

Supplemental Materials

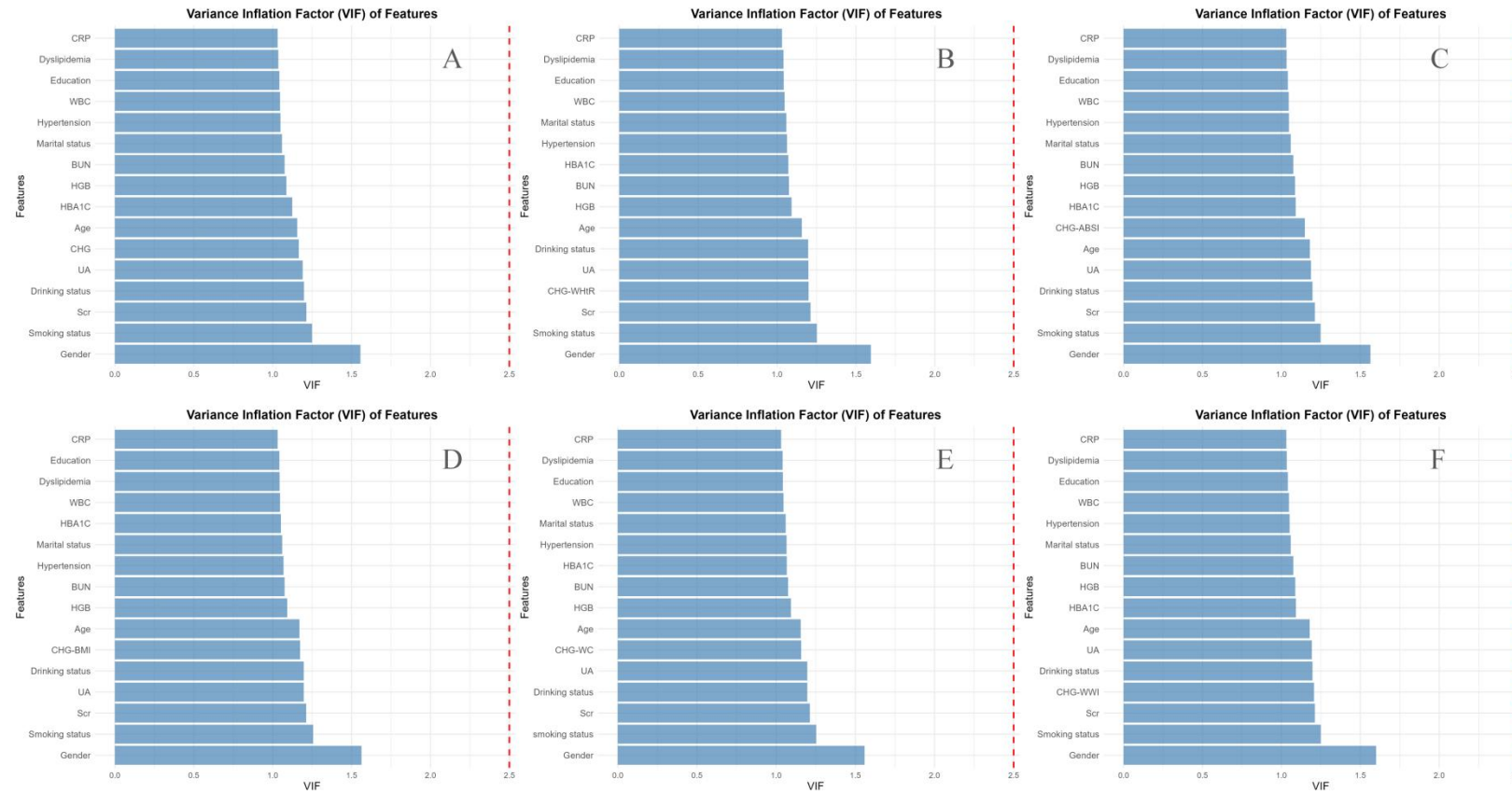


Fig S1. Assessment of multicollinearity using variance inflation factor (VIF) across six exposure models. VIF was calculated for all features included in each of the six models, in which the main exposure was (A) CHG, (B) CHG-WHtR, (C) CHG-ABSI, (D) CHG-BMI, (E) CHG-WC, and (F) CHG-WWI, respectively.

