.72	0.65	0.79	0.68
Absolute residuals, median (IQR)	-0.1 (-0.5-0.4)	0.3 (-2.6-2.3)	-7.4 (-43.6-28.6)	0.0 (-0.3-0.3)	-0.2 (-2.1-1.1)	-7.5 (-21.9-7.3)	0.2 (-0.3-0.5)	0.2 (-1.6-1.2)	-6.3 (-21.0-14.6)	-0.3 (-0.4-0.4)	-0.2 (-1.5-1.0)	8.7 (-32.6-23.2)
P ₁₀ (%)	59	36	36	97	50	70	71	61	82	78	52	43
P ₂₀ (%)	82	73	68	100	77	93	89	89	93	100	91	83
P ₃₀ (%)	100	86	95	100	90	100	96	96	96	100	100	100

Correlations are the correlation of the biomarker with mean CGM glucose. Residuals come from a linear regression of the biomarker on the mean CGM glucose; units for residuals are percent for HbA1c and glycated albumin, and $\mu\text{mol/L}$ for fructosamine. P₁₀, P₂₀, and P₃₀ are the percentage of observed biomarkers that fall within 10%, 20%, and 30% of the predicted value of the biomarker from the linear regression, respectively. Analyses exclude one participant with an implausible HbA1c to mean CGM glucose relationship.

Supplemental Table 4: Covariate determinants of bias of HbA1c, by CKD stage

	eGFR < 30 (N = 22)		eGFR 30-44 (N = 30)		eGFR 45-59 (N = 28)		eGFR ≥ 60 (N = 23)	
	% Difference (95% CI)	p-value	% Difference (95% CI)	p-value	% Difference (95% CI)	p-value	% Difference (95% CI)	p-value
Age (per 10 year increment)	-4.7 (-7.1, -2.1)	0.0004	-1.1 (-3.7, 1.5)	0.41	0.1 (-4.5, 4.9)	0.98	-0.8 (-4.1, 2.6)	0.64
Male sex	-9.9 (-19.8, 1.1)	0.08	-2.0 (-6.2, 2.4)	0.37	0.5 (-7.5, 9.1)	0.91	1.9 (-4.5, 8.8)	0.57
Race/ethnicity								
Black	-3.6 (-21.3, 18.0)	0.72	-1.9 (-12.1, 9.5)	0.74	-5.9 (-18.2, 8.3)	0.40	-8.6 (-13.6, -3.3)	0.002
Other	-11.3 (-24.6, 4.3)	0.15	-3.0 (-7.1, 1.4)	0.18	4.7 (-6.6, 17.3)	0.44	-8.1 (-13.9, -2.0)	0.01
BMI (per 5 kg/m ² increment)	-0.4 (-7.5, 7.3)	0.92	-0.7 (-1.9, 0.4)	0.22	-2.5 (-6.0, 1.1)	0.18	0.8 (-1.2, 2.9)	0.41
eGFR (per 15 mL/min/1.73m ² decrement)	-6.8 (-16.4, 3.8)	0.20	3.2 (-5.7, 12.9)	0.49	-6.3 (-18.1, 7.1)	0.34	-3.2 (-6.8, 0.6)	0.10
Urine ACR (per doubling)	-0.8 (-2.3, 0.8)	0.33	-0.8 (-1.5, 0.0)	0.04	1.1 (-0.6, 2.9)	0.22	0.3 (-1.0, 1.7)	0.62
Urine ACR > 1000 mg/gCr	-8.1 (-17.6, 2.5)	0.13	-5.0 (-11.9, 2.5)	0.19	NA	NA	5.0 (-6.8, 18.4)	0.42
Hemoglobin (per g/dL increment)	2.0 (-1.4, 5.6)	0.25	0.3 (-1.1, 1.6)	0.70	0.8 (-1.5, 3.1)	0.50	0.5 (-1.4, 2.5)	0.58
Serum albumin (per 0.5 g/dL increment)	0.7 (-5.1, 6.9)	0.82	0.6 (-2.9, 4.2)	0.75	-0.8 (-7.6, 6.6)	0.83	-1.7 (-4.5, 1.2)	0.26
Serum iron (per 25 µg/dL increment)	-1.8 (-13.8, 11.9)	0.79	0.3 (-1.1, 1.7)	0.66	2.6 (-2.7, 8.2)	0.34	-1.1 (-3.9, 1.9)	0.47
Transferrin saturation (per 10% increment)	-0.7 (-8.9, 8.2)	0.87	0.2 (-1.0, 1.4)	0.78	-0.1 (-7.4, 7.9)	0.99	-0.8 (-3.0, 1.6)	0.52

Differences are the percent difference in the alternative marker of glycemia per difference in the listed covariate, derived from a regression of the alternative biomarker on mean CGM glucose, the listed covariate, CKD stage, and an interaction of the listed covariate with CKD stage. Analyses exclude one participant with an implausible HbA1c to mean CGM glucose relationship.

Supplemental Table 5: Covariate determinants of bias of glycated albumin, by CKD stage

