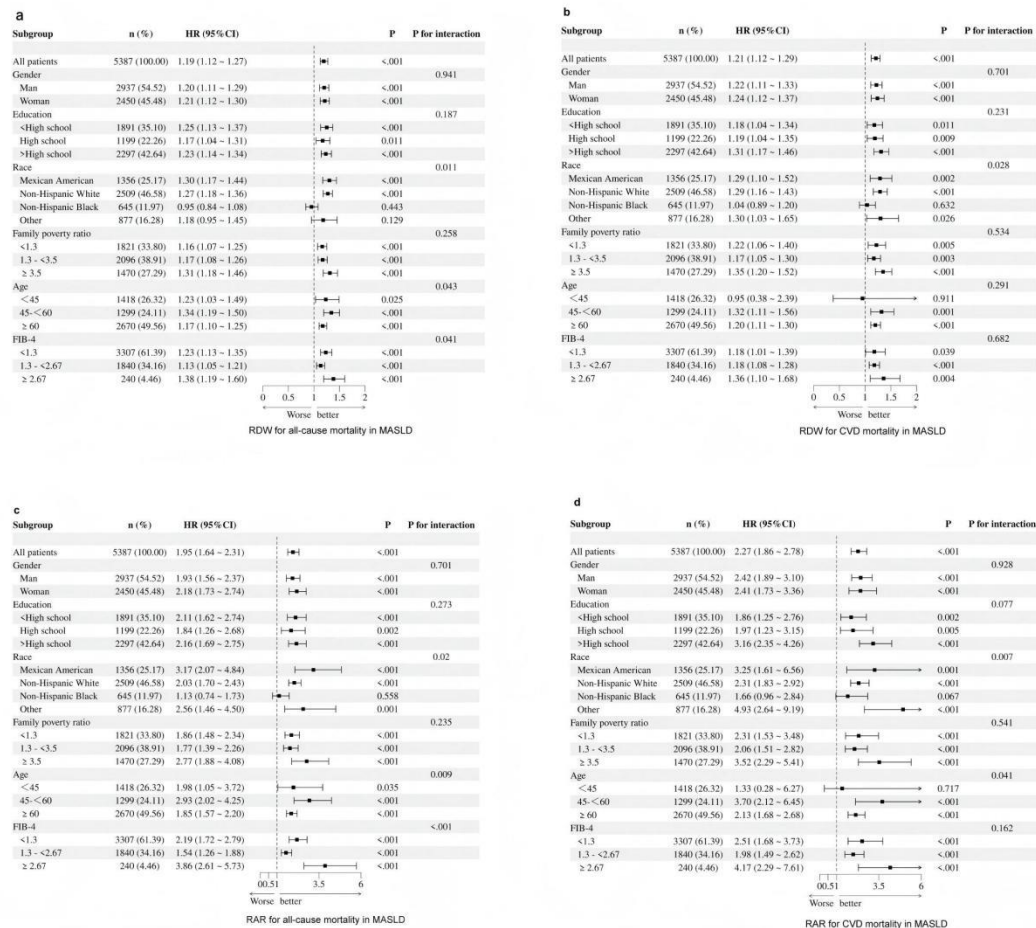
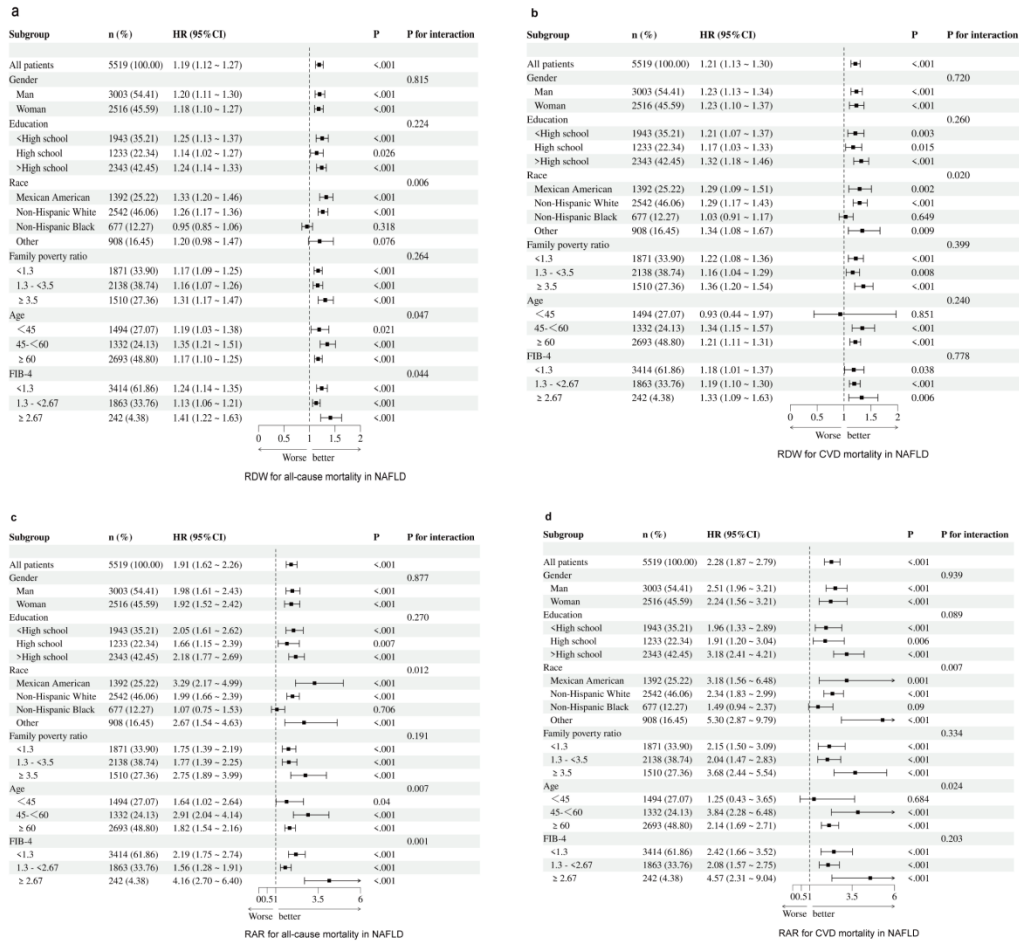


Supplementary Figures:
Supplementary Figure S1. Forest plots of stratified analyses of RDW / RAR with all-cause and CVD mortality among participants with MASLD



Note: a. RDW for all-cause mortality in MASLD; b. RDW for CVD mortality in MASLD; c. RAR for all-cause mortality in MASLD RAR and all-cause mortality; d. RAR for CVD mortality in MASLD. Adjusted for gender, age, race, marital status, education, smoke, physical activity, PIR, hypertension, diabetes, hyperlipidemia, cancer, and FIB-4. Abbreviations: CI, confidence intervals; HR, hazard ratios; CVD, cardiovascular disease; MASLD, metabolic dysfunction-associated steatotic liver disease; RDW, red blood cell distribution width; RAR, RDW-to-albumin ratio; FIB-4, fibrosis-4 index; PIR, poverty-income ratio.

Supplementary Figure S2. Forest plots of stratified analyses of RDW / RAR with all-cause and CVD mortality among participants with NAFLD.



Note: a. RDW for all-cause mortality in NAFLD; b. RDW for CVD mortality in NAFLD; c. RAR for all-cause mortality in NAFLD; d. RAR for CVD mortality in NAFLD. Models were adjusted for gender, age, race, marital status, education, smoke, physical activity, poverty-income ratio (PIR), hypertension, diabetes, hyperlipidemia, cancer, and fibrosis-4 (FIB-4) score. Abbreviations: CI, confidence intervals; HR, hazard ratios; CVD, cardiovascular disease; NAFLD, non-alcoholic fatty liver disease; RDW, red blood cell distribution width; RAR, RDW-to-albumin ratio; FIB-4, fibrosis-4 index; PIR, poverty-income ratio.

Supplementary Table S1. Missing data proportion before and after imputation in the MASLD and NAFLD cohorts

Variables	MASLD (N=5,387)		NAFLD (N=5,519)	
	Missing before imputation, n (%)	Missing after imputation, n (%)	Missing before imputation, n (%)	Missing after imputation, n (%)
RDW	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
FIB-4	9 (0.17)	0 (0.00)	10 (0.18)	0 (0.00)
ALB	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Gender	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Age	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Education	6 (0.11)	0 (0.00)	6 (0.11)	0 (0.00)
Smoke	183 (3.40)	0 (0.00)	192 (3.48)	0 (0.00)
Physical Activity	957 (17.76)	0 (0.00)	978 (17.72)	0 (0.00)
Energy intake	231 (4.29)	0 (0.00)	274 (4.96)	0 (0.00)
BIM	41 (0.76)	0 (0.00)	45 (0.82)	0 (0.00)
Race	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)

Variables	MASLD (N=5,387)		NAFLD (N=5,519)	
	Missing before imputation, n (%)	Missing after imputation, n (%)	Missing before imputation, n (%)	Missing after imputation, n (%)
Marital status	141 (2.62)	0 (0.00)	141 (2.55)	0 (0.00)
Sleep disorders	1868 (34.68)	—	1959 (35.50)	—
PIR	521 (9.67)	0 (0.00)	531 (9.62)	0 (0.00)
Hypertension	16 (0.30)	0 (0.00)	16 (0.29)	0 (0.00)
Diabetes	76 (1.41)	0 (0.00)	76 (1.38)	0 (0.00)
Hyperlipidemia	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Cancer	222 (4.12)	0 (0.00)	231 (4.19)	0 (0.00)
All-cause mortality	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
CVD mortality	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
survival time	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)

Note: “—” indicates that imputation was not performed for sleep disorders. MASLD, Metabolic Dysfunction-Associated Steatotic Liver Disease; NAFLD, Non-Alcoholic Fatty Liver Disease; RDW, Red Blood Cell Distribution Width; FIB-4, fibrosis-4 index; ALB, albumin; BMI, body mass index; PIR, family poverty ratio; CVD, cardiovascular disease.