Table S1. Predictive performance of CHG-related indices for incident CMM evaluated by time-dependent AUC and Harrell's C-index

	AUC at 3years	AUC at 7years	C-index
CHG	0.686(0.617-0.756)	0.692(0.665-0.719)	0.676 (0.655-0.698)
CHG-WHtR	0.743(0.683-0.804)	0.726(0.701-0.750)	0.701 (0.681-0.721)
CHG-ABSI	0.683(0.618-0.749)	0.690(0.663-0.716)	0.672 (0.651-0.692)
CHG-BMI	0.746(0.686-0.805)	0.709(0.683-0.736)	0.685 (0.664-0.706)
CHG-WC	0.755(0.698-0.812)	0.727(0.702-0.752)	0.701 (0.681-0.721)
CHG-WWI	0.702(0.637-0.767)	0.706(0.681-0.731)	0.686 (0.666-0.706)

Table S2. Predictive performance of CHG and TyG for cardiometabolic multimorbidity assessed by C-index.

	C-index	P for comparison
TyG	0.641 (0.621-0.662)	Ref
CHG	0.676 (0.655-0.698)	<0.001

Table S3. Associations of the CHG Index and CHG-Related Composite Indices with Incident CMM in different levels of blood pressure Using Multivariable Cox Proportional Hazards Models

	Normal BP(N=3376)		High-normal BP(N=1858)		Grade 1 HTN(N=1316)		Grade 1 HTN(N=441)	
	HR (95%CI)	P	HR (95%CI)	P	HR (95%CI)	P	HR (95%CI)	P
CHG	2.21 (1.56 ~ 3.13)	<0.001	1.94 (1.33 ~ 2.84)	<0.001	1.57 (1.15 ~ 2.14)	0.005	1.09 (0.62 ~ 1.92)	0.767
CHG tertile								
T1	Ref (1.00)		Ref (1.00)		Ref (1.00)		Ref (1.00)	
T2	1.52 (0.98 ~ 2.35)	0.059	1.47 (0.88 ~ 2.46)	0.141	1.25 (0.86 ~ 1.82)	0.235	1.36 (0.73 ~ 2.53)	0.332
T3	2.29 (1.51 ~ 3.48)	<0.001	2.50 (1.53 ~ 4.10)	<0.001	2.04 (1.42 ~ 2.94)	<0.001	1.12 (0.57 ~ 2.19)	0.751
P for trend		<0.001		<0.001		<0.001		0.795

CHG-WHtR	2.51 (1.80 ~ 3.48)	<0.001	2.58 (1.80 ~ 3.71)	<0.001	1.66 (1.25 ~ 2.21)	<0.001	0.86 (0.51 ~ 1.47)	0.586
CHG-WHtR tertile								
T1	Ref (1.00)		Ref (1.00)		Ref (1.00)		Ref (1.00)	
T2	1.27 (0.79 ~ 2.05)	0.319	2.17 (1.25 ~ 3.78)	0.006	1.57 (1.08 ~ 2.28)	0.018	1.28 (0.70 ~ 2.35)	0.42
T3	2.86 (1.84 ~ 4.43)	<0.001	3.68 (2.13 ~ 6.36)	<0.001	2.01 (1.37 ~ 2.96)	<0.001	0.71 (0.35 ~ 1.45)	0.348
P for trend		<0.001		<0.001		<0.001		0.277
CHG-ABSI	1.85 (1.35 ~ 2.54)	<0.001	1.60 (1.15 ~ 2.21)	0.005	1.79 (1.37 ~ 2.34)	<0.001	0.99 (0.60 ~ 1.64)	0.982
CHG-ABSI tertile								
T1	Ref (1.00)		Ref (1.00)		Ref (1.00)		Ref (1.00)	
T2	1.45 (0.92 ~ 2.26)	0.107	1.85 (1.13 ~ 3.05)	0.015	1.83 (1.25 ~ 2.66)	0.002	0.86 (0.48 ~ 1.52)	0.601
T3	2.42 (1.59 ~ 3.70)	<0.001	2.42 (1.48 ~ 3.95)	<0.001	2.34 (1.60 ~ 3.42)	<0.001	0.79 (0.42 ~ 1.49)	0.466
P for trend		<0.001		<0.001		<0.001		0.465
CHG-BMI	1.02 (1.01 ~ 1.02)	<0.001	1.02 (1.01 ~ 1.03)	<0.001	1.01 (1.01 ~ 1.01)	0.021	1.00 (0.99 ~ 1.01)	0.666
CHG-BMI tertile								
T1	Ref (1.00)		Ref (1.00)		Ref (1.00)		Ref (1.00)	
T2	1.43 (0.91 ~ 2.24)	0.124	1.61 (0.94 ~ 2.77)	0.083	0.80 (0.55 ~ 1.15)	0.228	1.91 (0.98 ~ 3.72)	0.056
T3	2.81 (1.84 ~ 4.28)	<0.001	3.25 (1.94 ~ 5.46)	<0.001	1.39 (0.97 ~ 1.98)	0.074	1.12 (0.53 ~ 2.36)	0.76
P for trend		<0.001		<0.001		0.028		0.93
CHG-WC	1.01 (1.01 ~ 1.01)	<0.001	1.01 (1.01 ~ 1.01)	<0.001	1.01 (1.01 ~ 1.01)	<0.001	1.00 (1.00 ~ 1.00)	0.755
CHG-WC tertile								
T1	Ref (1.00)		Ref (1.00)		Ref (1.00)		Ref (1.00)	
T2	1.81 (1.14 ~ 2.87)	0.012	2.62 (1.45 ~ 4.74)	0.001	1.18 (0.81 ~ 1.73)	0.39	1.39 (0.75 ~ 2.59)	0.299
T3	2.99 (1.92 ~ 4.65)	<0.001	4.58 (2.59 ~ 8.12)	<0.001	2.04 (1.41 ~ 2.95)	<0.001	0.88 (0.44 ~ 1.75)	0.715
P for trend		<0.001		<0.001				0.563
CHG-WWI	1.05 (1.03 ~ 1.07)	<0.001	1.04 (1.02 ~ 1.07)	<0.001	1.04 (1.02 ~ 1.06)	<0.001	0.99 (0.96 ~ 1.03)	0.757
CHG-WWI tertile								