	eGFR < 30 (N = 22)		eGFR 30-44 (N = 30)		eGFR 45-59 (N = 28)		eGFR ≥ 60 (N = 24)	
	% Difference (95% CI)	p-value	% Difference (95% CI)	p-value	% Difference (95% CI)	p-value	% Difference (95% CI)	p-value
Age (per 10 year increment)	4.5 (-2.7, 12.3)	0.23	6.8 (-1.8, 16)	0.12	4.7 (-3.2, 13.2)	0.26	6.7 (1.9, 11.8)	0.005
Male sex	-4.1 (-20.0, 14.9)	0.65	4.2 (-7.8, 17.8)	0.51	1.9 (-7.5, 12.1)	0.71	2.2 (-8.7, 14.3)	0.71
Race/ethnicity								
Black	7.2 (-18.3, 40.6)	0.62	-15.0 (-30.1, 3.4)	0.10	0.7 (-8.6, 10.9)	0.89	-18.6 (-24.7, -12.1)	< 0.0001
Other	1.9 (-10.3, 15.9)	0.77	-11.9 (-24.6, 2.9)	0.11	13.6 (3.8, 24.4)	0.006	3.6 (-2.2, 9.8)	0.23
BMI (per 5 kg/m ² increment)	-5.4 (-12.5, 2.3)	0.17	-2.9 (-8.5, 3.1)	0.34	-1.9 (-4.6, 1.0)	0.20	-6.9 (-9.6, -4.1)	< 0.0001
eGFR (per 15 mL/min/1.73m ² decrement)	8.2 (-9.1, 28.9)	0.38	-6.0 (-27.1, 21.2)	0.63	6.1 (-8.1, 22.4)	0.42	5.0 (-3.2, 13.9)	0.24
Urine ACR (per doubling)	-1.6 (-4.1, 0.9)	0.2	-1.9 (-3.9, 0.1)	0.07	-0.1 (-2.3, 2.1)	0.91	-0.8 (-2.2, 0.6)	0.28
Urine ACR > 1000 mg/gCr	-13.5 (-24.4, -1.0)	0.04	-16.7 (-27.2, -4.7)	0.008	NA	NA	-6.7 (-15.3, 2.7)	0.16
Hemoglobin (per g/dL increment)	-1.2 (-4.6, 2.4)	0.51	-3.8 (-7.5, 0.0)	0.049	-2.0 (-6.2, 2.3)	0.36	-1.0 (-3.9, 2.1)	0.54
Serum albumin (per 0.5 g/dL increment)	5.5 (-2.1, 13.7)	0.16	-0.1 (-8.2, 8.7)	0.98	4.7 (-4.8, 15.1)	0.34	4.5 (-1.2, 10.6)	0.12
Serum iron (per 25 µg/dL increment)	6.4 (-8.2, 23.4)	0.41	2.8 (-1.8, 7.7)	0.24	6.7 (-1.2, 15.2)	0.10	3.0 (-1.8, 8.0)	0.22
Transferrin saturation (per 10% increment)	4.9 (-5.2, 16.0)	0.36	2.8 (-1.0, 6.7)	0.15	6.3 (-0.7, 13.8)	0.08	2.1 (-2.4, 6.8)	0.37

Differences are the percent difference in the alternative marker of glycemia per difference in the listed covariate, derived from a regression of the alternative biomarker on mean CGM glucose, the listed covariate, CKD stage, and an interaction of the listed covariate with CKD stage.

Analyses exclude one participant with an implausible HbA1c to mean CGM glucose relationship.

Supplemental Table 6: Covariate determinants of bias of fructosamine, by CKD stage

	eGFR < 30 (N = 22)		eGFR 30-44 (N = 30)		eGFR 45-59 (N = 28)		eGFR ≥ 60 (N = 24)	
	% Difference (95% CI)	p-value	% Difference (95% CI)	p-value	% Difference (95% CI)	p-value	% Difference (95% CI)	p-value
Age (per 10 year increment)	5.1 (-0.6, 11.2)	0.08	3.3 (-1.4, 8.3)	0.17	2.9 (-3.3, 9.4)	0.37	6.2 (0.9, 11.8)	0.02
Male sex	5.7 (-9.5, 23.3)	0.48	2.6 (-5.4, 11.4)	0.53	4.7 (-1.4, 11.2)	0.13	7.2 (-3.8, 19.5)	0.21
Race/ethnicity								
Black	5.3 (-13.6, 28.4)	0.61	-8.7 (-19.1, 3.0)	0.14	0.3 (-9.3, 11.0)	0.95	-18.9 (-24.5, -12.8)	< 0.0001
Other	-17.7 (-24.7, -10.2)	< 0.0001	-6.7 (-15.0, 2.4)	0.14	9.1 (-1.4, 20.8)	0.09	7.9 (0.2, 16.1)	0.04
BMI (per 5 kg/m ² increment)	-4.5 (-11.1, 2.7)	0.21	-3.4 (-6.3, -0.4)	0.03	-2.2 (-4.7, 0.3)	0.09	-6.9 (-9.2, -4.6)	< 0.0001
eGFR (per 15 mL/min/1.73m ² decrement)	8.1 (-8.7, 28.0)	0.36	-1.2 (-16.3, 16.7)	0.89	6.9 (-3.7, 18.7)	0.21	5.0 (-3.1, 13.8)	0.23
Urine ACR (per doubling)	-2.1 (-4.7, 0.6)	0.12	-1.3 (-2.7, 0.2)	0.09	-1.0 (-2.6, 0.6)	0.22	-1.0 (-2.6, 0.6)	0.23
Urine ACR > 1000 mg/gCr	-17.0 (-27.1, -5.4)	0.005	-14.5 (-20.2, -8.3)	< 0.0001	NA	NA	-6.1 (-19.0, 8.8)	0.40
Hemoglobin (per g/dL increment)	-1.1 (-6.0, 4.1)	0.68	-0.6 (-3.7, 2.7)	0.73	-0.4 (-3.4, 2.6)	0.77	0.4 (-2.7, 3.6)	0.82
Serum albumin (per 0.5 g/dL increment)	10.6 (5.8, 15.6)	< 0.0001	3.1 (-1.9, 8.4)	0.23	9.3 (4.1, 14.8)	< 0.0001	10.3 (5.8, 15.1)	< 0.0001
Serum iron (per 25 µg/dL increment)	2.5 (-10.3, 17.1)	0.72	3.3 (1.1, 5.7)	0.004	5.9 (0.4, 11.6)	0.03	7.4 (2.4, 12.6)	0.003
Transferrin saturation (per 10% increment)	1.1 (-8.1, 11.3)	0.82	2.6 (0.7, 4.6)	0.009	3.6 (-2.1, 9.7)	0.22	4.8 (-0.3, 10.2)	0.07

Differences are the percent difference in the alternative marker of glycemia per difference in the listed covariate, derived from a regression of the alternative biomarker on mean CGM glucose, the listed covariate, CKD stage, and an interaction of the listed covariate with CKD stage.

Analyses exclude one participant with an implausible HbA1c to mean CGM glucose relationship.

