

Supplementary Information

Title: Hemoglobin to red blood cell distribution width ratio and mortality among US adults with diabetes or prediabetes: a nationwide population-based cohort study

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Table S1. Baseline Characteristics of Included and Excluded Population in the National Health and Nutrition Examination Survey, 2001-2018

Characteristic	Included (N = 18017)	Excluded (N = 4692)	P value
Age, mean (SD), y	56.8 (16.0)	58.7 (16.4)	<0.001
Sex			
Male	9588 (53.2)	2197 (46.8)	<0.001
Female	8427 (46.8)	2495 (53.2)	
Race/ethnicity^a			
Hispanic	4654 (25.8)	1361 (29.0)	<0.001
White	7618 (42.3)	1444 (30.8)	
Black	4129 (22.9)	1194 (25.4)	
Other	1616 (9.0)	693 (14.8)	
Education Level			
Below than high school	5278 (29.3)	1807 (38.9)	<0.001
High school / equivalent	4303 (23.9)	1024 (22.0)	
Great than high school	8436 (46.8)	1820 (39.1)	
Marital status			
Married	9971 (55.3)	2438 (52.1)	<0.001
Never married	2049 (11.4)	603 (12.9)	
Living with partner	1065 (5.9)	254 (5.4)	
Others ^c	4932 (27.4)	1382 (29.5)	
BMI, mean (SD), kg/m²	30.8 (7.2)	30.2 (6.9)	<0.001
Smoke status			
No	9084 (50.4)	2610 (55.9)	<0.001
Yes	8933 (49.6)	2059 (44.1)	
Alcohol consumption			
No	6296 (34.9)	982 (42.0)	<0.001
Yes	11721 (65.1)	1356 (58.0)	
Death events	3380 (18.8)	3268 (70.3)	<0.001
Follow-up years, mean (SD)	8.2 (4.7)	7.1 (4.6)	<0.001

^a Race and ethnicity were self-reported.

^b Included widowed, divorced or separated.

NHANES, National Health and Nutrition Examination Survey; BMI, Body Mass Index.

Table S2. Threshold Effect Analysis of HRR on All-Cause and Cardiovascular Mortality

Segmented cox proportional hazards model	Adjusted HR (95% CI)	<i>P</i> value
All-cause mortality		
Inflection point	1.00	NA
HRR < 1.00	0.08 (0.06-0.12)	<0.001
HRR ≥ 1.00	0.20 (0.13-0.29)	<0.001
<i>P</i> for Log-likelihood ratio	0.005	NA
Cardiovascular mortality		
Inflection point	1.08	NA
HRR < 1.08	0.09 (0.05-0.14)	<0.001
HRR ≥ 1.08	0.29 (0.12-0.72)	0.007
<i>P</i> for Log-likelihood ration	0.042	NA

HR, hazard ratio; CI, confidence interval.

HR was adjusted for the age, sex, race/ethnicity, education level, marital status, family PIR, BMI, smoking status, alcohol consumption, hypertension, CVD, stroke, and cancer.

Table S3. Hazard Ratios of All-Cause Mortality According to HRR After Excluding Accidental Death.^a

	No. of	Model I^b		Model II^c	
All-cause mortality	events	HR (95% CI)	P value	HR (95% CI)	P value
Continuous	3308	0.08 (0.06-0.10)	<0.001	0.10 (0.07-0.13)	<0.001
Tertiles					
HRR Low	1311	1 [Reference]		1 [Reference]	
HRR Medium	1061	0.57 (0.52-0.63)	<0.001	0.60 (0.54-0.66)	<0.001
HRR High	936	0.33 (0.30-0.37)	<0.001	0.44 (0.38-0.50)	<0.001
<i>P</i> for trend	NA	NA	<0.001	NA	<0.001

^a After excluding accidental deaths, there were 3308 all-cause deaths in 17945 participants.

^b Model I is the crude model.