T1	Ref (1.00)		Ref (1.00)		Ref (1.00)		Ref (1.00)	
T2	1.31 (0.81 ~ 2.10)	0.267	2.12 (1.25 ~ 3.62)	0.005	2.06 (1.39 ~ 3.05)	<0.001	0.94 (0.53 ~ 1.69)	0.84
T3	2.79 (1.80 ~ 4.33)	<0.001	3.07 (1.81 ~ 5.23)	<0.001	2.58 (1.73 ~ 3.86)	<0.001	0.69 (0.35 ~ 1.37)	0.287
P for trend		<0.001		<0.001		<0.001		0.293

HR: Hazard Ratio, CI: Confidence Interval

Model: Adjust: gender, marital status, education, smoking status, drinking status, age, Dyslipidemia, WBC, BUN, Scr, CRP, HbA1c, UA, HGB.

Table S4. Fine-Gray competing risk analysis of the association between CHG-related indices and incident cardiometabolic multimorbidity

	Model1		Model2		Model3	
	sHR (95%CI)	P	sHR (95%CI)	P	sHR (95%CI)	P
CHG	3.25 (2.86-3.70)	<0.001	3.20 (2.81-3.66)	<0.001	1.78 (1.49-2.13)	<0.001
CHG tertile						
T1 (2.67-5.11)	Ref(1.00)		Ref(1.00)		Ref(1.00)	
T2 (5.11-5.45)	1.71 (1.35-2.17)	<0.001	1.68 (1.33-2.14)	<0.001	1.44 (1.14-1.84)	0.003
T3 (5.45-7.96)	3.86 (3.12-4.78)	<0.001	3.78 (3.06-4.67)	<0.001	2.25 (1.79-2.84)	<0.001
P for trend		<0.001		<0.001		<0.001
CHG-WHtR	3.60 (3.18-4.08)	<0.001	3.58 (3.14-4.09)	<0.001	1.94 (1.64-2.29)	<0.001
CHG-WHtR tertile						
T1 (1.58-2.63)	Ref(1.00)		Ref(1.00)		Ref(1.00)	
T2 (2.63-3.06)	2.26 (1.75-2.91)	<0.001	2.23 (1.73-2.88)	<0.001	1.83 (1.41-2.36)	<0.001
T3 (3.06-5.42)	5.01 (3.97-6.32)	<0.001	4.89 (3.85-6.20)	<0.001	2.68 (2.06-3.48)	<0.001
P for trend		<0.001		<0.001		<0.001
CHG-ABSI	2.76 (2.45-3.10)	<0.001	2.73 (2.42-3.09)	<0.001	1.65 (1.41-1.92)	<0.001