Supplemental Table 7: Covariate determinants of bias in albumin-corrected fructosamine

	Albumin-corrected fructosamine	
	% Difference (95% CI)	p-value
Age (per 10 year increment)	3.8 (1.3, 6.4)	0.003
Male sex	-0.5 (-5.5, 4.8)	0.85
Race/ethnicity		
Black	1.5 (-9.7, 14.1)	0.80
Other	1.3 (-5.5, 8.7)	0.71
BMI (per 5 kg/m ² increment)	-2.7 (-4.9, -0.5)	0.02
eGFR (per 15 mL/min/1.73m ² decrement)	2.4 (0.9, 3.9)	0.002
eGFR < 30	6.3 (-0.7, 13.8)	0.08
Urine ACR (per doubling)	0.4 (-0.5, 1.4)	0.38
Urine ACR > 1000 mg/gCr	-3.1 (-10.1, 4.4)	0.40
Hemoglobin (per g/dL increment)	-2.5 (-3.9, -1.0)	0.001
Serum albumin (per 0.5 g/dL increment)	-3.7 (-6.3, -1.1)	0.006
Serum iron (per 25 µg/dL increment)	0.5 (-1.8, 2.9)	0.67
Transferrin saturation (per 10% increment)	1.8 (-0.4, 4.1)	0.11

Differences are the percent difference in albumin-corrected fructosamine per difference in the listed covariate, when additionally adjusting for mean CGM glucose. Analyses exclude one participant with an implausible HbA1c to mean CGM glucose relationship.

Supplemental Table 8: Measures of correlation, variability, and accuracy of glycemia markers for mean CGM glucose, restricted to most recent CGM (N = 102)

	Overall			eGFR < 60			eGFR ≥ 60		
	HbA1c	Glycated albumin	Fructosamine	HbA1c	Glycated albumin	Fructosamine	HbA1c	Glycated albumin	Fructosamine
Metric									
Pearson r	0.72	0.75	0.66	0.72	0.77	0.67	0.71	0.61	0.51
Spearman r	0.69	0.68	0.59	0.7	0.7	0.6	0.57	0.6	0.49
Absolute residuals, median (IQR)	-0.0 (-0.4-0.4)	-0.3 (-1.6-1.3)	-2.1 (-25.8-28.6)	-0.0 (-0.4-0.5)	-0.4 (-1.7-1.3)	-5.5 (-25.5-26.8)	-0.1 (-0.5-0.3)	0.0 (-2.3-1.4)	10.0 (-36.0-29.9)
P ₁₀ (%)	68	58	56	66	59	59	74	48	35
P ₂₀ (%)	92	78	77	90	81	77	100	78	78
P ₃₀ (%)	97	92	96	96	91	96	100	100	100

Correlations are the correlation of the biomarker with mean CGM glucose. Residuals come from a linear regression of the biomarker on the mean CGM glucose; units for residuals are percent for HbA1c and glycated albumin, and $\mu\text{mol/L}$ for fructosamine. P₁₀, P₂₀, and P₃₀ are the percentage of observed biomarkers that fall within 10%, 20%, and 30% of the predicted value of the biomarker from the linear regression, respectively. Analyses exclude one participant with an implausible HbA1c to mean CGM glucose relationship.

Supplemental Table 9: Covariate determinants of bias, restricted to the most recent CGM (N = 102)

	HbA1c		Glycated albumin		Fructosamine	
	% Difference (95% CI)	p-value	% Difference (95% CI)	p-value	% Difference (95% CI)	p-value
Age (per 10 year increment)	-2.3 (-4.3, -0.3)	0.03	5.1 (1.9, 8.5)	0.002	4.6 (1.9, 7.4)	0.0009
Male sex	-3.0 (-7.2, 1.4)	0.18	0.2 (-6.4, 7.2)	0.96	4.0 (-1.8, 10.1)	0.18
Race/ethnicity						
Black	-2.8 (-12.8, 8.3)	0.61	-1.3 (-13.9, 13.1)	0.85	0.2 (-9.3, 10.7)	0.97
Other	-1.1 (-8.6, 7.1)	0.79	4.9 (-2.3, 12.6)	0.19	1.6 (-8.1, 12.3)	0.76
BMI (per 5 kg/m ² increment)	-0.7 (-2.4, 1.1)	0.45	-3.9 (-6.5, -1.1)	0.007	-3.9 (-6.0, -1.7)	< 0.0001
eGFR (per 15 mL/min/1.73m ² decrement)	-1.1 (-2.5, 0.2)	0.10	0.5 (-1.5, 2.5)	0.65	0.7 (-1.3, 2.8)	0.49
eGFR < 30	-4.1 (-10.2, 2.4)	0.21	-3.1 (-11.5, 6.0)	0.49	-4.1 (-11.7, 4.2)	0.33
Urine ACR (per doubling)	-0.1 (-0.9, 0.6)	0.76	-0.7 (-1.8, 0.4)	0.24	-0.9 (-2.0, 0.2)	0.10
Urine ACR > 1000 mg/gCr	-5.2 (-11.3, 1.2)	0.11	-10.8 (-17.4, -3.6)	0.004	-12.8 (-19.8, -5.3)	0.001
Hemoglobin (per g/dL increment)	1.3 (-0.3, 2.9)	0.11	-1.1 (-3.0, 0.9)	0.27	-0.1 (-2.3, 2.2)	0.94
Serum albumin (per 0.5 g/dL increment)	1.2 (-1.8, 4.3)	0.43	4.9 (1.5, 8.5)	0.004	9.2 (6.8, 11.8)	< 0.0001
Serum iron (per 25 µg/dL increment)	0.4 (-1.9, 2.8)	0.71	3.9 (0.5, 7.5)	0.03	4.7 (2.0, 7.5)	0.0006
Transferrin saturation (per 10% increment)	-0.5 (-2.7, 1.7)	0.63	3.2 (0.2, 6.4)	0.04	2.8 (0.3, 5.3)	0.03

Differences are the percent difference in the alternative marker of glycemia per difference in the listed covariate, when additionally adjusting for mean CGM glucose. Analyses exclude one participant with an implausible HbA1c to mean CGM glucose relationship.

Supplemental Table 10: Measures of correlation, variability and accuracy of glycemia markers for mean CGM glucose, restricted to only those with biomarkers measured after 2nd CGM period (N = 92)

	Overall			eGFR < 60			eGFR ≥ 60		
	HbA1c	Glycated albumin	Fructosamine	HbA1c	Glycated albumin	Fructosamine	HbA1c	Glycated albumin	Fructosamine
Metric									
Pearson r	0.78	0.78	0.71	0.78	0.78	0.72	0.8	0.73	0.64
Spearman r	0.76	0.69	0.63	0.76	0.65	0.61	0.68	0.82	0.69
Absolute residuals, median (IQR)	-0.0 (-0.4-0.4)	-0.1 (-1.6-1.2)	-3.5 (-17.9-20.9)	0.0 (-0.4-0.5)	-0.2 (-1.8-1.1)	-7.3 (-18.4-18.8)	-0.2 (-0.4-0.4)	-0.2 (-1.4-0.7)	8.7 (-32.6-19.4)
P ₁₀ (%)	79	58	63	77	57	69	86	59	45
P ₂₀ (%)	92	80	82	90	79	83	100	86	86
P ₃₀ (%)	99	96	98	99	93	97	100	100	100

Correlations are the correlation of the biomarker with mean CGM glucose. Residuals come from a linear regression of the biomarker on the mean CGM glucose; units for residuals are percent for HbA1c and glycated albumin, and $\mu\text{mol/L}$ for fructosamine. P₁₀, P₂₀, and P₃₀ are the percentage of observed biomarkers that fall within 10%, 20%, and 30% of the predicted value of the biomarker from the linear regression, respectively. Analyses exclude one participant with an implausible HbA1c to mean CGM glucose relationship.