Supplementary Table S2. Baseline characteristics of NAFLD patients stratified by quartile grouping of RDW

Variable	RDW(%)					Statistic	P
	Total	Q1	Q2	Q3	Q4		
Number of participants (%)	5519(100)	1137(20.60)	1452(26.31)	1332(24.13)	1598(28.95)		
Gender, n(%)						$\chi^2=80.08$	<0.001
Male	3003 (56.83)	664 (63.12)	857 (60.47)	717 (57.40)	765 (47.42)		
Female	2516 (43.17)	473 (36.88)	595 (39.53)	615 (42.60)	833 (52.58)		
Age, Mean (SE)	53.96 (0.31)	49.27 (0.54)	53.14 (0.55)	55.28 (0.64)	57.37 (0.50)	F=39.55	<0.001
Race, n(%)						$\chi^2=137.13$	<0.001
Mexican American	1392 (10.27)	389 (11.99)	394 (10.45)	312 (10.16)	297 (8.79)		
Non-Hispanic White	2542 (71.94)	547 (75.36)	718 (75.14)	617 (71.90)	660 (65.87)		
Non-Hispanic Black	677 (6.36)	66 (2.93)	132 (4.55)	139 (5.26)	340 (12.05)		
Other	908 (11.43)	135 (9.71)	208 (9.86)	264 (12.68)	301 (13.29)		
Marital status, n(%)						$\chi^2=30.53$	0.007
Married or living with a partner	3507 (68.56)	751 (71.12)	950 (70.44)	844 (68.02)	962 (65.03)		
Single	1296 (19.79)	206 (15.56)	321 (18.57)	335 (21.29)	434 (23.10)		
Never married	716 (11.65)	180 (13.32)	181 (10.99)	153 (10.69)	202 (11.88)		
Education, n(%)						$\chi^2=6.14$	0.707
Less than high school	1943 (22.42)	420 (22.90)	514 (22.43)	470 (22.23)	539 (22.20)		
high school or equivalent	1233 (24.65)	252 (22.62)	326 (25.41)	285 (23.76)	370 (26.31)		
college or above	2343 (52.93)	465 (54.48)	612 (52.16)	577 (54.01)	689 (51.49)		
Physical Activity, n(%)						$\chi^2=64.31$	<0.001
Low physical activity	2529 (42.31)	435 (35.29)	630 (41.29)	608 (40.90)	856 (50.37)		
High physical activity	2990 (57.69)	702 (64.71)	822 (58.71)	724 (59.10)	742 (49.63)		
Smoke, n(%)						$\chi^2=3.31$	0.941
Never	3025 (54.12)	634 (52.96)	779 (55.57)	745 (53.81)	867 (53.84)		
Former	1740 (32.31)	355 (32.60)	474 (31.26)	407 (33.30)	504 (32.25)		
Now	754 (13.57)	148 (14.44)	199 (13.18)	180 (12.89)	227 (13.91)		
Energy intake, Mean (SE)	2096.20 (16.48)	2223.45 (37.50)	2145.73 (29.84)	2055.38 (34.97)	1979.16 (32.65)	F=10.84	<0.001

Variable	RDW(%)					Statistic	P
	Total	Q1	Q2	Q3	Q4		
BMI, Mean (SE)	33.91 (0.15)	31.94 (0.24)	33.39 (0.24)	34.09 (0.24)	35.88 (0.27)	F=44.43	<0.001
PIR, n(%)						$\chi^2=29.11$	0.009
<1.3	1871 (22.70)	359 (20.82)	476 (20.62)	451 (22.13)	585 (26.96)		
1.3 - <3.5	2138 (37.81)	436 (37.23)	552 (37.57)	520 (38.05)	630 (38.31)		
≥3.5	1510 (39.48)	342 (41.95)	424 (41.81)	361 (39.82)	383 (34.73)		
FIB-4, Mean (SE)	1.18 (0.01)	1.02 (0.02)	1.13 (0.02)	1.23 (0.03)	1.31 (0.03)	F=27.31	<0.001
Hypertension, n(%)						$\chi^2=61.72$	<0.001
No	2237 (41.80)	539 (46.48)	659 (47.13)	516 (39.29)	523 (34.76)		
Yes	3282 (58.20)	598 (53.52)	793 (52.87)	816 (60.71)	1075 (65.24)		
Diabetes, n(%)						$\chi^2=130.32$	<0.001
No	3351 (66.75)	790 (74.23)	960 (73.67)	775 (62.33)	826 (57.55)		
Yes	2168 (33.25)	347 (25.77)	492 (26.33)	557 (37.67)	772 (42.45)		
Hyperlipidemia, n(%)						$\chi^2=5.49$	0.425
No	660 (11.11)	118 (9.46)	167 (10.87)	167 (12.23)	208 (11.65)		
Yes	4859 (88.89)	1019 (90.54)	1285 (89.13)	1165 (87.77)	1390 (88.35)		
Cancer, n(%)						$\chi^2=84.82$	<0.001
No	4837 (87.10)	1045 (91.61)	1280 (88.46)	1175 (88.80)	1337 (80.44)		
Yes	682 (12.90)	92 (8.39)	172 (11.54)	157 (11.20)	261 (19.56)		
All cause mortality, n(%)						$\chi^2=15.24$	0.017
No	4339 (82.92)	931 (84.92)	1116 (82.55)	1067 (84.72)	1225 (80.02)		
Yes	1180 (17.08)	206 (15.08)	336 (17.45)	265 (15.28)	373 (19.98)		
CVD mortality, n(%)						$\chi^2=16.67$	0.006
No	5124 (94.39)	1069 (94.89)	1359 (95.38)	1241 (95.08)	1455 (92.29)		
Yes	395 (5.61)	68 (5.11)	93 (4.62)	91 (4.92)	143 (7.71)		

Note: Values are presented as mean (SE) for continuous variables and n (%) for categorical variables. Q1: RDW ≤12.40%, Q2: 12.40%<RDW≤13.00%, Q3: 13.00%<RDW≤13.70%, Q4: RDW>13.70%. Abbreviations: BMI, body mass index; FIB-4, fibrosis-4 index; PIR, family poverty ratio; RDW, red cell distribution width. Group differences were assessed by chi-square test (categorical) or one-way ANOVA (continuous).

Supplementary Table S3. Baseline characteristics of NAFLD patients stratified by quartile grouping of RAR.

Variable	RAR					Statistic	P
	Total	Q1	Q2	Q3	Q4		
Number of participants (%)	5519(100)	1256(22.76)	1313(22.79)	1388(25.15)	1562(28.30)		
Gender, n(%)						$\chi^2=377.25$	<0.001
Male	3003 (56.83)	894 (74.76)	794 (61.29)	683 (52.30)	632 (39.22)		
Female	2516 (43.17)	362 (25.24)	519 (38.71)	705 (47.70)	930 (60.78)		
Age, Mean (SE)	53.96 (0.31)	49.03 (0.54)	54.45 (0.52)	56.22 (0.59)	56.08 (0.57)	F=38.30	<0.001
Race, n(%)						$\chi^2=161.77$	<0.001
Mexican American	1392 (10.27)	423 (12.14)	337 (9.71)	333 (10.23)	299 (9.01)		
Non-Hispanic White	2542 (71.94)	591 (74.47)	658 (75.84)	658 (72.77)	635 (64.76)		
Non-Hispanic Black	677 (6.36)	62 (2.37)	98 (3.64)	184 (6.96)	333 (12.40)		
Other	908 (11.43)	180 (11.02)	220 (10.81)	213 (10.04)	295 (13.84)		
Marital status, n(%)						$\chi^2=111.36$	<0.001
Married or living with a partner	3507 (68.56)	845 (73.35)	896 (71.08)	872 (68.88)	894 (61.01)		

