

SUPPLEMENTARY DATA

**Supplementary Table 1.** Characteristics of 12,533 NHANES III participants without diabetes by glycosylated hemoglobin category.

	HbA1c<4.0 (n=84)	HbA1c 4.0-4.5 (n=415)	HbA1c 4.5-5.0 (n=2,287)	HbA1c 5.0-5.5 (n=4,873)	HbA1c 5.5-6.0 (n=3,411)	HbA1c 6.0-6.5 (n=985)	HbA1c≥6.5 (n=478)
Demographics							
Age (years)	43.3 (3.1)	35.6 (1.5)	35.9 (0.5)	42.1 (0.5)	50.7 (0.8)	58.7 (1.3)	58.7 (1.2)
Females	55.3 (10.9)	62.5 (4.4)	62.8 (1.8)	49.4 (1.6)	46.0 (2.1)	52.5 (3.6)	41.6 (4.4)
Race							
Non-Hispanic white	60.0 (10.2)	74.7 (5.1)	83.2 (2.5)	79.8 (1.9)	72.5 (2.9)	61.5 (3.1)	55.5 (3.3)
Non-Hispanic black	27.1 (6.4)	15.5 (3.1)	6.5 (0.8)	7.3 (0.9)	12.6 (1.6)	21.4 (2.4)	22.6 (2.8)
Mexican-American	1.7 (1.0)	3.7 (1.1)	4.1 (0.8)	5.2 (0.7)	5.5 (0.7)	5.3 (1.3)	6.9 (1.7)
Lifestyle factors							
Education < high school	20.9 (8.6)	14.8 (3.7)	16.3 (2.2)	19.1 (1.5)	28.1 (2.6)	38.4 (3.2)	47.6 (3.2)
Family income < poverty level	9.5 (3.3)	15.9 (3.7)	11.4 (2.0)	11.0 (1.5)	12.7 (1.8)	16.9 (2.9)	19.5 (4.5)
Cigarette smoking status							
Current > 1 pack per day	0.0 (0.0)	3.4 (2.4)	3.9 (8.8)	6.8 (1.3)	8.6 (1.5)	12.0 (2.5)	6.8 (2.6)
Current ≤ 1 pack per day	25.5 (9.5)	9.9 (2.4)	18.5 (2.0)	18.6 (1.4)	20.2 (1.8)	18.5 (2.1)	16.8 (3.4)
Former	24.3 (9.8)	24.9 (5.0)	20.9 (1.6)	24.6 (1.2)	30.5 (1.9)	29.9 (3.2)	31.9 (5.3)
Never	50.2 (10.2)	61.7 (4.6)	56.7 (1.9)	50.0 (2.3)	40.7 (1.8)	39.7 (3.0)	44.5 (5.6)
Alcohol use status							
High current (≥5 drinks/day)	3.1 (2.0)	8.8 (2.1)	8.0 (0.9)	6.5 (0.7)	4.1 (0.6)	2.1 (0.5)	5.7 (1.7)
Moderate current (Women >1 to <5 drinks/day, Men >2 to <5 drinks/day)	4.9 (4.8)	5.3 (2.0)	3.4 (0.7)	3.4 (0.4)	2.5 (0.5)	1.8 (0.8)	1.1 (0.6)
Low current (Women ≤1 drink/day; Men ≤2 drinks/day)	39.4 (7.3)	51.2 (4.5)	50.1 (1.9)	45.8 (1.6)	38.1 (1.8)	28.5 (2.8)	31.9 (3.4)
Former high (≥5 drinks/day)	1.3 (0.9)	3.5 (1.4)	2.4 (0.5)	3.8 (0.5)	7.3 (0.2)	9.6 (1.7)	8.0 (2.2)
Former low/moderate (<5 drinks/day)	22.2 (6.4)	19.9 (3.5)	25.6 (1.6)	27.4 (1.2)	32.7 (0.8)	40.6 (2.4)	35.3 (3.5)
Never	29.1 (8.7)	11.3 (2.2)	10.4 (1.0)	13.1 (0.8)	15.3 (1.3)	17.3 (1.6)	18.0 (2.6)
Body mass index							

