

Supplementary Online Content

Changes in the estimated glucose disposal rate and cardiometabolic multimorbidity in middle-aged and older adults

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eTable 1. Schoenfeld residuals tests for analyzing eGDR metrics with cardiometabolic multimorbidity.

Exposures	Multivariable-adjusted models	
	Chisq Statistics	P value
Cumulative eGDR	1.04	0.793
Change of eGDR	2.24	0.525

Age, sex, residence, household expend, marriage, education level, BMI level, smoking status, current drinking, sleep duration, and renal function measured by eGFR were adjusted in the multivariable-adjusted models.

eTable 2. Association of cumulative eGDR and eGDR change with incident cardiovascular disease.

Exposures	Age-adjusted model		Multivariable-adjusted model	
	HR (95% CI)	P value	HR (95% CI)	P value
Cumulative eGDR				
Quartile 4	1 (ref)			
Quartile 3	1.13(0.88-1.44)	0.351	1.12(0.87-1.43)	0.391
Quartile 2	1.46(1.16-1.85)	0.001	1.37(1.06-1.76)	0.015
Quartile 1	1.81(1.45-2.25)	<0.001	1.67(1.31-2.13)	<0.001
Change of eGDR				
High-High	1 (ref)			
Moderate-Moderate	1.3(1.07-1.58)	0.009	1.19(0.95-1.47)	0.124
Low-Low	1.78(1.45-2.19)	<0.001	1.61(1.28-2.02)	<0.001
Moderate-Low	1.77(1.38-2.26)	<0.001	1.68(1.3-2.16)	<0.001

Abbreviations: HR, hazard ratio; CI, confidence interval; BMI, body mass index; eGDR, estimated glucose disposal rate.

Age, sex, residence, household expend, marriage, education level, BMI level, smoking status, current drinking, sleep duration, and renal function measured by eGFR were adjusted in the multivariable-adjusted models.

eTable 3. Association of cumulative eGDR and eGDR change with incident diabetes.

Exposures	Age-adjusted model		Multivariable-adjusted model	
	HR (95% CI)	P value	HR (95% CI)	P value
Cumulative eGDR				
Quartile 4	1 (ref)			
Quartile 3	1.40(0.92-2.14)	0.112	1.27(0.83-1.95)	0.268
Quartile 2	1.93(1.30-2.86)	0.001	1.38(0.89-2.14)	0.15
Quartile 1	2.40(1.65-3.50)	<0.001	1.61(1.05-2.47)	0.03
Change of eGDR				
High-High	1 (ref)			
Moderate-Moderate	1.85(1.35-2.53)	<0.001	1.36(0.95-1.95)	0.088
Low-Low	2.24(1.60-3.15)	<0.001	1.56(1.06-2.29)	0.023
Moderate-Low	1.93(1.27-2.92)	0.002	1.51(1.08-2.34)	0.043

Abbreviations: HR, hazard ratio; CI, confidence interval; BMI, body mass index; eGDR, estimated glucose disposal rate.

Age, sex, residence, household expend, marriage, education level, BMI level, smoking status, current drinking, sleep duration, and renal function measured by eGFR were adjusted in the multivariable-adjusted models.

eTable 4. Subgroup associations of cumulative eGDR and incident cardiometabolic multimorbidity.

	HR (95% CI)		P for interaction
Cumulative eGDR	Age <65	Age >65	0.268
Quartile 3	1.06 (0.80, 1.40)	1.47 (1.04, 2.10)	
Quartile 2	1.64 (1.26, 2.13)	1.52 (1.08, 2.14)	
Quartile 1	1.91 (1.48, 2.47)	2.11 (1.56, 2.86)	
	Female	Male	0.125
Quartile 3	1.15 (0.86, 1.55)	1.22 (0.87, 1.70)	
Quartile 2	1.30 (0.98, 1.72)	1.96 (1.44, 2.67)	
Quartile 1	1.62 (1.24, 2.11)	2.29 (1.71, 3.07)	
	BMI<23.9	BMI>23.9	0.937
Quartile 3	1.15 (0.91, 1.47)	1.11 (0.47, 2.61)	
Quartile 2	1.43 (1.10, 1.88)	1.42 (0.63, 3.22)	
Quartile 1	1.61 (1.25, 2.08)	1.81 (0.80, 4.09)	
	Married	Others	0.914
Quartile 3	1.17 (0.92, 1.49)	1.28 (0.74, 2.22)	
Quartile 2	1.60 (1.28, 2.00)	1.40 (0.80, 2.45)	
Quartile 1	1.95 (1.58, 2.42)	1.75 (1.06, 2.87)	
	Non-smoking	Current smoking	0.964
Quartile 3	1.17 (0.89, 1.53)	1.22 (0.83, 1.81)	
Quartile 2	1.50 (1.17, 1.92)	1.74 (1.19, 2.54)	
Quartile 1	1.87 (1.48, 2.36)	1.90 (1.32, 2.73)	
	Rural	Urban	0.666
Quartile 3	1.20 (0.95, 1.51)	1.04 (0.47, 2.29)	
Quartile 2	1.65 (1.33, 2.04)	1.11 (0.52, 2.36)	
Quartile 1	1.95 (1.59, 2.39)	1.58 (0.76, 3.31)	

Age, sex, residence, household expend, marriage, education level, BMI level, smoking status, current drinking, sleep duration, and renal function measured by eGFR were adjusted in the multivariable-adjusted models, if not stratified.

eTable 5. Subgroup associations of eGDR change and incident cardiometabolic multimorbidity.