Supplemental Table 11: Covariate determinants of bias, restricted to only those with biomarkers measured after 2nd CGM period (N = 92)

	HbA1c		Glycated albumin		Fructosamine	
	% Difference (95% CI)	p-value	% Difference (95% CI)	p-value	% Difference (95% CI)	p-value
Age (per 10 year increment)	-2.1 (-3.8, -0.3)	0.02	5.7 (2.2, 9.3)	0.001	4.5 (1.4, 7.7)	0.004
Male sex	-1.6 (-5.6, 2.5)	0.44	1.9 (-4.8, 9.0)	0.59	4.7 (-0.8, 10.5)	0.10
Race/ethnicity						
Black	-3.9 (-14.1, 7.5)	0.48	0.4 (-12.3, 14.8)	0.96	0.5 (-9.8, 12.1)	0.92
Other	-4.2 (-10.3, 2.2)	0.19	0.2 (-7.4, 8.4)	0.95	-2.4 (-10.1, 5.9)	0.56
BMI (per 5 kg/m ² increment)	-0.7 (-2.5, 1.0)	0.42	-4.4 (-7.1, -1.7)	0.002	-4.1 (-6.2, -2.0)	0.0002
eGFR (per 15 mL/min/1.73m ² decrement)	-0.9 (-2.1, 0.5)	0.20	1.4 (-0.4, 3.2)	0.12	0.9 (-1.0, 2.8)	0.34
eGFR < 30	-3.1 (-8.7, 2.9)	0.31	-1.8 (-9.3, 6.4)	0.66	-4.1 (-11, 3.2)	0.26
Urine ACR (per doubling)	-0.2 (-0.8, 0.5)	0.59	-0.6 (-1.8, 0.6)	0.31	-1.1 (-2.0, -0.1)	0.04
Urine ACR > 1000 mg/gCr	-6.2 (-11.6, -0.4)	0.04	-13.2 (-19.8, -6)	0.0005	-15.9 (-20.9, -10.5)	< 0.0001
Hemoglobin (per g/dL increment)	0.8 (-0.7, 2.3)	0.28	-2.1 (-3.9, -0.2)	0.03	-0.1 (-2.1, 1.9)	0.88
Serum albumin (per 0.5 g/dL increment)	0.3 (-2.5, 3.2)	0.83	2.7 (-1.0, 6.5)	0.16	8.6 (6.0, 11.2)	< 0.0001
Serum iron (per 25 µg/dL increment)	-0.1 (-2.2, 2.1)	0.95	2.8 (-0.8, 6.5)	0.13	4.2 (1.3, 7.1)	0.004
Transferrin saturation (per 10% increment)	-0.7 (-2.9, 1.5)	0.53	3.0 (-0.2, 6.3)	0.07	2.3 (-0.1, 4.8)	0.06

Differences are the percent difference in the alternative marker of glycemia per difference in the listed covariate, when additionally adjusting for mean CGM glucose. Analyses exclude one participant with an implausible HbA1c to mean CGM glucose relationship.

Supplemental Table 12: Measures of correlation, variability, and accuracy of glycemia markers for mean CGM glucose, overall and by eGFR strata (including excluded participant)

	Overall			eGFR < 60			eGFR ≥ 60		
	HbA1c	Glycated albumin	Fructosamine	HbA1c	Glycated albumin	Fructosamine	HbA1c	Glycated albumin	Fructosamine
Metric									
Pearson r	0.75	0.77	0.71	0.78	0.78	0.71	0.59	0.69	0.63
Spearman r	0.74	0.69	0.63	0.75	0.66	0.63	0.67	0.79	0.7
Absolute residuals, median (IQR)	-0.0 (-0.4-0.5)	-0.1 (-1.7-1.4)	-4.7 (-19.5-21.9)	0.0 (-0.4-0.5)	0.0 (-1.8-1.3)	-7.1 (-20.7-19.2)	-0.5 (-0.6-0.4)	-0.6 (-1.6-1.2)	7.7 (-31.5-27.8)
P ₁₀ (%)	76	56	62	75	55	64	83	42	42
P ₂₀ (%)	91	80	83	90	79	84	96	83	83
P ₃₀ (%)	97	94	97	99	92	95	96	100	100

Correlations are the correlation of the biomarker with mean CGM glucose. Residuals come from a linear regression of the biomarker on the mean CGM glucose; units for residuals are percent for HbA1c and glycated albumin, and $\mu\text{mol/L}$ for fructosamine. P₁₀, P₂₀, and P₃₀ are the percentage of observed biomarkers that fall within 10%, 20%, and 30% of the predicted value of the biomarker from the linear regression, respectively.

Supplemental Table 13: Covariate determinants of bias (including excluded participant)