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< 18.5 kg/m <sup>2</sup>	2.3 (1.5)	0.6 (0.3)	3.0 (0.7)	2.8 (0.5)	1.4 (0.4)	1.1 (0.6)	0.0 (0.0)
18.5 – 24.9 kg/m <sup>2</sup>	41.1 (1.3)	54.0 (6.0)	49.7 (1.8)	44.2 (1.0)	32.9 (2.9)	28.5 (3.2)	13.3 (3.9)
25 – 29.9 kg/m <sup>2</sup>	29.0 (1.1)	34.4 (6.3)	28.8 (1.8)	34.2 (1.4)	37.7 (2.3)	36.9 (3.4)	26.9 (4.3)
≥ 30 kg/m <sup>2</sup>	27.7 (1.1)	10.9 (2.3)	18.5 (2.0)	18.7 (1.3)	28.0 (1.9)	33.5 (4.3)	59.7 (5.4)
Waist Hip Ratio	0.88 (0.02)	0.87 (0.01)	0.88 (0.01)	0.90 (0.01)	0.94 (0.01)	0.96 (0.01)	0.98 (0.01)
Sedentary	23.2 (8.5)	29.7 (6.1)	21.3 (2.3)	25.2 (1.7)	33.6 (1.7)	35.9 (2.5)	43.4 (4.0)
Liver related tests							
ALT (U/l)	26.6 (5.5)	20.4 (1.5)	18.0 (0.5)	19.6 (0.6)	18.6 (0.5)	19.2 (0.8)	26.4 (2.1)
AST (U/l)	40.9 (9.3)	22.9 (1.1)	20.5 (0.4)	21.9 (0.3)	21.7 (0.3)	22.0 (0.6)	25.5 (1.5)
AST/ALT Ratio	1.75 (0.10)	1.44 (0.03)	1.48 (0.05)	1.45 (0.03)	1.47 (0.03)	1.52 (0.04)	1.31 (0.05)
* GGT (U/L)	43.4 (14.0)	29.6 (3.4)	26.4 (1.6)	28.1 (1.3)	29.8 (1.0)	36.9 (2.2)	56.6 (5.5)
Hepatic steatosis	17.4 (0.07)	12.0 (0.02)	14.8 (0.01)	16.9 (0.01)	24.2 (0.01)	29.4 (0.03)	45.3 (0.04)
Alkaline phosphatase (U/l)	106.6 (23.2)	80.2 (2.6)	78.6 (0.7)	81.0 (0.8)	89.2 (1.0)	93.4 (2.0)	99.0 (3.7)
Total bilirubin (mg/dl)	1.37 (0.19)	0.71 (0.05)	0.67 (0.02)	0.62 (0.01)	0.58 (0.02)	0.53 (0.01)	0.60 (0.03)
Serum albumin (g/dL)	3.70 (0.19)	4.11 (0.06)	4.13 (0.2)	4.14 (0.02)	4.07 (0.03)	3.98 (0.02)	3.95 (0.03)
Platelet count	233.9 (18.4)	272.1 (2.5)	252.7 (4.7)	266.3 (2.5)	272.3 (3.1)	274.7 (3.8)	273.5 (4.3)
† Hepatitis B seropositivity	0.0 (0.0)	0.0 (0.0)	0.1 (0.1)	0.9 (0.4)	0.2 (0.1)	0.3 (0.2)	0.0 (0.0)
‡ Hepatitis C seropositivity	21.9 (10.5)	2.5 (1.3)	1.1 (0.3)	3.1 (0.7)	2.4 (0.5)	3.5 (1.2)	5.9 (3.0)
Health status factors							
History of cardiovascular disease	10.3 (9.5)	2.7 (1.6)	1.6 (0.5)	3.2 (0.6)	7.8 (1.0)	12.0 (2.0)	14.0 (2.9)
History of cancer (non-skin)	2.2 (2.0)	5.0 (2.7)	2.8 (0.5)	3.2 (0.7)	3.7 (0.6)	5.6 (1.4)	6.3 (1.2)
C-reactive protein (mg/dL)	0.46 (0.20)	0.33 (0.03)	0.35 (0.02)	0.38 (0.02)	0.45 (0.02)	0.60 (0.05)	0.65 (0.07)
Health status excellent / very good / good	89.0 (0.08)	92.3 (0.03)	96.2 (0.01)	95.1 (0.01)	90.7 (0.02)	84.1 (0.02)	75.8 (0.04)
Health status fair / poor	11.0 (0.08)	7.7 (0.03)	3.8 (0.01)	4.9 (0.01)	9.3 (0.02)	15.9 (0.02)	24.2 (0.04)

Values are means (SEs) or proportions (SEs).

\* Subpopulation of participants with GGT measured (n=10,841).

† Hepatitis B seropositivity is HBsAg positive or anti-core HBV positive.

‡ Hepatitis C seropositivity is HCV antibody positive.

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**Supplementary Table 2.** Adjusted Odds Ratios for Elevated Liver Enzymes and Hepatic Steatosis.