Variable	RAR					Statistic	P
	Total	Q1	Q2	Q3	Q4		
Single (widowed/divorced/separated)	1296 (19.79)	191 (12.24)	280 (19.16)	370 (22.39)	455 (25.28)		
Never married	716 (11.65)	220 (14.41)	137 (9.76)	146 (8.74)	213 (13.71)		
Education, n(%)						$\chi^2=12.63$	0.291
Less than high school	1943 (22.42)	441 (21.17)	459 (22.38)	488 (21.80)	555 (24.32)		
high school or equivalent	1233 (24.65)	287 (24.25)	303 (25.83)	281 (22.68)	362 (25.86)		
college or above	2343 (52.93)	528 (54.58)	551 (51.79)	619 (55.52)	645 (49.82)		
Physical Activity, n(%)						$\chi^2=63.20$	<0.001
Low physical activity	2529 (42.31)	461 (35.38)	562 (39.96)	670 (44.07)	836 (49.74)		
High physical activity	2990 (57.69)	795 (64.62)	751 (60.04)	718 (55.93)	726 (50.26)		
Smoke, n(%)						$\chi^2=12.49$	0.276
Never	3025 (54.12)	708 (55.07)	691 (53.10)	743 (51.99)	883 (56.35)		
Former	1740 (32.31)	397 (32.91)	445 (33.58)	447 (33.48)	451 (29.26)		
Now	754 (13.57)	151 (12.01)	177 (13.32)	198 (14.53)	228 (14.39)		
Energy intake, Mean (SE)	2096.20 (16.48)	2278.87 (31.62)	2061.65 (33.66)	2075.00 (30.57)	1970.65 (30.36)	F=18.99	<0.001
BMI, Mean (SE)	33.91 (0.15)	31.27 (0.19)	32.73 (0.21)	34.54 (0.25)	37.05 (0.32)	F=107.70	<0.001
PIR, n(%)						$\chi^2=53.94$	<0.001
<1.3	1871 (22.70)	376 (18.55)	428 (21.25)	463 (22.17)	604 (28.79)		
1.3 - <3.5	2138 (37.81)	504 (39.31)	494 (37.23)	545 (36.81)	595 (37.92)		
≥ 3.5	1510 (39.48)	376 (42.14)	391 (41.51)	380 (41.02)	363 (33.29)		
FIB-4, Mean (SE)	1.18 (0.01)	1.04 (0.02)	1.19 (0.02)	1.23 (0.02)	1.26 (0.03)	F=19.01	<0.001
Hypertension, n(%)						$\chi^2=48.72$	<0.001
No	2237 (41.80)	619 (48.02)	514 (40.42)	563 (43.51)	541 (35.28)		
Yes	3282 (58.20)	637 (51.98)	799 (59.58)	825 (56.49)	1021 (64.72)		
Diabetes, n(%)						$\chi^2=132.52$	<0.001
No	3351 (66.75)	896 (76.81)	842 (69.59)	819 (63.76)	794 (56.99)		
Yes	2168 (33.25)	360 (23.19)	471 (30.41)	569 (36.24)	768 (43.01)		
Hyperlipidemia, n(%)						$\chi^2=18.00$	0.018
No	660 (11.11)	137 (9.26)	148 (9.86)	161 (11.38)	214 (13.91)		
Yes	4859 (88.89)	1119 (90.74)	1165 (90.14)	1227 (88.62)	1348 (86.09)		
Cancer, n(%)						$\chi^2=68.30$	<0.001
No	4837 (87.10)	1160 (92.41)	1154 (88.34)	1208 (85.44)	1315 (82.28)		
Yes	682 (12.90)	96 (7.59)	159 (11.66)	180 (14.56)	247 (17.72)		
All cause mortality, n(%)						$\chi^2=20.22$	0.006
No	4339 (82.92)	1037 (86.28)	1022 (82.32)	1088 (83.18)	1192 (79.91)		
Yes	1180 (17.08)	219 (13.72)	291 (17.68)	300 (16.82)	370 (20.09)		
CVD mortality, n(%)						$\chi^2=22.59$	0.002
No	5124 (94.39)	1187 (95.90)	1213 (94.53)	1300 (95.14)	1424 (91.98)		
Yes	395 (5.61)	69 (4.10)	100 (5.47)	88 (4.86)	138 (8.02)		

Note: Values are presented as mean (SE) for continuous variables and n (%) for categorical variables. Q1: $RAR \leq 2.88$; Q2: $2.88 < RAR \leq 3.10$; Q3: $3.10 < RAR \leq 3.38$; Q4: $RAR > 3.38$. Abbreviations: BMI, body mass index; FIB-4, fibrosis-4 index; PIR, family poverty ratio; RAR, red blood cell distribution width-to-albumin ratio; RDW, red cell distribution width. Group differences were assessed by chi-square test (categorical) or one-way ANOVA (continuous).

Supplementary Table S4. Variance Inflation Factors (VIF) for covariates in the fully adjusted model (Model 3) in MASLD

	GVIF	Df	GVIF ^{1/(2*Df)}		GVIF	Df	GVIF ^{1/(2*Df)}
CVD mortality	1.083	1	1.041	CVD mortality	1.083	1	1.041
Gender	1.695	1	1.302	Gender	1.693	1	1.301
Education	1.464	2	1.100	Education	1.464	2	1.100
Smoke	1.288	2	1.065	Smoke	1.288	2	1.065
Physical Activity	1.071	1	1.035	Physical Activity	1.071	1	1.035
Race	1.56	3	1.077	Race	1.558	3	1.077
Marital status	1.272	2	1.062	Marital status	1.273	2	1.062
PIR	1.396	2	1.087	PIR	1.396	2	1.087
Hypertension	1.249	1	1.117	Hypertension	1.249	1	1.117
Diabetes	1.213	1	1.101	Diabetes	1.213	1	1.101
Hyperlipidemia	1.035	1	1.017	Hyperlipidemia	1.035	1	1.017
Cardiovascular disease	1.211	1	1.100	Cardiovascular disease	1.211	1	1.101
Cancer	1.115	1	1.056	Cancer	1.114	1	1.056
RDW	1.215	1	1.102	RAR	2.461	1	1.569
Age	2.749	1	1.658	Age	2.746	1	1.657
Energy intake	1.306	1	1.143	Energy intake	1.306	1	1.143
BMI	1.367	1	1.169	BMI	1.366	1	1.169
FIB-4	3.258	1	1.805	FIB-4	3.263	1	1.806

Note: GVIF, Generalized Variance Inflation Factor; Df, degrees of freedom. All GVIF^{1/(2*Df)} values are well below the conventional threshold of 5, indicating no concerning multicollinearity. MASLD, metabolic dysfunction-associated steatotic liver disease; RDW, red blood cell distribution width; RAR, RDW-to-albumin ratio; PIR, poverty-income ratio; BMI, body mass index; FIB-4, fibrosis-4 index.

Supplementary Table S5. Proportional hazards assumption checked using Schoenfeld residuals among participants with MASLD

all cause mortality				CVD mortality			
	chisq	df	p		chisq	df	p
RDW_four	2.22E-03	3	1.00	RDW_four	1.60E-03	3	1.00
Gender	6.99E-06	1	1.00	Gender	4.97E-06	1	1.00
Education	2.37E-04	2	1.00	Education	1.48E-04	2	1.00
Smoke	7.36E-04	2	1.00	Smoke	5.93E-06	2	1.00
Physical Activity	7.88E-05	1	0.99	Physical Activity	2.40E-06	1	1.00
Race	5.40E-04	3	1.00	Race	1.16E-03	3	1.00
Marital status	1.02E-03	2	1.00	Marital status	2.41E-04	2	1.00
PIR	1.76E-05	2	1.00	PIR	1.58E-04	2	1.00
Hypertension	4.07E-04	1	0.98	Hypertension	8.02E-05	1	0.99
Diabetes	9.51E-04	1	0.98	Diabetes	6.97E-04	1	0.98
Hyperlipidemia	1.76E-04	1	0.99	Hyperlipidemia	1.23E-07	1	1.00
Cancer	2.70E-04	1	0.99	Cancer	8.18E-04	1	0.98
Age	1.34E-03	1	0.97	Age	7.77E-04	1	0.98
FIB-4	5.96E-04	1	0.98	FIB-4	3.49E-04	1	0.99
GLOBAL	9.25E-03	22	1.00	GLOBAL	6.45E-03	22	1.00
	chisq	df	p		chisq	df	p
RAR_four	1.93E-03	3	1.00	RAR_four	2.11E-04	3	1.00
Gender	1.87E-06	1	1.00	Gender	5.34E-08	1	1.00
Education	1.83E-04	2	1.00	Education	1.63E-04	2	1.00

Smoke	6.77E-04	2	1.00	Smoke	9.32E-06	2	1.00
Physical Activity	7.76E-05	1	0.99	Physical Activity	1.34E-06	1	1.00
Race	5.90E-04	3	1.00	Race	1.13E-03	3	1.00
Marital status	1.07E-03	2	1.00	Marital status	2.99E-04	2	1.00
PIR	1.95E-05	2	1.00	PIR	1.77E-04	2	1.00
Hypertension	3.46E-04	1	0.99	Hypertension	1.21E-04	1	0.99
Diabetes	9.78E-04	1	0.98	Diabetes	6.14E-04	1	0.98
Hyperlipidemia	1.23E-04	1	0.99	Hyperlipidemia	1.55E-06	1	1.00
Cancer	2.09E-04	1	0.99	Cancer	7.98E-04	1	0.98
Age	1.62E-03	1	0.97	Age	9.13E-04	1	0.98
FIB-4	6.29E-04	1	0.98	FIB-4	3.57E-04	1	0.98
GLOBAL	9.00E-03	22	1.00	GLOBAL	4.99E-03	22	1.00

Note: All p-values > 0.05 indicate that the proportional hazards assumption is not violated. RDW, red blood cell distribution width; RAR, RDW-to-albumin ratio; PIR, poverty-income ratio; FIB-4, fibrosis-4 index; CVD, cardiovascular disease.