	HbA1c		Glycated albumin		Fructosamine	
	% Difference (95% CI)	p-value	% Difference (95% CI)	p-value	% Difference (95% CI)	p-value
Age (per 10 year increment)	-2.2 (-4.2, -0.1)	0.04	5.1 (1.6, 8.9)	0.005	4.7 (1.8, 7.7)	0.002
Male sex	-3.4 (-7.6, 1.0)	0.12	0.4 (-6.0, 7.3)	0.90	4.4 (-0.9, 10.0)	0.10
Race/ethnicity						
Black	-1.0 (-11.7, 10.9)	0.86	-1.1 (-13.4, 12.9)	0.87	-1.0 (-9.9, 8.7)	0.83
Other	-2.8 (-9.0, 3.7)	0.39	2.1 (-5.4, 10.2)	0.59	-0.5 (-8.6, 8.4)	0.91
BMI (per 5 kg/m ² increment)	-1.0 (-2.8, 0.8)	0.26	-4.1 (-6.8, -1.4)	0.003	-4.0 (-6.0, -2.0)	0.0001
eGFR (per 15 mL/min/1.73m ² decrement)	-1.4 (-2.7, 0.0)	0.047	0.5 (-1.4, 2.4)	0.64	0.7 (-1.2, 2.6)	0.46
eGFR < 30	-4.6 (-9.9, 1.1)	0.11	-2.8 (-10.7, 5.9)	0.52	-3.7 (-10.8, 3.9)	0.33
Urine ACR (per doubling)	-0.1 (-0.8, 0.6)	0.80	-0.6 (-1.7, 0.5)	0.26	-1.0 (-1.9, 0.0)	0.057
Urine ACR > 1000 mg/gCr	-6.0 (-11.1, -0.6)	0.03	-11.2 (-17.7, -4.2)	0.002	-13.3 (-19.7, -6.4)	0.0003
Hemoglobin (per g/dL increment)	0.4 (-1.3, 2.2)	0.63	-1.8 (-3.6, 0.0)	0.052	-0.5 (-2.4, 1.5)	0.64
Serum albumin (per 0.5 g/dL increment)	0.1 (-2.8, 3.0)	0.97	3.4 (-0.4, 7.5)	0.08	8.2 (5.6, 10.8)	< 0.0001
Serum iron (per 25 µg/dL increment)	0.3 (-1.8, 2.4)	0.79	3.8 (0.3, 7.5)	0.03	4.7 (2.1, 7.3)	0.0003
Transferrin saturation (per 10% increment)	-0.4 (-2.4, 1.6)	0.71	3.5 (0.5, 6.5)	0.02	3.0 (0.8, 5.3)	0.008

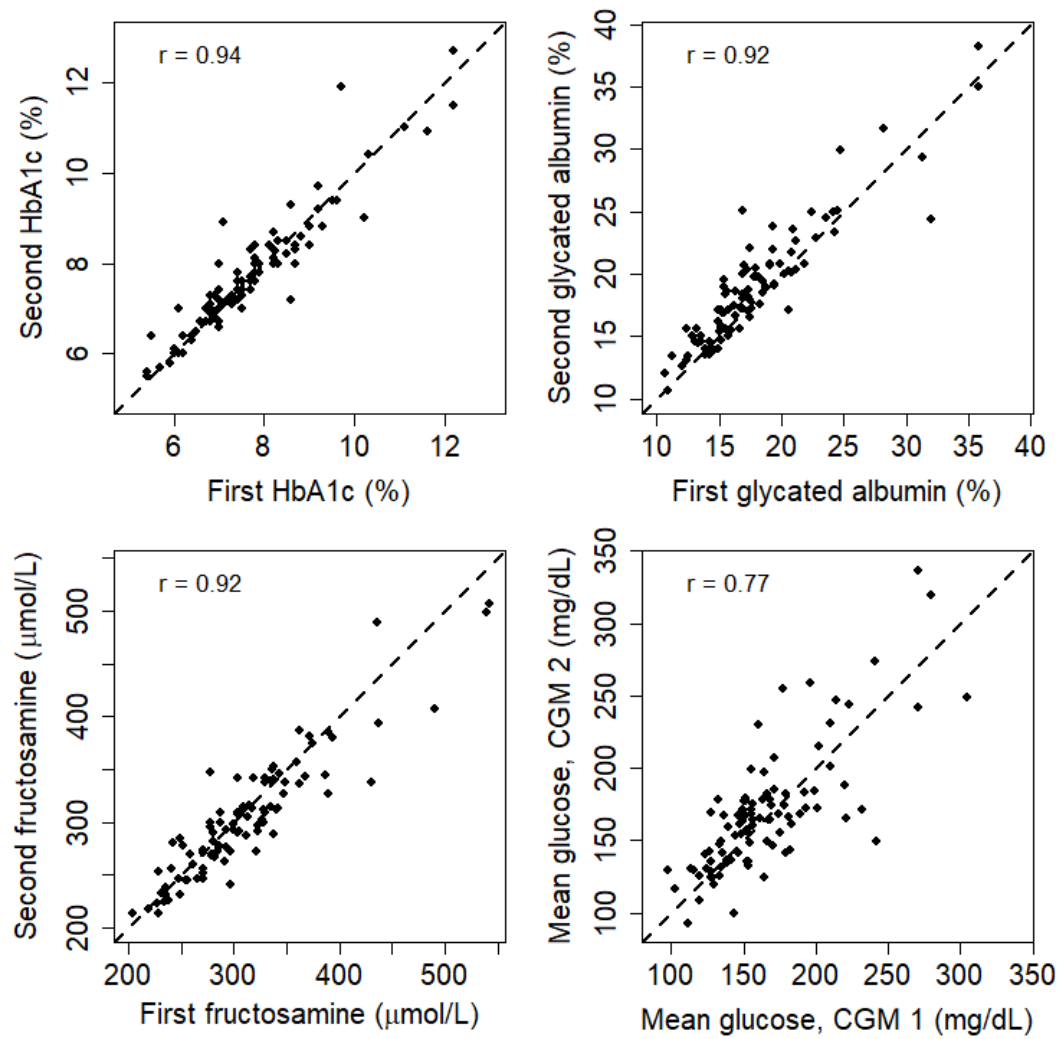
Differences are the percent difference in the alternative marker of glycemia per difference in the listed covariate, when additionally adjusting for mean CGM glucose

Supplemental Table 14: Covariate determinants of bias (N = 100, excluding highly influential participants)