CHG-ABSI tertile						
T1 (2.53-4.20)	Ref(1.00)		Ref(1.00)		Ref(1.00)	
T2 (4.20-4.60)	1.79 (1.42-2.26)	<0.001	1.78 (1.41-2.24)	<0.001	1.50 (1.19-1.89)	<0.001
T3 (4.60-7.30)	3.61 (2.93-4.46)	<0.001	3.55 (2.86-4.41)	<0.001	2.16 (1.72-2.72)	<0.001
P for trend		<0.001		<0.001		<0.001
CHG-BMI	1.02 (1.02-1.03)	<0.001	1.02 (1.02-1.03)	<0.001	1.01 (1.01-1.02)	<0.001
CHG-BMI tertile						
T1 (46.75-111.16)	Ref(1.00)		Ref(1.00)		Ref(1.00)	
T2 (111.16-132.99)	1.79 (1.40-2.29)	<0.001	1.85 (1.44-2.36)	<0.001	1.53 (1.20-1.96)	<0.001
T3 (132.99-251.14)	4.30 (3.46-5.34)	<0.001	4.42 (3.54-5.51)	<0.001	.44 (1.91-3.13)	<0.001
P for trend		<0.001		<0.001		<0.001
CHG-WC	1.01 (1.01-1.01)	<0.001	1.01 (1.01-1.01)	<0.001	1.01 (1.00-1.01)	<0.001
CHG-WC tertile						
T1 (229.46-413.37)	Ref(1.00)		Ref(1.00)		Ref(1.00)	
T2 (413.37-481.42)	2.73 (2.10-3.55)	<0.001	2.70 (2.07-3.50)	<0.001	2.28 (1.75-2.97)	<0.001
T3 (481.42-833.69)	5.68 (4.45-7.25)	<0.001	5.54 (4.34-7.07)	<0.001	3.13 (2.40-4.09)	<0.001
P for trend		<0.001		<0.001		<0.001
CHG-WWI	1.08 (1.07-1.09)	<0.001	1.08 (1.07-1.09)	<0.001	1.04 (1.03-1.05)	<0.001
CHG-WWI tertile						
T1 (35.19-56.05)	Ref(1.00)		Ref(1.00)		Ref(1.00)	
T2 (56.05-62.20)	2.27 (1.77-2.91)	<0.001	2.25 (1.76-2.89)	<0.001	1.89 (1.48-2.43)	<0.001
T3 (62.20-98.52)	4.60 (3.66-5.78)	<0.001	4.57 (3.61-5.79)	<0.001	2.61 (2.01-3.37)	<0.001
P for trend		<0.001		<0.001		<0.001

sHR: subdistribution hazard ratio; CI: confidence interval.

Model 1: Crude

Model 2: Adjust: gender, marital status, education, smoking status, drinking status, age

Model 3: Adjust: gender, marital status, education, smoking status, drinking status, age, Hypertension, Dyslipidemia, WBC, BUN, Scr, CRP, HBA1C, UA, HGB.

Table S5. Sensitivity analysis of the association between CHG-related composite indices and incident CMM among participants free of diabetes, heart disease, or stroke at baseline.