Supplementary Table S6. Variance Inflation Factors (VIF) for covariates in the fully adjusted model (Model 3) in NAFLD

	GVIF	Df	GVIF ^{1/(2*Df)}		GVIF	Df	GVIF ^{1/(2*Df)}
CVD-cause mortality	1.083	1	1.040	CVD-cause mortality	1.083	1	1.041
Gender	1.698	1	1.303	Gender	1.696	1	1.302
Education	1.459	2	1.099	Education	1.458	2	1.099
Smoke	1.284	2	1.065	Smoke	1.284	2	1.064
Physical Activity	1.071	1	1.035	Physical Activity	1.071	1	1.035
Race	1.564	3	1.077	Race	1.562	3	1.077
Marital status	1.267	2	1.061	Marital status	1.268	2	1.061
PIR	1.395	2	1.087	PIR	1.395	2	1.087
Hypertension	1.254	1	1.120	Hypertension	1.253	1	1.120
Diabetes	1.213	1	1.101	Diabetes	1.213	1	1.102
Hyperlipidemia	1.035	1	1.017	Hyperlipidemia	1.035	1	1.017
Cardiovascular disease	1.212	1	1.101	Cardiovascular disease	1.212	1	1.101
Cancer	1.114	1	1.055	Cancer	1.113	1	1.055
RDW	1.214	1	1.102	RDW	2.426	1	1.557
FIB-4	3.274	1	1.809	FIB-4	3.279	1	1.811
Age	2.766	1	1.663	Age	2.763	1	1.662
Energy intake	1.303	1	1.141	Energy intake	1.303	1	1.141
BMI	1.370	1	1.170	BMI	1.368	1	1.170

Note: GVIF, Generalized Variance Inflation Factor; Df, degrees of freedom. All GVIF^{1/(2*Df)} values are well below the conventional threshold of 5, indicating no concerning multicollinearity. MASLD, metabolic dysfunction-associated steatotic liver disease; RDW, red blood cell distribution width; RAR, RDW-to-albumin ratio; PIR, poverty-income ratio; BMI, body mass index; FIB-4, fibrosis-4 index.

Supplementary Table S7. Proportional hazards assumption checked using Schoenfeld residuals among participants with NAFLD

all cause mortality				CVD mortality			
	chisq	df	p		chisq	df	p
RDW_four	2.06E-03	3	1.00	RDW_four	1.60E-03	3	1.00
Gender	6.31E-06	1	1.00	Gender	2.83E-06	1	1.00
Education	2.12E-04	2	1.00	Education	1.26E-04	2	1.00
Smoke	7.47E-04	2	1.00	Smoke	1.45E-05	2	1.00
Physical Activity	6.81E-05	1	0.99	Physical Activity	5.52E-05	1	0.99

Race	5.56E-04	3	1.00	Race	1.23E-03	3	1.00
Marital status	9.25E-04	2	1.00	Marital status	2.78E-04	2	1.00
PIR	7.43E-05	2	1.00	PIR	4.18E-04	2	1.00
Hypertension	5.13E-04	1	0.98	Hypertension	3.36E-05	1	1.00
Diabetes	1.08E-03	1	0.97	Diabetes	6.85E-04	1	0.98
Hyperlipidemia	3.16E-04	1	0.99	Hyperlipidemia	1.21E-06	1	1.00
Cancer	1.38E-04	1	0.99	Cancer	7.05E-04	1	0.98
Age	1.39E-03	1	0.97	Age	7.04E-04	1	0.98
FIB-4	5.88E-04	1	0.98	FIB-4	3.35E-04	1	0.99
GLOBAL	9.42E-03	22	1.00	GLOBAL	7.09E-03	22	1.00
	chisq	df	p		chisq	df	p
RAR_four	1.86E-03	3	1.00	RAR_four	2.46E-04	3	1.00
Gender	2.09E-06	1	1.00	Gender	8.53E-09	1	1.00
Education	1.45E-04	2	1.00	Education	1.47E-04	2	1.00
Smoke	6.94E-04	2	1.00	Smoke	1.92E-05	2	1.00
Physical Activity	3.51E-05	1	1.00	Physical Activity	3.15E-05	1	1.00
Race	5.96E-04	3	1.00	Race	1.21E-03	3	1.00
Marital status	9.56E-04	2	1.00	Marital status	3.38E-04	2	1.00
PIR	7.54E-05	2	1.00	PIR	4.23E-04	2	1.00
Hypertension	4.63E-04	1	0.98	Hypertension	5.27E-05	1	0.99
Diabetes	1.10E-03	1	0.97	Diabetes	6.04E-04	1	0.98
Hyperlipidemia	2.41E-04	1	0.99	Hyperlipidemia	1.79E-07	1	1.00
Cancer	9.27E-05	1	0.99	Cancer	7.07E-04	1	0.98
Age	1.68E-03	1	0.97	Age	8.32E-04	1	0.98
FIB-4	6.05E-04	1	0.98	FIB-4	3.32E-04	1	0.99
GLOBAL	9.16E-03	22	1.00	GLOBAL	5.63E-03	22	1.00

Note: All p-values > 0.05 indicate that the proportional hazards assumption is not violated. RDW, red blood cell distribution width; RAR, RDW-to-albumin ratio; PIR, poverty-income ratio; FIB-4, fibrosis-4 index; CVD, cardiovascular disease.

Supplementary Table S8. Results of sensitivity analysis in participants with MASLD with additional covariates (BMI, energy intake)

Variables	Model 1		Model 2		Model 3	
	HR (95%CI)	P	HR (95%CI)	P	HR (95%CI)	P
All-cause mortality						
RDW	1.20 (1.13 - 1.28)	<0.001	1.20 (1.14 - 1.27)	<0.001	1.19 (1.12 - 1.27)	<0.001
Categories						
Q1	1.00 (Reference)		1.00 (Reference)		1.00 (Reference)	
Q2	1.47 (1.19 - 1.82)	<0.001	1.17 (0.94 - 1.45)	0.165	1.14 (0.91 - 1.43)	0.244
Q3	1.90 (1.51 - 2.39)	<0.001	1.33 (1.08 - 1.64)	0.008	1.27 (1.03 - 1.58)	0.026
Q4	3.28 (2.64 - 4.06)	<0.001	2.11 (1.70 - 2.62)	<0.001	1.92 (1.53 - 2.42)	<0.001
P trend	<0.001		<0.001		<0.001	
CVD mortality						
RDW	1.22 (1.14 - 1.31)	<0.001	1.22 (1.14 - 1.30)	<0.001	1.21 (1.12 - 1.29)	<0.001
Q1	1.00 (Reference)		1.00 (Reference)		1.00 (Reference)	
Q2	1.16 (0.82 - 1.63)	0.401	0.90 (0.64 - 1.28)	0.563	0.87 (0.61 - 1.23)	0.429
Q3	1.81 (1.17 - 2.79)	0.007	1.23 (0.81 - 1.87)	0.333	1.12 (0.74 - 1.69)	0.584
Q4	3.80 (2.60 - 5.56)	<0.001	2.33 (1.57 - 3.47)	<0.001	2.08 (1.39 - 3.10)	<0.001
P trend	<0.001		<0.001		<0.001	
All-cause mortality						

Variables	Model 1		Model 2		Model 3	
	HR (95%CI)	P	HR (95%CI)	P	HR (95%CI)	P
RAR	2.03 (1.69 - 2.43)	<0.001	2.08 (1.77 - 2.45)	<0.001	1.93 (1.62 - 2.29)	<0.001
Categories						
Q1	1.00 (Reference)		1.00 (Reference)		1.00 (Reference)	
Q2	1.71 (1.35 - 2.17)	<0.001	1.33 (1.03 - 1.70)	0.027	1.30 (1.01 - 1.66)	0.040
Q3	2.05 (1.58 - 2.67)	<0.001	1.46 (1.14 - 1.88)	0.003	1.47 (1.14 - 1.91)	0.003
Q4	3.05 (2.43 - 3.83)	<0.001	2.50 (1.92 - 3.26)	<0.001	2.29 (1.75 - 3.01)	<0.001
P trend	<0.001		<0.001		<0.001	
CVD mortality						
RAR	2.30 (1.83 - 2.90)	<0.001	2.42 (1.99 - 2.94)	<0.001	2.27 (1.86 - 2.77)	<0.001
Q1	1.00 (Reference)		1.00 (Reference)		1.00 (Reference)	
Q2	1.81 (1.21 - 2.69)	0.004	1.38 (0.93 - 2.06)	0.113	1.30 (0.87 - 1.93)	0.198
Q3	2.02 (1.25 - 3.26)	0.004	1.41 (0.85 - 2.36)	0.185	1.36 (0.81 - 2.28)	0.246
Q4	4.18 (2.80 - 6.25)	<0.001	3.34 (2.16 - 5.17)	<0.001	2.91 (1.91 - 4.43)	<0.001
P trend	<0.001		<0.001		<0.001	

Note: HR, hazard ratio; CI, confidence interval; CVD, cardiovascular disease; RDW, red cell distribution width; RAR, red blood cell distribution width-to-albumin ratio; PIR, poverty-income ratio; FIB-4, fibrosis-4 index. Q1–Q4, quartiles of RDW or RAR (defined in Table 1 and Table 2). Model 1: Crude (unadjusted). Model 2: Adjusted for gender, age, and race. Model 3: Adjusted for gender, age, race, marital status, education, smoke, physical activity, PIR, hypertension, diabetes, hyperlipidemia, cancer, and FIB-4. P for trend was calculated using the median value of each quartile as a continuous variable.