	HbA1c		Glycated albumin		Fructosamine	
	% Difference (95% CI)	p-value	% Difference (95% CI)	p-value	% Difference (95% CI)	p-value
Age (per 10 year increment)	-1.3 (-3.0, 0.4)	0.14	5.8 (2.2, 9.4)	0.001	5.2 (2.3, 8.2)	0.0004
Male sex	-1.1 (-4.8, 2.7)	0.56	3.2 (-3.1, 9.9)	0.32	6.7 (1.6, 12.2)	0.01
Race/ethnicity						
Black	-4.7 (-13.0, 4.5)	0.30	-5.5 (-17.6, 8.3)	0.42	-2.1 (-11.5, 8.2)	0.68
Other	-2.8 (-9.0, 3.7)	0.39	2.7 (-4.8, 10.9)	0.49	-0.1 (-8.3, 8.8)	0.98
BMI (per 5 kg/m ² increment)	-0.2 (-1.8, 1.4)	0.79	-3.7 (-6.3, -1.0)	0.008	-3.7 (-5.6, -1.6)	0.0004
eGFR (per 15 mL/min/1.73m ² decrement)	-1.2 (-2.3, 0.0)	0.055	0.4 (-1.5, 2.2)	0.71	0.7 (-1.2, 2.6)	0.48
eGFR < 30	-3.9 (-9.0, 1.5)	0.15	-3.0 (-10.9, 5.6)	0.48	-3.6 (-10.8, 4.3)	0.36
Urine ACR (per doubling)	-0.2 (-0.8, 0.4)	0.55	-0.6 (-1.6, 0.5)	0.28	-0.9 (-1.9, 0.1)	0.08
Urine ACR > 1000 mg/gCr	-3.6 (-8.4, 1.3)	0.15	-10.0 (-16.9, -2.5)	0.01	-12.1 (-18.9, -4.8)	0.002
Hemoglobin (per g/dL increment)	1.4 (0.1, 2.7)	0.04	-1.4 (-3.2, 0.4)	0.14	-0.2 (-2.1, 1.9)	0.88
Serum albumin (per 0.5 g/dL increment)	0.2 (-2.6, 3.0)	0.90	3.5 (-0.3, 7.6)	0.07	8.1 (5.6, 10.7)	<0.0001
Serum iron (per 25 µg/dL increment)	0.4 (-1.6, 2.4)	0.71	3.8 (0.3, 7.4)	0.04	4.6 (2.1, 7.3)	0.0004
Transferrin saturation (per 10% increment)	-0.4 (-2.2, 1.4)	0.65	3.3 (0.3, 6.3)	0.03	3.0 (0.8, 5.2)	0.008

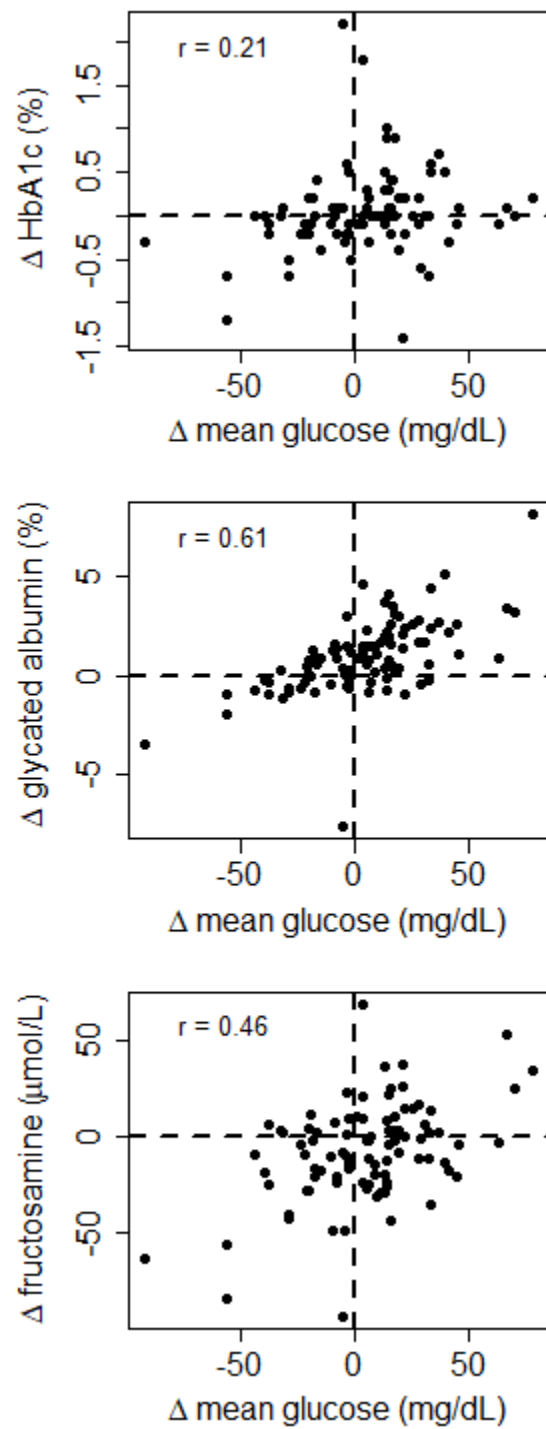
Results exclude 3 highly influential participants. Differences are the percent difference in the alternative marker of glycemia per difference in the listed covariate, when additionally adjusting for mean CGM glucose

Supplemental Figure 1: Plots of within-person repeatability of glycemia markers over approximately three weeks