^c Model II is the age, sex, race/ethnicity, education level, marital status, family PIR, BMI, smoking status, alcohol consumption, hypertension, CVD, stroke, and cancer.

HR, hazard ratio; NHANES, National Health and Nutrition Examination Survey; PIR, Poverty Income Ratio; BMI, Body Mass Index; CI, confidence interval.

Table S4. Hazard Ratios of All-Cause and Cardiovascular Mortality According to HRR After Excluding Death within 2 years follow-up.^a

	No. of	Model I^b		Model II^c	
Mortality cause	events	HR (95% CI)	P value	HR (95% CI)	P value
All-cause mortality					
Continuous HRR	2871	0.11 (0.08-0.14)	<0.001	0.13 (0.09-0.18)	<0.001
Tertiles					
HRR Low	1030	1.00 [Reference]	NA	1.00 [Reference]	NA
HRR Medium	965	0.64 (0.57-0.71)	<0.001	0.65 (0.58-0.72)	<0.001
HRR High	876	0.38 (0.34-0.42)	<0.001	0.47 (0.41-0.55)	<0.001
<i>P</i> for trend	NA	NA	<0.001	NA	<0.001
Cardiovascular mortality					
Continuous HRR	926	0.07 (0.05-0.10)	<0.001	0.09 (0.05-0.16)	<.001
Tertiles					
HRR Low	364	1.00 [Reference]	NA	1.00 [Reference]	NA
HRR Medium	285	0.47 (0.39-0.57)	<0.001	0.51 (0.42-0.62)	<0.001
HRR High	277	0.30 (0.25-0.36)	<0.001	0.41 (0.33-0.51)	<0.001
<i>P</i> for trend	NA	NA	<0.001	NA	<0.001

^a After excluding death within 2 years follow-up, there were 2871 all-cause deaths and 926 CVD deaths in 17508 participants.

^b Model I is the crude model.

^c Model II is the age, sex, race/ethnicity, education level, marital status, family PIR, BMI, smoking status, alcohol consumption, hypertension, CVD, stroke, and cancer.

HR, hazard ratio; NHANES, National Health and Nutrition Examination Survey; PIR, Poverty Income Ratio; BMI, Body Mass Index; CI, confidence interval.

Table S5. Hazard Ratios of All-Cause and Cardiovascular Mortality According to HRR After Excluding Participants with CVD, stroke, or cancer at baseline. ^a

	No. of	Model I ^b		Model II ^c	
Mortality cause	events	HR (95% CI)	<i>P</i> value	HR (95% CI)	<i>P</i> value
All-cause mortality					
Continuous HRR	1700	0.14 (0.10-0.19)	<0.001	0.11 (0.07-0.18)	<0.001
Tertiles					
HRR Low	560	1.00 [Reference]	NA	1.00 [Reference]	NA
HRR Medium	565	0.70 (0.61-0.81)	<0.001	0.64 (0.55-0.74)	<0.001
HRR High	575	0.44 (0.38-0.52)	<0.001	0.47 (0.39-0.58)	<0.001
<i>P</i> for trend	NA	NA	<0.001	NA	<0.001
Cardiovascular mortality					
Continuous HRR	498	0.10 (0.06-0.16)	<0.001	0.10 (0.05-0.21)	<.001
Tertiles					
HRR Low	177	1.00 [Reference]	NA	1.00 [Reference]	NA
HRR Medium	158	0.61 (0.46-0.79)	<0.001	0.58 (0.44-0.78)	<0.001
HRR High	163	0.35 (0.26-0.45)	<0.001	0.40 (0.29-0.57)	<0.001
<i>P</i> for trend	NA	NA	<0.001	NA	<0.001

^a After excluding participants with CVD, stroke, or cancer at baseline, there were 1700 all-cause deaths and 498 CVD deaths in 13445 participants.

^b Model I is the crude model.