Supplementary Table S9. Results of sensitivity analysis in participants with NAFLD with additional covariates (BMI, energy intake)

Variables	Model 1		Model 2		Model 3	
	HR (95%CI)	P	HR (95%CI)	P	HR (95%CI)	P
All-cause mortality						
RDW	1.20 (1.13 - 1.27)	<0.001	1.20 (1.14 - 1.27)	<0.001	1.19 (1.12 - 1.27)	<0.001
Categories						
Q1	1.00 (Reference)		1.00 (Reference)		1.00 (Reference)	
Q2	1.47 (1.19 - 1.81)	<0.001	1.16 (0.93 - 1.44)	0.185	1.16 (0.93 - 1.44)	0.202
Q3	1.91 (1.52 - 2.39)	<0.001	1.33 (1.08 - 1.64)	0.007	1.29 (1.04 - 1.59)	0.020
Q4	3.36 (2.70 - 4.17)	<0.001	2.16 (1.74 - 2.68)	<0.001	1.97 (1.56 - 2.48)	<0.001
P trend	<0.001		<0.001		<0.001	
CVD mortality						
RDW	1.21 (1.14 - 1.30)	<0.001	1.22 (1.14 - 1.29)	<0.001	1.20 (1.12 - 1.29)	<0.001
Q1	1.00 (Reference)		1.00 (Reference)		1.00 (Reference)	
Q2	1.47 (1.19 - 1.81)	<0.001	0.89 (0.63 - 1.26)	0.502	0.86 (0.61 - 1.22)	0.394
Q3	1.91 (1.52 - 2.39)	<0.001	1.22 (0.81 - 1.86)	0.342	1.11 (0.74 - 1.67)	0.604
Q4	3.36 (2.70 - 4.17)	<0.001	2.32 (1.57 - 3.44)	<0.001	2.05 (1.38 - 3.05)	<0.001
P trend	<0.001		<0.001		<0.001	
All-cause mortality						
RAR	1.93 (1.63 - 2.28)	<0.001	2.07 (1.78 - 2.41)	<0.001	1.95 (1.65 - 2.32)	<0.001
Categories						
Q1	1.00 (Reference)		1.00 (Reference)		1.00 (Reference)	
Q2	1.70 (1.35 - 2.15)	<0.001	1.32 (1.03 - 1.69)	0.028	1.28 (1.01 - 1.63)	0.049
Q3	2.04 (1.57 - 2.64)	<0.001	1.45 (1.13 - 1.86)	0.003	1.44 (1.11 - 1.86)	0.006
Q4	3.10 (2.47 - 3.88)	<0.001	2.55 (1.96 - 3.31)	<0.001	2.34 (1.78 - 3.07)	<0.001
P trend	<0.001		<0.001		<0.001	
CVD mortality						
RAR	2.15 (1.75 - 2.64)	<0.001	2.37 (1.96 - 2.86)	<0.001	2.25 (1.85 - 2.75)	<0.001
Q1	1.00 (Reference)		1.00 (Reference)		1.00 (Reference)	

Variables	Model 1		Model 2		Model 3	
	HR (95%CI)	P	HR (95%CI)	P	HR (95%CI)	P
Q2	1.78 (1.20 - 2.63)	0.004	1.36 (0.91 - 2.02)	0.131	1.27 (0.86 - 1.87)	0.235
Q3	1.99 (1.24 - 3.19)	0.004	1.39 (0.84 - 2.30)	0.206	1.31 (0.78 - 2.18)	0.305
Q4	4.14 (2.78 - 6.15)	<0.001	3.29 (2.13 - 5.08)	<0.001	2.85 (1.88 - 4.33)	<0.001
P trend	<0.001		<0.001		<0.001	

Note: HR, hazard ratio; CI, confidence interval; CVD, cardiovascular disease; RDW, red cell distribution width; RAR, red blood cell distribution width-to-albumin ratio; PIR, poverty-income ratio; FIB-4, fibrosis-4 index. Q1–Q4, quartiles of RDW or RAR (defined in Table 1 and Table 2). Model 1: Crude (unadjusted). Model 2: Adjusted for gender, age, and race. Model 3: Adjusted for gender, age, race, marital status, education, smoke, physical activity, PIR, hypertension, diabetes, hyperlipidemia, cancer, and FIB-4, BMI, energy intake. P for trend was calculated using the median value of each quartile as a continuous variable.

Supplementary Table S10. Results of sensitivity analysis in participants with MASLD without any data imputation

Variables	Model 1		Model 2		Model 3	
	HR (95%CI)	P	HR (95%CI)	P	HR (95%CI)	P
All-cause mortality						
RDW	1.20 (1.13 - 1.28)	<0.001	1.20 (1.14 - 1.27)	<0.001	1.19 (1.10 - 1.28)	<0.001
Categories						
Q1	1.00 (Reference)		1.00 (Reference)		1.00 (Reference)	
Q2	1.47 (1.19 - 1.82)	<0.001	1.17 (0.94 - 1.45)	0.165	1.34 (1.04 - 1.72)	0.022
Q3	1.90 (1.51 - 2.39)	<0.001	1.33 (1.08 - 1.64)	0.008	1.36 (1.01 - 1.83)	0.043
Q4	3.28 (2.64 - 4.06)	<0.001	2.11 (1.70 - 2.62)	<0.001	2.00 (1.49 - 2.67)	<0.001
P trend	<0.001		<0.001		<0.001	
CVD mortality						
RDW	1.22 (1.14 - 1.31)	<0.001	1.22 (1.14 - 1.30)	<0.001	1.27 (1.17 - 1.37)	<0.001
Q1	1.00 (Reference)		1.00 (Reference)		1.00 (Reference)	
Q2	1.16 (0.82 - 1.63)	0.401	0.90 (0.64 - 1.28)	0.563	1.07 (0.62 - 1.85)	0.814
Q3	1.81 (1.17 - 2.79)	0.007	1.23 (0.81 - 1.87)	0.333	1.09 (0.61 - 1.95)	0.766
Q4	3.80 (2.60 - 5.56)	<0.001	2.33 (1.57 - 3.47)	<0.001	2.67 (1.58 - 4.50)	<0.001
P trend	<0.001		<0.001		<0.001	
All-cause mortality						
RAR	2.03 (1.69 - 2.43)	<0.001	2.08 (1.77 - 2.45)	<0.001	1.95 (1.60 - 2.37)	<0.001
Categories						
Q1	1.00 (Reference)		1.00 (Reference)		1.00 (Reference)	
Q2	1.71 (1.35 - 2.17)	<0.001	1.33 (1.03 - 1.70)	0.027	1.37 (0.99 - 1.89)	0.056
Q3	2.05 (1.58 - 2.67)	<0.001	1.46 (1.14 - 1.88)	0.003	1.43 (1.03 - 1.98)	0.033
Q4	3.05 (2.43 - 3.83)	<0.001	2.50 (1.92 - 3.26)	<0.001	2.21 (1.62 - 3.00)	<0.001
P trend	<0.001		<0.001		<0.001	
CVD mortality						
RAR	2.30 (1.83 - 2.90)	<0.001	2.42 (1.99 - 2.94)	<0.001	2.46 (1.92 - 3.15)	<0.001
Q1	1.00 (Reference)		1.00 (Reference)		1.00 (Reference)	
Q2	1.81 (1.21 - 2.69)	0.004	1.38 (0.93 - 2.06)	0.113	1.37 (0.80 - 2.35)	0.246
Q3	2.02 (1.25 - 3.26)	0.004	1.41 (0.85 - 2.36)	0.185	1.46 (0.80 - 2.69)	0.220
Q4	4.18 (2.80 - 6.25)	<0.001	3.34 (2.16 - 5.17)	<0.001	3.20 (1.95 - 5.25)	<0.001
P trend	<0.001		<0.001		<0.001	

Note: HR, hazard ratio; CI, confidence interval; CVD, cardiovascular disease; RDW, red cell distribution width; RAR, red blood cell distribution width-to-albumin ratio; PIR, poverty-income ratio; FIB-4, fibrosis-4 index. Q1–Q4, quartiles of RDW or RAR (defined in Table 1 and Table 2). Model 1: Crude (unadjusted). Model 2: Adjusted for gender, age, and race. Model 3: Adjusted for gender, age, race, marital status, education, smoke, physical activity, PIR, hypertension, diabetes, hyperlipidemia, cancer, and FIB-4. P for trend was calculated using the median value of each quartile as a continuous variable.