	Model1		Model2		Model3	
	HR (95%CI)	<i>P</i>	HR (95%CI)	<i>P</i>	HR (95%CI)	<i>P</i>
CHG	3.35 (2.72 ~ 4.12)	<0.001	2.81 (2.26 ~ 3.48)	<0.001	1.94 (1.51 ~ 2.50)	<0.001
CHG tertile						
T1	Ref (1.00)		Ref (1.00)		Ref (1.00)	
T2	2.02 (1.45 ~ 2.81)	<0.001	1.91 (1.37 ~ 2.66)	<0.001	1.75 (1.25 ~ 2.45)	0.001
T3	3.88 (2.85 ~ 5.27)	<0.001	3.27 (2.39 ~ 4.47)	<0.001	2.55 (1.84 ~ 3.52)	<0.001
P for trend		<0.001		<0.001		<0.001
CHG-WHtR	3.74 (3.09 ~ 4.53)	<0.001	3.06 (2.49 ~ 3.77)	<0.001	2.27 (1.80 ~ 2.86)	<0.001
CHG-WHtR tertile						
T1	Ref (1.00)		Ref (1.00)		Ref (1.00)	
T2	2.17 (1.51 ~ 3.10)	<0.001	2.00 (1.39 ~ 2.87)	<0.001	1.85 (1.29 ~ 2.67)	<0.001
T3	5.03 (3.63 ~ 6.98)	<0.001	4.09 (2.91 ~ 5.76)	<0.001	3.23 (2.26 ~ 4.61)	<0.001
P for trend		<0.001		<0.001		<0.001
CHG-ABSI	2.89 (2.41 ~ 3.48)	<0.001	2.51 (2.07 ~ 3.03)	<0.001	1.86 (1.49 ~ 2.31)	<0.001
CHG-ABSI tertile						
T1	Ref (1.00)		Ref (1.00)		Ref (1.00)	
T2	1.80 (1.30 ~ 2.47)	<0.001	1.66 (1.20 ~ 2.29)	0.002	1.53 (1.11 ~ 2.12)	0.009
T3	3.46 (2.58 ~ 4.64)	<0.001	2.88 (2.13 ~ 3.88)	<0.001	2.21 (1.61 ~ 3.02)	<0.001
P for trend		<0.001		<0.001		<0.001

CHG-BMI	1.02 (1.02 ~ 1.03)	<0.001	1.02 (1.01 ~ 1.02)	<0.001	1.01 (1.01 ~ 1.02)	<0.001
CHG-BMI tertile						
T1	Ref (1.00)		Ref (1.00)		Ref (1.00)	
T2	1.38 (0.99 ~ 1.93)	0.058	1.31 (0.93 ~ 1.84)	0.117	1.29 (0.92 ~ 1.81)	0.147
T3	3.65 (2.73 ~ 4.89)	<0.001	2.96 (2.18 ~ 4.03)	<0.001	2.54 (1.84 ~ 3.51)	<0.001
P for trend		<0.001		<0.001		<0.001
CHG-WC	1.01 (1.01 ~ 1.01)	<0.001	1.01 (1.01 ~ 1.01)	<0.001	1.01 (1.01 ~ 1.01)	<0.001
CHG-WC tertile						
T1	Ref (1.00)		Ref (1.00)		Ref (1.00)	
T2	2.95 (2.03 ~ 4.30)	<0.001	2.74 (1.88 ~ 3.99)	<0.001	2.58 (1.77 ~ 3.77)	<0.001
T3	5.83 (4.09 ~ 8.30)	<0.001	4.67 (3.25 ~ 6.71)	<0.001	3.79 (2.60 ~ 5.50)	<0.001
P for trend		<0.001		<0.001		<0.001
CHG-WWI	1.08 (1.07 ~ 1.10)	<0.001	1.07 (1.06 ~ 1.09)	<0.001	1.05 (1.03 ~ 1.07)	<0.001
CHG-WWI tertile						
T1	Ref (1.00)		Ref (1.00)		Ref (1.00)	
T2	2.39 (1.68 ~ 3.39)	<0.001	2.21 (1.55 ~ 3.15)	<0.001	2.04 (1.43 ~ 2.91)	<0.001
T3	4.78 (3.45 ~ 6.61)	<0.001	4.00 (2.85 ~ 5.61)	<0.001	3.09 (2.18 ~ 4.40)	<0.001
P for trend		<0.001		<0.001		<0.001

HR: Hazard Ratio, CI: Confidence Interval

Model1: Crude

Model2: Adjust: gender, age, marital status, education, smoking status, drinking status

Model3: Adjust:gender, age, marital status, education, smoking status, drinking status, Hypertension, Dyslipidemia, WBC, BUN, Scr, CRP, HBA1C, UA, HGB.

Table S6. Sensitivity analysis of the association between CHG-related composite indices and incident CMM among participants free of baseline chronic conditions (hypertension, dyslipidemia, diabetes, heart disease, or stroke).