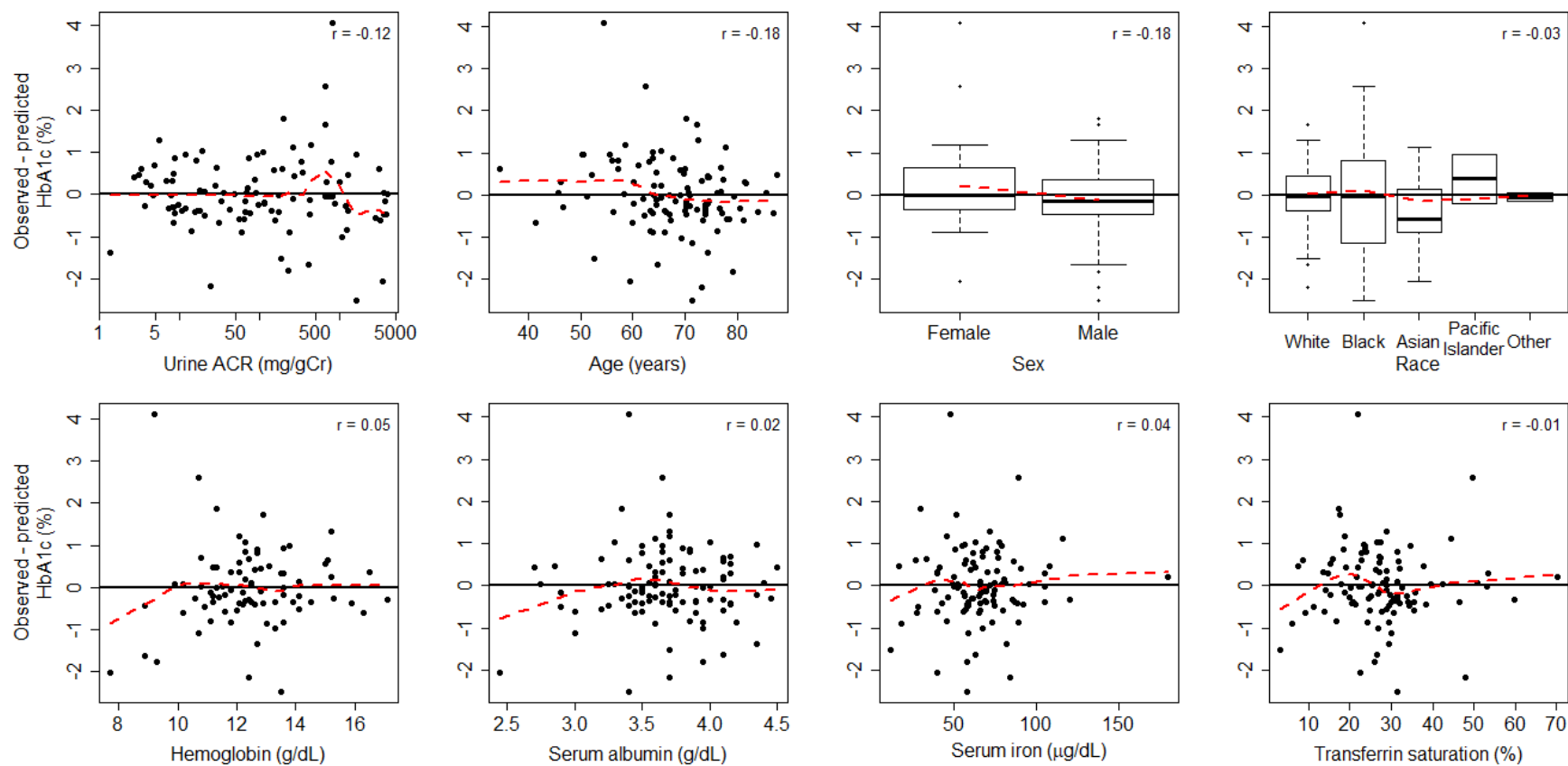


Dotted lines indicate the line of identity.

Supplemental Figure 2: Plots of change in glycemia markers and change in mean CGM blood glucose over approximately three weeks