Supplementary Table S11. Results of sensitivity analysis in participants with NAFLD without any data imputation

Variables	Model 1		Model 2		Model 3	
	HR (95%CI)	P	HR (95%CI)	P	HR (95%CI)	P
All-cause mortality						
RDW	1.20 (1.13 - 1.27)	<0.001	1.20 (1.14 - 1.27)	<0.001	1.19 (1.11 - 1.28)	<0.001
Categories						
Q1	1.00 (Reference)		1.00 (Reference)		1.00 (Reference)	
Q2	1.47 (1.19 - 1.81)	<0.001	1.16 (0.93 - 1.44)	0.185	1.33 (1.03 - 1.70)	0.026
Q3	1.91 (1.52 - 2.39)	<0.001	1.33 (1.08 - 1.64)	0.007	1.36 (1.02 - 1.83)	0.039
Q4	3.36 (2.70 - 4.17)	<0.001	2.16 (1.74 - 2.68)	<0.001	2.03 (1.52 - 2.71)	<0.001
P trend	<0.001		<0.001		<0.001	
CVD mortality						
RDW	1.21 (1.14 - 1.30)	<0.001	1.22 (1.14 - 1.29)	<0.001	1.26 (1.17 - 1.37)	<0.001
Q1	1.00 (Reference)		1.00 (Reference)		1.00 (Reference)	
Q2	1.15 (0.81 - 1.62)	0.431	0.89 (0.63 - 1.26)	0.502	1.07 (0.62 - 1.85)	0.821
Q3	1.81 (1.18 - 2.79)	0.007	1.22 (0.81 - 1.86)	0.342	1.11 (0.62 - 1.96)	0.729
Q4	3.82 (2.61 - 5.57)	<0.001	2.32 (1.57 - 3.44)	<0.001	2.67 (1.58 - 4.49)	<0.001
P trend	<0.001		<0.001		<0.001	
All-cause mortality						
RAR	1.93 (1.63 - 2.28)	<0.001	2.07 (1.78 - 2.41)	<0.001	1.95 (1.62 - 2.35)	<0.001
Categories						
Q1	1.00 (Reference)		1.00 (Reference)		1.00 (Reference)	
Q2	1.70 (1.35 - 2.15)	<0.001	1.32 (1.03 - 1.69)	0.028	1.37 (0.99 - 1.88)	0.058
Q3	2.04 (1.57 - 2.64)	<0.001	1.45 (1.13 - 1.86)	0.003	1.41 (1.02 - 1.96)	0.038
Q4	3.10 (2.47 - 3.88)	<0.001	2.55 (1.96 - 3.31)	<0.001	2.27 (1.66 - 3.09)	<0.001
P trend	<0.001		<0.001		<0.001	
CVD mortality						
RAR	2.15 (1.75 - 2.64)	<0.001	2.37 (1.96 - 2.86)	<0.001	2.44 (1.91 - 3.12)	<0.001
Q1	1.00 (Reference)		1.00 (Reference)		1.00 (Reference)	
Q2	1.78 (1.20 - 2.63)	0.004	1.36 (0.91 - 2.02)	0.131	1.36 (0.80 - 2.32)	0.255
Q3	1.99 (1.24 - 3.19)	0.004	1.39 (0.84 - 2.30)	0.206	1.44 (0.79 - 2.63)	0.230
Q4	4.14 (2.78 - 6.15)	<0.001	3.29 (2.13 - 5.08)	<0.001	3.20 (1.95 - 5.23)	<0.001
P trend	<0.001		<0.001		<0.001	

Note: HR, hazard ratio; CI, confidence interval; CVD, cardiovascular disease; RDW, red cell distribution width; RAR, red blood cell distribution width-to-albumin ratio; PIR, poverty-income ratio; FIB-4, fibrosis-4 index. Q1–Q4, quartiles of RDW or RAR (defined in Table 1 and Table 2). Model 1: Crude (unadjusted). Model 2: Adjusted for gender, age, and race. Model 3: Adjusted for gender, age, race, marital status, education, smoke, physical activity, PIR, hypertension, diabetes, hyperlipidemia, cancer, and FIB-4. P for trend was calculated using the median value of each quartile as a continuous variable.

Supplementary Table S12. Results of sensitivity analysis in participants with MASLD after removing RDW/RAR extreme values

Variables	Model 1		Model 2		Model 3	
	HR (95%CI)	P	HR (95%CI)	P	HR (95%CI)	P
All-cause mortality						
RDW	1.20 (1.13 - 1.28)	<0.001	1.20 (1.14 - 1.27)	<0.001	1.19 (1.12 - 1.26)	<0.001
Categories						
Q1	1.00 (Reference)		1.00 (Reference)		1.00 (Reference)	
Q2	1.47 (1.19 - 1.82)	<0.001	1.17 (0.94 - 1.45)	0.165	1.14 (0.91 - 1.43)	0.251
Q3	1.90 (1.51 - 2.39)	<0.001	1.33 (1.08 - 1.64)	0.008	1.27 (1.03 - 1.57)	0.026
Q4	3.28 (2.64 - 4.06)	<0.001	2.11 (1.70 - 2.62)	<0.001	1.92 (1.52 - 2.41)	<0.001
P trend	<0.001		<0.001		<0.001	
CVD mortality						
RDW	1.22 (1.14 - 1.31)	<0.001	1.22 (1.14 - 1.30)	<0.001	1.21 (1.13 - 1.30)	<0.001
Q1	1.00 (Reference)		1.00 (Reference)		1.00 (Reference)	

Variables	Model 1		Model 2		Model 3	
	HR (95%CI)	P	HR (95%CI)	P	HR (95%CI)	P
Q2	1.16 (0.82 - 1.63)	0.401	0.90 (0.64 - 1.28)	0.563	0.89 (0.62 - 1.28)	0.520
Q3	1.81 (1.17 - 2.79)	0.007	1.23 (0.81 - 1.87)	0.333	1.16 (0.77 - 1.76)	0.471
Q4	3.80 (2.60 - 5.56)	<0.001	2.33 (1.57 - 3.47)	<0.001	2.17 (1.46 - 3.25)	<0.001
P trend	<0.001		<0.001		<0.001	
All-cause mortality						
RAR	2.03 (1.69 - 2.43)	<0.001	2.08 (1.77 - 2.45)	<0.001	1.90 (1.61 - 2.26)	<0.001
Categories						
Q1	1.00 (Reference)		1.00 (Reference)		1.00 (Reference)	
Q2	1.71 (1.35 - 2.17)	<0.001	1.33 (1.03 - 1.70)	0.027	1.29 (1.01 - 1.65)	0.044
Q3	2.05 (1.58 - 2.67)	<0.001	1.46 (1.14 - 1.88)	0.003	1.44 (1.12 - 1.86)	0.004
Q4	3.05 (2.43 - 3.83)	<0.001	2.50 (1.92 - 3.26)	<0.001	2.22 (1.69 - 2.91)	<0.001
P trend	<0.001		<0.001		<0.001	
CVD mortality						
RAR	2.30 (1.83 - 2.90)	<0.001	2.42 (1.99 - 2.94)	<0.001	2.30 (1.87 - 2.82)	<0.001
Q1	1.00 (Reference)		1.00 (Reference)		1.00 (Reference)	
Q2	1.81 (1.21 - 2.69)	0.004	1.38 (0.93 - 2.06)	0.113	1.31 (0.88 - 1.94)	0.178
Q3	2.02 (1.25 - 3.26)	0.004	1.41 (0.85 - 2.36)	0.185	1.38 (0.82 - 2.33)	0.220
Q4	4.18 (2.80 - 6.25)	<0.001	3.34 (2.16 - 5.17)	<0.001	3.00 (1.96 - 4.59)	<0.001
P trend	<0.001		<0.001		<0.001	

Note: HR, hazard ratio; CI, confidence interval; CVD, cardiovascular disease; RDW, red cell distribution width; RAR, red blood cell distribution width-to-albumin ratio; PIR, poverty-income ratio; FIB-4, fibrosis-4 index. Q1–Q4, quartiles of RDW or RAR (defined in Table 1 and Table 2). Model 1: Crude (unadjusted). Model 2: Adjusted for gender, age, and race. Model 3: Adjusted for gender, age, race, marital status, education, smoke, physical activity, PIR, hypertension, diabetes, hyperlipidemia, cancer, and FIB-4. P for trend was calculated using the median value of each quartile as a continuous variable.

Supplementary Table S13. Results of sensitivity analysis in participants with NAFLD after removing RDW/RAR extreme values

Variables	Model 1		Model 2		Model 3	
	HR (95%CI)	P	HR (95%CI)	P	HR (95%CI)	P
All-cause mortality						
RDW	1.42 (1.33 - 1.51)	<0.001	1.33 (1.25 - 1.42)	<0.001	1.29 (1.19 - 1.38)	<0.001
Categories						
Q1	1.00 (Reference)		1.00 (Reference)		1.00 (Reference)	
Q2	1.47 (1.19 - 1.81)	<0.001	1.16 (0.93 - 1.44)	0.185	1.15 (0.92 - 1.43)	0.217
Q3	1.91 (1.52 - 2.39)	<0.001	1.33 (1.08 - 1.64)	0.007	1.28 (1.04 - 1.58)	0.022
Q4	3.36 (2.70 - 4.17)	<0.001	2.16 (1.74 - 2.68)	<0.001	1.95 (1.55 - 2.45)	<0.001
P trend	<0.001		<0.001		<0.001	
CVD mortality						
RDW	1.50 (1.37 - 1.65)	<0.001	1.41 (1.27 - 1.57)	<0.001	1.37 (1.23 - 1.54)	<0.001
Q1	1.00 (Reference)		1.00 (Reference)		1.00 (Reference)	
Q2	1.15 (0.81 - 1.62)	0.431	0.89 (0.63 - 1.26)	0.502	0.89 (0.62 - 1.26)	0.500
Q3	1.81 (1.18 - 2.79)	0.007	1.22 (0.81 - 1.86)	0.342	1.16 (0.77 - 1.75)	0.485
Q4	3.82 (2.61 - 5.57)	<0.001	2.32 (1.57 - 3.44)	<0.001	2.14 (1.44 - 3.19)	<0.001
P trend	<0.001		<0.001		<0.001	
All-cause mortality						
RAR	2.57 (2.19 - 3.03)	<0.001	2.53 (2.06 - 3.09)	<0.001	2.25 (1.83 - 2.77)	<0.001
Categories						
Q1	1.00 (Reference)		1.00 (Reference)		1.00 (Reference)	
Q2	1.70 (1.35 - 2.15)	<0.001	1.32 (1.03 - 1.69)	0.028	1.26 (0.99 - 1.61)	0.058
Q3	2.04 (1.57 - 2.64)	<0.001	1.45 (1.13 - 1.86)	0.003	1.41 (1.09 - 1.81)	0.009
Q4	3.10 (2.47 - 3.88)	<0.001	2.55 (1.96 - 3.31)	<0.001	2.25 (1.72 - 2.94)	<0.001