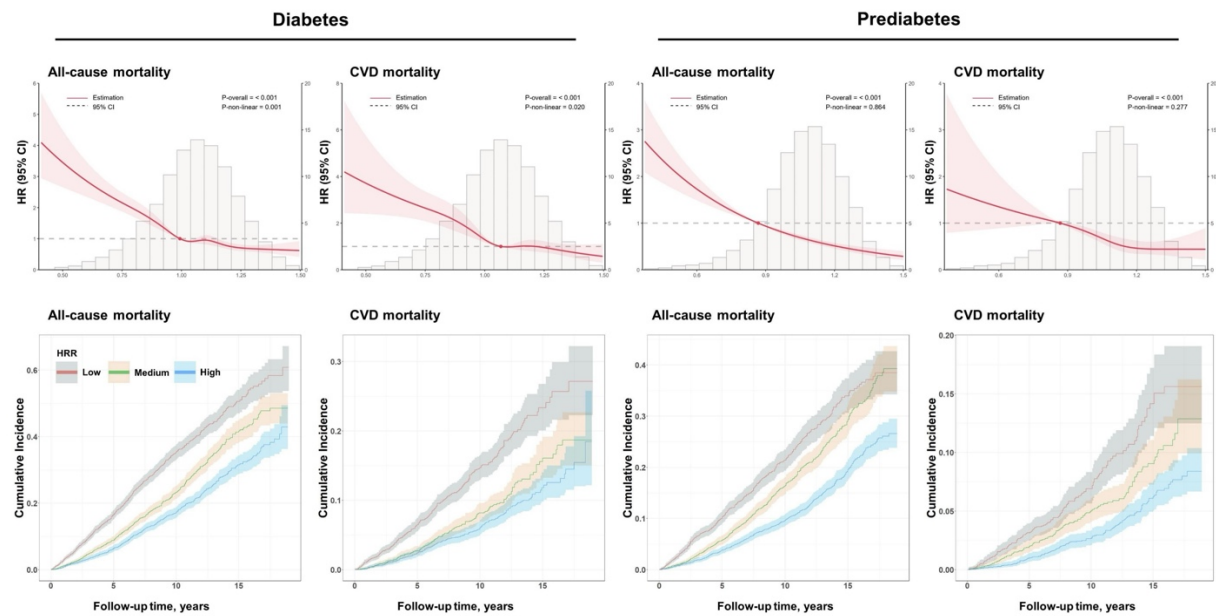
^c Model II is the age, sex, race/ethnicity, education level, marital status, family PIR, BMI, smoking status, alcohol consumption, and hypertension.

HR, hazard ratio; NHANES, National Health and Nutrition Examination Survey; PIR, Poverty Income Ratio; BMI, Body Mass Index; CI, confidence interval.

Table S6. E-values for the associations between HRR and mortality outcomes.