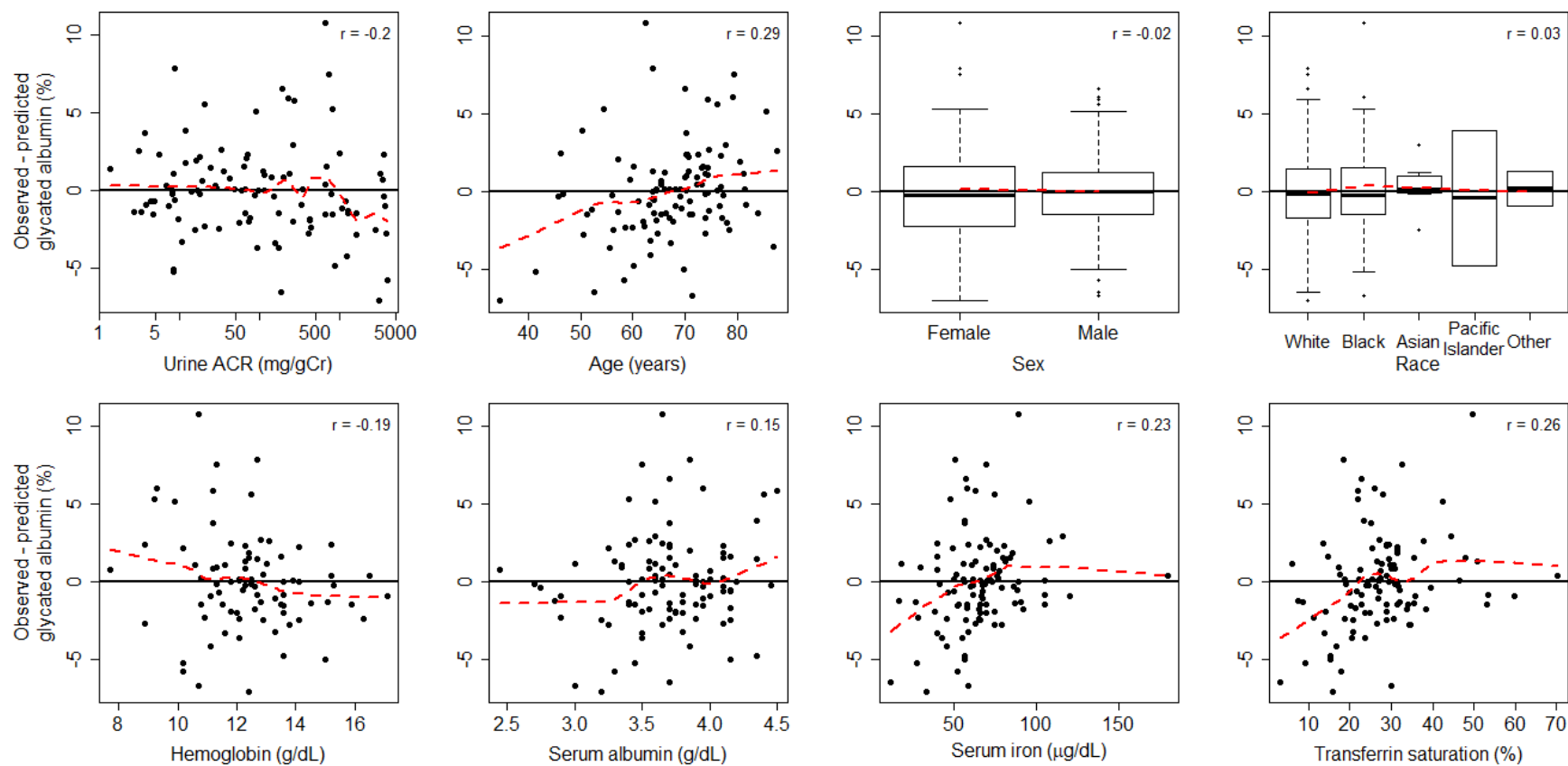


Supplemental Figure 3: Determinants of bias in HbA1c



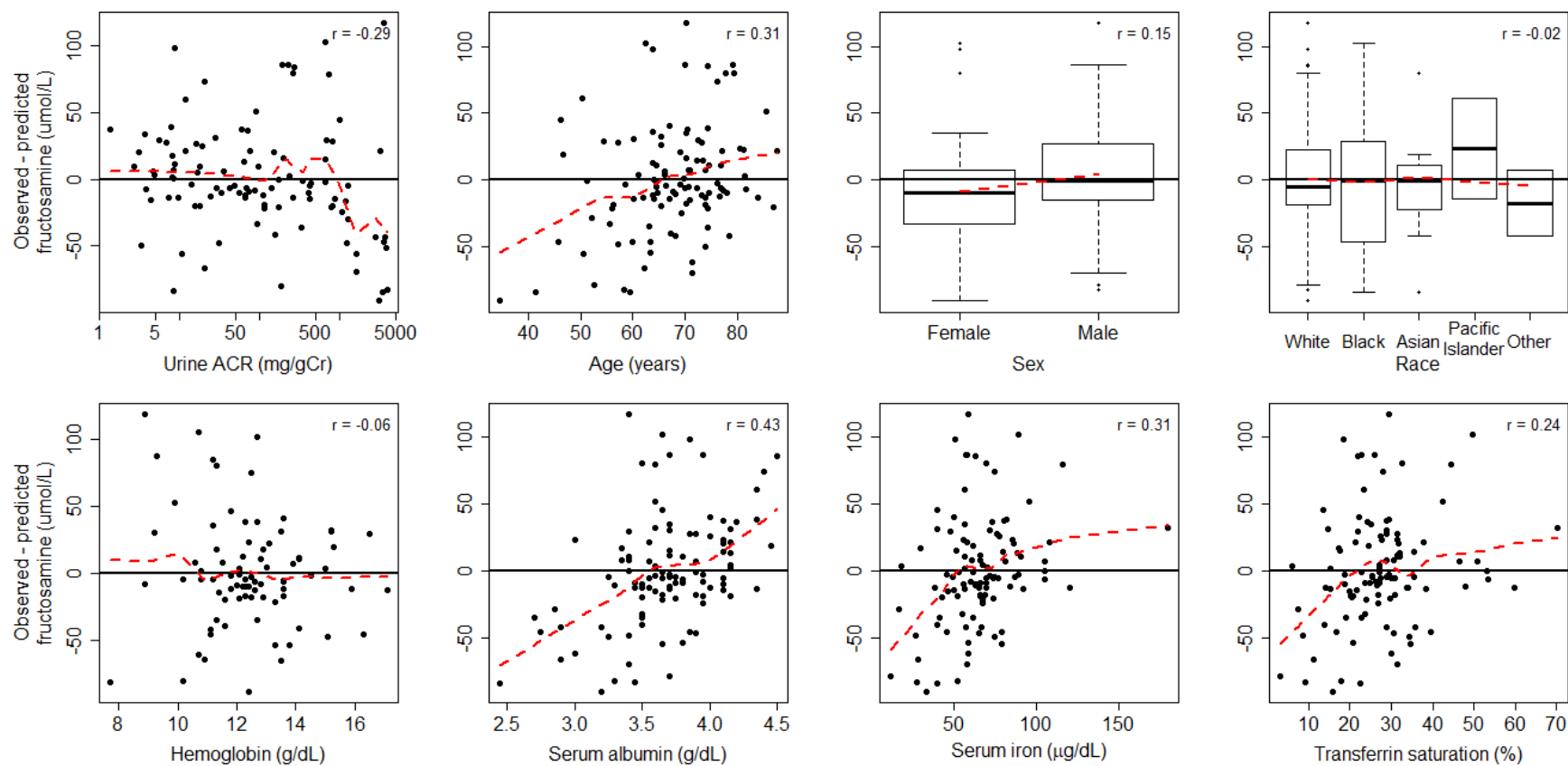
Predicted HbA1c values come from a linear regression of HbA1c on CGM mean glucose. Red dotted line signifies a Lowess curve.

Supplemental Figure 4: Determinants of bias in glycated albumin



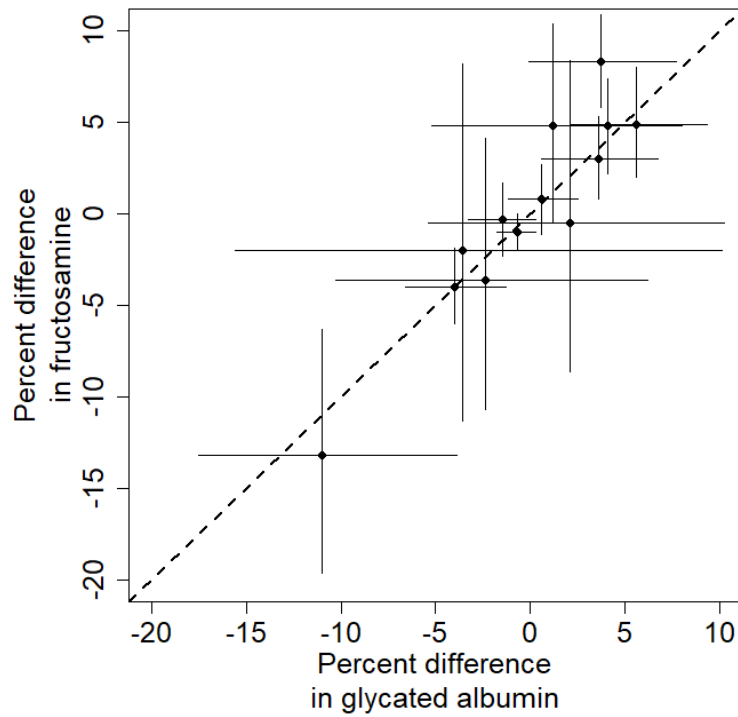
Predicted glycated albumin values come from a linear regression of glycated albumin on mean CGM glucose.

Supplemental Figure 5: Determinants of bias in fructosamine



Predicted fructosamine values come from a linear regression of fructosamine on mean CGM glucose.

Supplemental Figure 6: Covariate estimates of bias for glycated albumin and fructosamine



Plot shows parameter estimates and associated 95% confidence intervals for bias in glycated albumin and fructosamine shown in Table 4. Each point represents the percent difference in the biomarker per difference in the covariate shown in Table 4, holding mean CGM glucose fixed. Most point estimates are close to the line of identity (dotted line), and nearly all 95% confidence intervals cross the line of identity, supporting the idea that observed bias relative to mean CGM glucose is similar between the two analytes.