Variables	Model 1		Model 2		Model 3	
	HR (95%CI)	P	HR (95%CI)	P	HR (95%CI)	P
P trend	<0.001		<0.001		<0.001	
CVD mortality						
RAR	3.26 (2.56 - 4.15)	<0.001	3.24 (2.44 - 4.31)	<0.001	3.02 (2.25 - 4.04)	<0.001
Q1	1.00 (Reference)		1.00 (Reference)		1.00 (Reference)	
Q2	1.78 (1.20 - 2.63)	0.004	1.36 (0.91 - 2.02)	0.131	1.28 (0.87 - 1.89)	0.214
Q3	1.99 (1.24 - 3.19)	0.004	1.39 (0.84 - 2.30)	0.206	1.33 (0.80 - 2.23)	0.271
Q4	4.14 (2.78 - 6.15)	<0.001	3.29 (2.13 - 5.08)	<0.001	2.94 (1.92 - 4.49)	<0.001
P trend	<0.001		<0.001		<0.001	

Note: HR, hazard ratio; CI, confidence interval; CVD, cardiovascular disease; RDW, red cell distribution width; RAR, red blood cell distribution width-to-albumin ratio; PIR, poverty-income ratio; FIB-4, fibrosis-4 index. Q1–Q4, quartiles of RDW or RAR (defined in Table 1 and Table 2). Model 1: Crude (unadjusted). Model 2: Adjusted for gender, age, and race. Model 3: Adjusted for gender, age, race, marital status, education, smoke, physical activity, PIR, hypertension, diabetes, hyperlipidemia, cancer, and FIB-4. P for trend was calculated using the median value of each quartile as a continuous variable.

Supplementary Table S14. Results of sensitivity analysis in participants with MASLD after excluding patients who died within 2 years of follow-up

Variables	Model 1		Model 2		Model 3	
	HR (95%CI)	P	HR (95%CI)	P	HR (95%CI)	P
All-cause mortality						
RDW	1.19 (1.12 - 1.27)	<0.001	1.18 (1.11 - 1.25)	<0.001	1.17 (1.09 - 1.25)	<0.001
Categories						
Q1	1.00 (Reference)		1.00 (Reference)		1.00 (Reference)	
Q2	1.54 (1.23 - 1.93)	<0.001	1.21 (0.96 - 1.53)	0.109	1.19 (0.93 - 1.52)	0.160
Q3	2.05 (1.61 - 2.60)	<0.001	1.42 (1.14 - 1.77)	0.002	1.36 (1.10 - 1.70)	0.006
Q4	3.20 (2.55 - 4.01)	<0.001	2.04 (1.63 - 2.56)	<0.001	1.84 (1.43 - 2.36)	<0.001
P trend	<0.001		<0.001		<0.001	
CVD mortality						
RDW	1.21 (1.13 - 1.31)	<0.001	1.20 (1.13 - 1.29)	<0.001	1.20 (1.11 - 1.29)	<0.001
Q1	1.00 (Reference)		1.00 (Reference)		1.00 (Reference)	
Q2	1.20 (0.85 - 1.69)	0.296	0.92 (0.65 - 1.31)	0.655	0.91 (0.63 - 1.30)	0.594
Q3	1.93 (1.24 - 3.03)	0.004	1.29 (0.84 - 1.98)	0.250	1.22 (0.80 - 1.87)	0.355
Q4	3.67 (2.48 - 5.41)	<0.001	2.19 (1.45 - 3.30)	<0.001	2.02 (1.34 - 3.06)	<0.001
P trend	<0.001		<0.001		<0.001	
All-cause mortality						
RAR	1.93 (1.61 - 2.32)	<0.001	1.95 (1.63 - 2.33)	<0.001	1.78 (1.47 - 2.16)	<0.001
Categories						
Q1	1.00 (Reference)		1.00 (Reference)		1.00 (Reference)	
Q2	1.79 (1.41 - 2.27)	<0.001	1.37 (1.07 - 1.77)	0.014	1.35 (1.05 - 1.74)	0.020
Q3	1.97 (1.50 - 2.57)	<0.001	1.39 (1.08 - 1.79)	0.010	1.38 (1.08 - 1.78)	0.012
Q4	2.94 (2.33 - 3.73)	<0.001	2.45 (1.85 - 3.24)	<0.001	2.18 (1.63 - 2.90)	<0.001
P trend	<0.001		<0.001		<0.001	
CVD mortality						
RAR	2.27 (1.78 - 2.89)	<0.001	2.38 (1.92 - 2.95)	<0.001	2.25 (1.79 - 2.82)	<0.001
Q1	1.00 (Reference)		1.00 (Reference)		1.00 (Reference)	
Q2	1.90 (1.26 - 2.87)	0.002	1.45 (0.96 - 2.18)	0.079	1.39 (0.92 - 2.10)	0.114
Q3	1.87 (1.13 - 3.10)	0.015	1.30 (0.77 - 2.20)	0.333	1.28 (0.75 - 2.20)	0.364
Q4	4.36 (2.85 - 6.65)	<0.001	3.54 (2.21 - 5.67)	<0.001	3.20 (2.01 - 5.09)	<0.001
P trend	<0.001		<0.001		<0.001	

Note: HR, hazard ratio; CI, confidence interval; CVD, cardiovascular disease; RDW, red cell distribution width; RAR, red blood cell distribution width-to-albumin ratio; PIR, poverty-income ratio; FIB-4, fibrosis-4 index. Q1–Q4, quartiles of RDW or RAR (defined in Table 1 and Table 2). Model 1: Crude (unadjusted). Model 2: Adjusted

Variables	Model 1		Model 2		Model 3	
	HR (95%CI)	P	HR (95%CI)	P	HR (95%CI)	P

for gender, age, and race. Model 3: Adjusted for gender, age, race, marital status, education, smoke, physical activity, PIR, hypertension, diabetes, hyperlipidemia, cancer, and FIB-4. P for trend was calculated using the median value of each quartile as a continuous variable.

Supplementary Table S15. Results of sensitivity analysis in participants with NAFLD after excluding patients who died within 2 years of follow-up

Variables	Model 1		Model 2		Model 3	
	HR (95%CI)	P	HR (95%CI)	P	HR (95%CI)	P
All-cause mortality						
RDW	1.19 (1.12 - 1.26)	<0.001	1.18 (1.12 - 1.25)	<0.001	1.17 (1.09 - 1.25)	<0.001
Categories						
Q1	1.00 (Reference)		1.00 (Reference)		1.00 (Reference)	
Q2	1.53 (1.22 - 1.92)	<0.001	1.20 (0.95 - 1.51)	0.123	1.20 (0.94 - 1.52)	0.136
Q3	2.05 (1.62 - 2.60)	<0.001	1.42 (1.14 - 1.77)	0.002	1.38 (1.10 - 1.72)	0.005
Q4	3.28 (2.61 - 4.13)	<0.001	2.09 (1.67 - 2.63)	<0.001	1.88 (1.46 - 2.41)	<0.001
P trend	<0.001		<0.001		<0.001	
CVD mortality						
RDW	1.21 (1.13 - 1.29)	<0.001	1.20 (1.13 - 1.28)	<0.001	1.20 (1.11 - 1.29)	<0.001
Q1	1.00 (Reference)		1.00 (Reference)		1.00 (Reference)	
Q2	1.19 (0.84 - 1.68)	0.327	0.91 (0.64 - 1.29)	0.587	0.91 (0.63 - 1.30)	0.596
Q3	1.93 (1.24 - 3.01)	0.004	1.28 (0.84 - 1.97)	0.256	1.22 (0.80 - 1.86)	0.359
Q4	3.67 (2.49 - 5.41)	<0.001	2.18 (1.45 - 3.27)	<0.001	1.99 (1.32 - 3.00)	0.001
P trend	<0.001		<0.001		<0.001	
All-cause mortality						
RAR	1.85 (1.56 - 2.18)	<0.001	1.95 (1.65 - 2.30)	<0.001	1.80 (1.50 - 2.16)	<0.001
Categories						
Q1	1.00 (Reference)		1.00 (Reference)		1.00 (Reference)	
Q2	1.77 (1.40 - 2.24)	<0.001	1.37 (1.06 - 1.75)	0.014	1.32 (1.03 - 1.70)	0.027
Q3	1.95 (1.49 - 2.54)	<0.001	1.38 (1.08 - 1.77)	0.011	1.34 (1.04 - 1.73)	0.023
Q4	2.99 (2.37 - 3.78)	<0.001	2.50 (1.90 - 3.30)	<0.001	2.22 (1.67 - 2.95)	<0.001
P trend	<0.001		<0.001		<0.001	
CVD mortality						
RAR	2.11 (1.71 - 2.61)	<0.001	2.32 (1.89 - 2.86)	<0.001	2.23 (1.78 - 2.78)	<0.001
Q1	1.00 (Reference)		1.00 (Reference)		1.00 (Reference)	
Q2	1.87 (1.24 - 2.80)	0.003	1.42 (0.94 - 2.13)	0.094	1.35 (0.90 - 2.03)	0.144
Q3	1.85 (1.13 - 3.02)	0.015	1.27 (0.76 - 2.14)	0.365	1.23 (0.73 - 2.09)	0.439
Q4	4.29 (2.82 - 6.51)	<0.001	3.48 (2.18 - 5.55)	<0.001	3.11 (1.95 - 4.95)	<0.001
P trend	<0.001		<0.001		<0.001	

Note: HR, hazard ratio; CI, confidence interval; CVD, cardiovascular disease; RDW, red cell distribution width; RAR, red blood cell distribution width-to-albumin ratio; PIR, poverty-income ratio; FIB-4, fibrosis-4 index. Q1–Q4, quartiles of RDW or RAR (defined in Table 1 and Table 2). Model 1: Crude (unadjusted). Model 2: Adjusted for gender, age, and race. Model 3: Adjusted for gender, age, race, marital status, education, smoke, physical activity, PIR, hypertension, diabetes, hyperlipidemia, cancer, and FIB-4. P for trend was calculated using the median value of each quartile as a continuous variable.