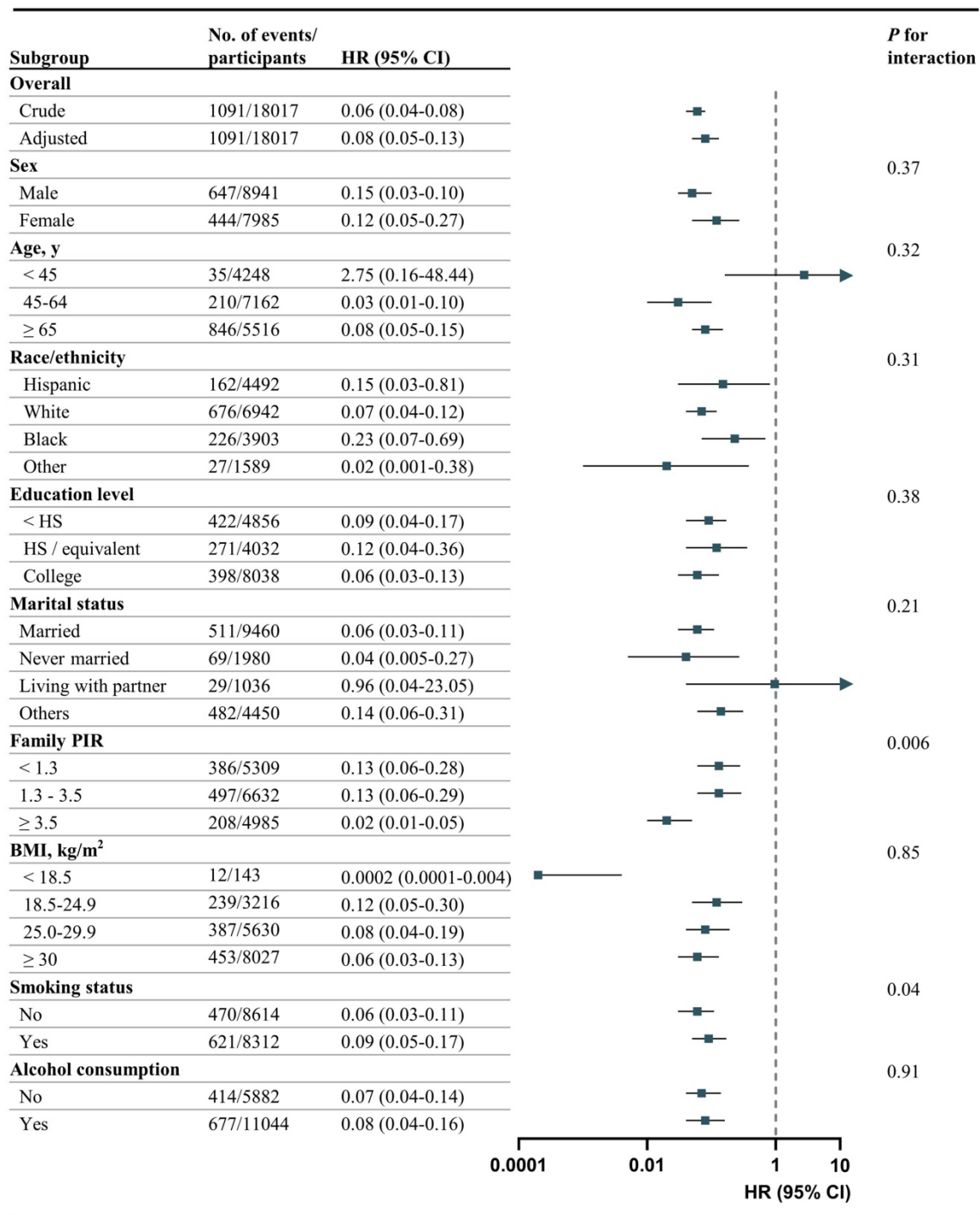
Outcome	Comparison	Adjusted HR (95% CI)	E-value for HR	E-value for CI
All-cause mortality	Medium vs low HRR	0.61 (0.55–0.67)	2.66	2.35
All-cause mortality	High vs low HRR	0.45 (0.39–0.51)	3.87	3.33
Cardiovascular mortality	Medium vs low HRR	0.51 (0.42–0.61)	3.33	2.66
Cardiovascular mortality	High vs low HRR	0.39 (0.32–0.47)	4.57	3.68

Figure S1. Association of HRR With All-Cause and Cardiovascular Mortality Among Individuals with Diabetes and Prediabetes



RCS, Restricted cubic spline; HR, hazard ratio; PIR, Poverty Income Ratio; BMI, Body Mass Index; HRR, Hemoglobin-to-Red Blood Cell Distribution Width Ratio.

Figure S2. Associations Between HRR Levels and Cardiovascular Mortality Among Subgroups



Each stratification was adjusted for age, sex, race/ethnicity, education level, marital status, family PIR, BMI, smoking status, alcohol consumption, hypertension, CVD, stroke, and cancer except the stratification factor itself. Rhombus indicate HRs with horizontal lines indicating 95% CIs.