	Model1		Model2		Model3	
	HR (95%CI)	<i>P</i>	HR (95%CI)	<i>P</i>	HR (95%CI)	<i>P</i>
CHG	3.97 (2.98 ~ 5.29)	<0.001	4.07 (3.03 ~ 5.46)	<0.001	2.85 (2.03 ~ 4.00)	<0.001
CHG tertile						
T1	Ref (1.00)		Ref (1.00)		Ref (1.00)	
T2	1.62 (1.04 ~ 2.52)	0.034	1.62 (1.04 ~ 2.52)	0.034	1.49 (0.95 ~ 2.33)	0.08
T3	3.56 (2.39 ~ 5.30)	<0.001	3.56 (2.39 ~ 5.31)	<0.001	2.84 (1.87 ~ 4.29)	<0.001
P for trend		<0.001		<0.001		<0.001
CHG-WHtR	4.25 (3.20 ~ 5.64)	<0.001	4.34 (3.23 ~ 5.84)	<0.001	3.39 (2.46 ~ 4.68)	<0.001
CHG-WHtR tertile						
T1	Ref (1.00)		Ref (1.00)		Ref (1.00)	
T2	1.89 (1.16 ~ 3.09)	0.011	1.93 (1.18 ~ 3.17)	0.009	1.83 (1.12 ~ 3.01)	0.017
T3	5.06 (3.27 ~ 7.84)	<0.001	5.13 (3.28 ~ 8.04)	<0.001	4.27 (2.69 ~ 6.79)	<0.001
P for trend		<0.001		<0.001		<0.001
CHG-ABSI	3.17 (2.45 ~ 4.11)	<0.001	3.06 (2.33 ~ 4.01)	<0.001	2.29 (1.70 ~ 3.09)	<0.001
CHG-ABSI tertile						
T1	Ref (1.00)		Ref (1.00)		Ref (1.00)	
T2	1.69 (1.08 ~ 2.63)	0.02	1.68 (1.08 ~ 2.63)	0.022	1.58 (1.01 ~ 2.47)	0.044
T3	3.72 (2.50 ~ 5.55)	<0.001	3.56 (2.37 ~ 5.35)	<0.001	2.81 (1.85 ~ 4.28)	<0.001
P for trend		<0.001		<0.001		<0.001
CHG-BMI	1.02 (1.02 ~ 1.03)	<0.001	1.02 (1.02 ~ 1.03)	<0.001	1.02 (1.02 ~ 1.03)	<0.001
CHG-BMI tertile						
T1	Ref (1.00)		Ref (1.00)		Ref (1.00)	
T2	1.29 (0.82 ~ 2.02)	0.264	1.40 (0.89 ~ 2.20)	0.142	1.36 (0.87 ~ 2.15)	0.179
T3	3.36 (2.28 ~ 4.95)	<0.001	3.78 (2.55 ~ 5.62)	<0.001	3.22 (2.13 ~ 4.85)	<0.001

P for trend		<0.001		<0.001		<0.001
CHG-WC	1.01 (1.01 ~ 1.01)	<0.001	1.01 (1.01 ~ 1.01)	<0.001	1.01 (1.01 ~ 1.01)	<0.001
CHG-WC tertile						
T1	Ref (1.00)		Ref (1.00)		Ref (1.00)	
T2	2.45 (1.51 ~ 3.97)	<0.001	2.49 (1.54 ~ 4.03)	<0.001	2.34 (1.44 ~ 3.80)	<0.001
T3	4.85 (3.10 ~ 7.60)	<0.001	4.94 (3.15 ~ 7.75)	<0.001	4.10 (2.58 ~ 6.51)	<0.001
P for trend		<0.001		<0.001		<0.001
CHG-WWI	1.09 (1.07 ~ 1.11)	<0.001	1.09 (1.07 ~ 1.11)	<0.001	1.07 (1.05 ~ 1.09)	<0.001
CHG-WWI tertile						
T1	Ref (1.00)		Ref (1.00)		Ref (1.00)	
T2	1.62 (1.01 ~ 2.62)	0.046	1.64 (1.01 ~ 2.65)	0.044	1.50 (0.93 ~ 2.43)	0.097
T3	4.66 (3.07 ~ 7.06)	<0.001	4.65 (3.02 ~ 7.16)	<0.001	3.72 (2.38 ~ 5.81)	<0.001
P for trend		<0.001		<0.001		<0.001

HR: Hazard Ratio, CI: Confidence Interval

Model1: Crude

Model2: Adjust: gender, age, marital status, education, smoking status, drinking status

Model3: Adjust: gender, age, marital status, education, smoking status, drinking status, WBC, BUN, Scr, CRP, HBA1C, UA, HGB.