Supplementary Table S16. Results of sensitivity analysis in participants with MASLD after excluding patients with CVD.

Variables	Model 1		Model 2		Model 3	
	HR (95%CI)	P	HR (95%CI)	P	HR (95%CI)	P
All-cause mortality						
RDW	1.18 (1.11 - 1.27)	<0.001	1.19 (1.11 - 1.27)	<0.001	1.19 (1.09 - 1.30)	<0.001
Categories						
Q1	1.00 (Reference)		1.00 (Reference)		1.00 (Reference)	
Q2	1.25 (0.97 - 1.61)	0.086	1.04 (0.80 - 1.36)	0.748	1.02 (0.77 - 1.34)	0.916

Variables	Model 1		Model 2		Model 3	
	HR (95%CI)	P	HR (95%CI)	P	HR (95%CI)	P
Q3	1.90 (1.47 - 2.45)	<0.001	1.33 (1.02 - 1.73)	0.033	1.34 (1.03 - 1.74)	0.031
Q4	2.69 (2.07 - 3.50)	<0.001	1.94 (1.49 - 2.54)	<0.001	1.77 (1.33 - 2.36)	<0.001
P trend	<0.001		<0.001		<0.001	
CVD mortality						
RDW	1.20 (1.11 - 1.29)	<0.001	1.20 (1.11 - 1.30)	<0.001	1.21 (1.10 - 1.34)	<0.001
Q1	1.00 (Reference)		1.00 (Reference)		1.00 (Reference)	
Q2	0.95 (0.56 - 1.61)	0.856	0.78 (0.47 - 1.32)	0.361	0.78 (0.45 - 1.34)	0.370
Q3	1.78 (1.07 - 2.96)	0.026	1.21 (0.72 - 2.03)	0.469	1.21 (0.75 - 1.97)	0.435
Q4	3.19 (1.91 - 5.33)	<0.001	2.22 (1.29 - 3.82)	0.004	2.10 (1.23 - 3.61)	0.007
P trend	<0.001		<0.001		0.002	
All-cause mortality						
RAR	1.88 (1.55 - 2.28)	<0.001	1.98 (1.61 - 2.44)	<0.001	1.93 (1.50 - 2.48)	<0.001
Categories						
Q1	1.00 (Reference)		1.00 (Reference)		1.00 (Reference)	
Q2	1.90 (1.41 - 2.57)	<0.001	1.55 (1.12 - 2.14)	0.008	1.52 (1.10 - 2.09)	0.012
Q3	1.97 (1.45 - 2.66)	<0.001	1.53 (1.13 - 2.08)	0.006	1.56 (1.13 - 2.14)	0.007
Q4	3.01 (2.21 - 4.09)	<0.001	2.61 (1.84 - 3.70)	<0.001	2.36 (1.64 - 3.38)	<0.001
P trend	<0.001		<0.001		<0.001	
CVD mortality						
RAR	2.12 (1.63 - 2.74)	<0.001	2.29 (1.71 - 3.07)	<0.001	2.42 (1.69 - 3.45)	<0.001
Q1	1.00 (Reference)		1.00 (Reference)		1.00 (Reference)	
Q2	1.81 (1.01 - 3.22)	0.045	1.47 (0.82 - 2.63)	0.191	1.39 (0.81 - 2.38)	0.235
Q3	1.83 (1.05 - 3.22)	0.034	1.43 (0.78 - 2.60)	0.246	1.42 (0.78 - 2.61)	0.254
Q4	4.17 (2.39 - 7.28)	<0.001	3.65 (2.02 - 6.59)	<0.001	3.44 (1.90 - 6.24)	<0.001
P trend	<0.001		<0.001		<0.001	

Note: HR, hazard ratio; CI, confidence interval; CVD, cardiovascular disease; RDW, red cell distribution width; RAR, red blood cell distribution width-to-albumin ratio; PIR, poverty-income ratio; FIB-4, fibrosis-4 index. Q1–Q4, quartiles of RDW or RAR (defined in Table 1 and Table 2). Model 1: Crude (unadjusted). Model 2: Adjusted for gender, age, and race. Model 3: Adjusted for gender, age, race, marital status, education, smoke, physical activity, PIR, hypertension, diabetes, hyperlipidemia, cancer, and FIB-4. P for trend was calculated using the median value of each quartile as a continuous variable.

Supplementary Table S17. Results of sensitivity analysis in participants with NAFLD after excluding patients with CVD.

Variables	Model 1		Model 2		Model 3	
	HR (95%CI)	P	HR (95%CI)	P	HR (95%CI)	P
All-cause mortality						
RDW	1.18 (1.11 - 1.25)	<0.001	1.19 (1.12 - 1.27)	<0.001	1.19 (1.09 - 1.29)	<0.001
Categories						
Q1	1.00 (Reference)		1.00 (Reference)		1.00 (Reference)	
Q2	1.24 (0.96 - 1.60)	0.097	1.03 (0.79 - 1.34)	0.820	1.02 (0.78 - 1.34)	0.891
Q3	1.89 (1.47 - 2.44)	<0.001	1.33 (1.02 - 1.72)	0.032	1.33 (1.03 - 1.72)	0.027
Q4	2.74 (2.11 - 3.56)	<0.001	1.98 (1.51 - 2.58)	<0.001	1.79 (1.34 - 2.39)	<0.001
P trend	<0.001		<0.001		<0.001	
CVD mortality						
RDW	1.19 (1.11 - 1.28)	<0.001	1.20 (1.10 - 1.30)	<0.001	1.20 (1.09 - 1.33)	<0.001
Q1	1.00 (Reference)		1.00 (Reference)		1.00 (Reference)	
Q2	0.94 (0.56 - 1.58)	0.812	0.77 (0.46 - 1.28)	0.312	0.75 (0.44 - 1.29)	0.303
Q3	1.76 (1.07 - 2.91)	0.027	1.19 (0.71 - 1.98)	0.508	1.17 (0.73 - 1.87)	0.526
Q4	3.16 (1.89 - 5.26)	<0.001	2.17 (1.27 - 3.73)	0.005	2.05 (1.21 - 3.49)	0.008
P trend	<0.001		<0.001		0.002.	
All-cause mortality						
RAR	1.80 (1.51 - 2.15)	<0.001	1.97 (1.62 - 2.39)	<0.001	1.92 (1.51 - 2.44)	<0.001

Variables	Model 1		Model 2		Model 3	
	HR (95%CI)	P	HR (95%CI)	P	HR (95%CI)	P
Categories						
Q1	1.00 (Reference)		1.00 (Reference)		1.00 (Reference)	
Q2	1.83 (1.35 - 2.47)	<0.001	1.51 (1.09 - 2.08)	0.013	1.46 (1.06 - 2.02)	0.022
Q3	2.01 (1.50 - 2.71)	<0.001	1.55 (1.16 - 2.09)	0.004	1.56 (1.14 - 2.13)	0.006
Q4	3.02 (2.23 - 4.09)	<0.001	2.63 (1.87 - 3.71)	<0.001	2.32 (1.62 - 3.32)	<0.001
P trend	<0.001		<0.001		<0.001	
CVD mortality						
RAR	1.98 (1.55 - 2.51)	<0.001	2.22 (1.66 - 2.97)	<0.001	2.31 (1.64 - 3.25)	<0.001
Q1	1.00 (Reference)		1.00 (Reference)		1.00 (Reference)	
Q2	1.70 (0.96 - 3.01)	0.067	1.40 (0.79 - 2.49)	0.253	1.30 (0.76 - 2.22)	0.338
Q3	1.85 (1.07 - 3.22)	0.028	1.42 (0.78 - 2.57)	0.250	1.39 (0.76 - 2.51)	0.282
Q4	4.04 (2.33 - 6.99)	<0.001	3.51 (1.95 - 6.32)	<0.001	3.24 (1.80 - 5.82)	<0.001
P trend	<0.001		<0.001		<0.001	

Note: HR, hazard ratio; CI, confidence interval; CVD, cardiovascular disease; RDW, red cell distribution width; RAR, red blood cell distribution width-to-albumin ratio; PIR, poverty-income ratio; FIB-4, fibrosis-4 index. Q1–Q4, quartiles of RDW or RAR (defined in Table 1 and Table 2). Model 1: Crude (unadjusted). Model 2: Adjusted for gender, age, and race. Model 3: Adjusted for gender, age, race, marital status, education, smoke, physical activity, PIR, hypertension, diabetes, hyperlipidemia, cancer, and FIB-4. P for trend was calculated using the median value of each quartile as a continuous variable.