Elevated ALT (>40 U/L for men, >31 U/L for women) (n=816)			
	Model 1	Model 2	Model 3
HbA1c <4.0	2.71 (0.74, 9.93)	3.39 (1.04, 11.07)	3.62 (1.09, 12.02)
HbA1c 4.0-4.5	0.96 (0.48, 1.89)	1.13 (0.58, 2.21)	1.06 (0.54, 2.09)
HbA1c 4.5-5.0	0.99 (0.73, 1.33)	1.04 (0.77, 1.39)	1.00 (0.73, 1.35)
HbA1c 5.0-5.5	1.00 (reference)	1.00 (reference)	1.00 (reference)
HbA1c 5.5-6.0	1.08 (0.82, 1.42)	0.93 (0.68, 1.26)	0.95 (0.68, 1.32)
HbA1c 6.0-6.5	1.81 (1.04, 3.15)	1.49 (0.82, 2.70)	1.70 (0.93, 3.14)
HbA1c ≥6.5	4.19 (2.34, 7.47)	2.77 (1.60, 4.80)	3.13 (1.84, 5.30)
Elevated AST (>37 U/L for men, >31 U/L for women) (n=814)			
	Model 1	Model 2	Model 3
HbA1c <4.0	6.02 (2.32, 15.62)	6.57 (2.77, 15.61)	6.80 (2.99, 15.43)
HbA1c 4.0-4.5	1.57 (0.91, 2.70)	1.71 (0.98, 2.99)	1.63 (0.93, 2.85)
HbA1c 4.5- 5.0	1.03 (0.73, 1.46)	1.07 (0.75, 1.52)	1.05 (0.72, 1.54)
HbA1c 5.0-5.5	1.00 (reference)	1.00 (reference)	1.00 (reference)
HbA1c 5.5-6.0	1.07 (0.79, 1.44)	1.04 (0.77, 1.40)	1.11 (0.82, 1.49)
HbA1c 6.0-6.5	1.38 (0.83, 2.29)	1.33 (0.77, 2.32)	1.35 (0.78, 2.31)
HbA1c ≥6.5	1.96 (1.09, 3.51)	1.64 (0.94, 2.86)	1.78 (1.02, 3.12)
* Elevated GGT (>51 U/L for men, >33 U/L for women) (n=1,656)			
	Model 1	Model 2	Model 3
HbA1c <4.0	2.14 (0.64, 7.15)	2.61 (0.83, 8.20)	2.46 (0.76, 7.95)
HbA1c 4.0-4.5	1.47 (0.64, 3.36)	1.64 (0.71, 3.80)	1.51 (0.61, 3.71)
HbA1c 4.5- 5.0	0.98 (0.67, 1.44)	1.03 (0.70, 1.51)	1.00 (0.69, 1.44)
HbA1c 5.0-5.5	1.00 (reference)	1.00 (reference)	1.00 (reference)
HbA1c 5.5-6.0	1.03 (0.77, 1.38)	0.92 (0.66, 1.29)	0.96 (0.66, 1.41)
HbA1c 6.0-6.5	1.32 (0.92, 1.88)	1.12 (0.75, 1.69)	1.23 (0.85, 1.78)
HbA1c ≥6.5	2.60 (1.61, 4.20)	1.91 (1.08, 3.36)	2.32 (1.24, 4.35)
Presence of Hepatic Steatosis on Ultrasound (n=2,279)			
	Model 1	Model 2	Model 3
HbA1c <4.0	1.25 (0.51, 3.06)	1.66 (0.62, 4.46)	1.59 (0.56, 4.49)
HbA1c 4.0-4.5	0.86 (0.60, 1.22)	1.04 (0.69, 1.56)	0.93 (0.59, 1.47)
HbA1c 4.5- 5.0	1.01 (0.79, 1.29)	1.07 (0.82, 1.39)	1.03 (0.79, 1.33)
HbA1c 5.0-5.5	1.00 (reference)	1.00 (reference)	1.00 (reference)
HbA1c 5.5-6.0	1.31 (1.05, 1.63)	1.11 (0.90, 1.37)	1.08 (0.87, 1.35)
HbA1c 6.0-6.5	1.67 (1.14, 2.45)	1.19 (0.85, 1.67)	1.21 (0.86, 1.70)
HbA1c ≥6.5	2.99 (2.03, 4.41)	1.62 (1.11, 2.35)	1.49 (1.00, 2.23)

Data are OR (95% confidence interval).

Model 1: age, race/ethnicity, gender, education, and income.

Model 2: model 1+ smoking, body mass index, physical activity, self-reported hypertension, systolic blood pressure, and high-density-lipoprotein and total cholesterol.

Model 3: model 2 + alcohol consumption, history of (non-skin) cancer, history of cardiovascular disease, and physician rated health status.

\* Suppopulation of participants with GGT measured (n=10,629).

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**Supplementary Table 3.** Adjusted Odds Ratios for Elevated Liver Enzymes and Hepatic Steatosis Comparing HbA1c and Fasting Blood Glucose (n=8,747).

	HbA1c 1 <sup>st</sup> percentile	Fasting Glucose 1 <sup>st</sup> Percentile
	(Cut Point 4.0%)	(Cut Point 73.4 mg/dL)
Elevated ALT (>40 U/L for men, >31 U/L for women)	3.18 (1.00, 10.27)	2.16 (0.65, 7.20)
Elevated AST (>37 U/L for men, >31 U/L for women)	5.80 (2.55, 13.19)	0.95 (0.28, 3.21)
* Elevated GGT (>51 U/L for men, >33 U/L for women)	2.31 (0.74, 7.25)	0.87 (0.23, 3.30)
Presence of Hepatic Fat on Ultrasound	1.51 (0.53, 4.28)	0.92 (0.30, 2.82)

Data are OR (95% confidence interval).

Reference is  $\geq$  1<sup>st</sup> percentile for both HbA1c and Fasting Glucose.

Models adjusted for age, race/ethnicity, gender, and education.

\* Subpopulation of participants with GGT measured (n=6,927).