	HR (95% CI)		P for interaction
Cumulative eGDR	Age <65	Age >65	0.996
Quartile 3	1.48 (1.19, 1.84)	1.45 (1.09, 1.94)	
Quartile 2	1.94 (1.53, 2.47)	1.99 (1.50, 2.63)	
Quartile 1	1.84 (1.37, 2.46)	1.81 (1.29, 2.53)	
	Female	Male	0.168
Quartile 3	1.24 (0.99, 1.56)	1.70 (1.31, 2.21)	
Quartile 2	1.61 (1.26, 2.06)	2.21 (1.68, 2.91)	
Quartile 1	1.47 (1.08, 1.99)	2.25 (1.63, 3.10)	
	BMI<23.9	BMI>23.9	0.983
Quartile 3	1.26 (0.99, 1.61)	1.28 (0.86, 1.90)	
Quartile 2	1.68 (1.29, 2.18)	1.65 (1.10, 2.48)	
Quartile 1	1.60 (1.20, 2.12)	1.72 (1.09, 2.70)	
	Married	Others	0.358
Quartile 3	1.49 (1.23, 1.79)	1.18 (0.73, 1.89)	
Quartile 2	1.89 (1.55, 2.31)	1.78 (1.13, 2.79)	
Quartile 1	1.96 (1.54, 2.48)	1.15 (0.65, 2.05)	
	Non-smoking	Current smoking	0.955
Quartile 3	1.39 (1.13, 1.71)	1.50 (1.08, 2.08)	
Quartile 2	1.82 (1.46, 2.25)	1.91 (1.34, 2.72)	
Quartile 1	1.69 (1.31, 2.20)	2.00 (1.32, 3.02)	
	Rural	Urban	0.774
Quartile 3	1.48 (1.23, 1.77)	1.26 (0.69, 2.29)	
Quartile 2	1.91 (1.58, 2.31)	1.60 (0.82, 3.14)	
Quartile 1	1.77 (1.40, 2.22)	2.12 (0.97, 4.63)	

Age, sex, residence, household expend, marriage, education level, BMI level, smoking status, current drinking, sleep duration, and renal function measured by eGFR were adjusted in the multivariable-adjusted models, if not stratified.

eTable 6. Association of cumulative eGDR and eGDR change with cardiometabolic multimorbidity further adjusting for dyslipidemia and medication use for hypertension and dyslipidemia.

	Multivariable-adjusted model + dyslipidemia and medication use	
	HR (95% CI)	P value
Cumulative eGDR		
Quartile 4		
Quartile 3	1.14(0.91-1.43)	0.241
Quartile 2	1.35(1.08-1.70)	0.009
Quartile 1	1.39(1.06-1.82)	0.017
Change of eGDR		
High-High		
Moderate-Moderate	1.25(1.04-1.52)	0.020
Low-Low	1.42(1.09-1.84)	0.009
Moderate-Low	1.48(1.13-1.94)	0.005

Age, sex, residence, household expend, marriage, education level, BMI level, smoking status, current drinking, sleep duration, and renal function measured by eGFR were adjusted in the multivariable-adjusted models.

eTable 7. Cumulative eGDR and eGDR change and incident cardiometabolic multimorbidity considering the competing risk of death.

	Multivariable-adjusted model	
	HR (95% CI)	P value
Cumulative eGDR		
Quartile 4		
Quartile 3	1.13(0.91-1.39)	0.270
Quartile 2	1.50(1.22-1.86)	<0.001
Quartile 1	2.00(1.63-2.45)	<0.001
Change of eGDR		
High-High		
Moderate-Moderate	1.37(1.14-1.64)	0.001
Low-Low	2.01(1.66-2.42)	<0.001
Moderate-Low	1.83(1.48-2.26)	<0.001

Age, sex, residence, household expend, marriage, education level, BMI level, smoking status, current drinking, sleep duration, and renal function measured by eGFR were adjusted in the multivariable-adjusted models.

eTable 8. Cumulative eGDR and eGDR change and incident cardiometabolic multimorbidity excluding cases occurring within a short follow-up period.

	Multivariable-adjusted model	
	HR (95% CI)	P value
Cumulative eGDR		
Quartile 4		
Quartile 3	1.30(0.98-1.73)	0.070
Quartile 2	1.52(1.14-2.04)	0.005
Quartile 1	1.98(1.49-2.62)	<0.001
Change of eGDR		
High-High		
Moderate-Moderate	1.42(1.11-1.82)	0.005
Low-Low	1.96(1.52-2.54)	<0.001
Moderate-Low	1.79(1.33-2.40)	<0.001

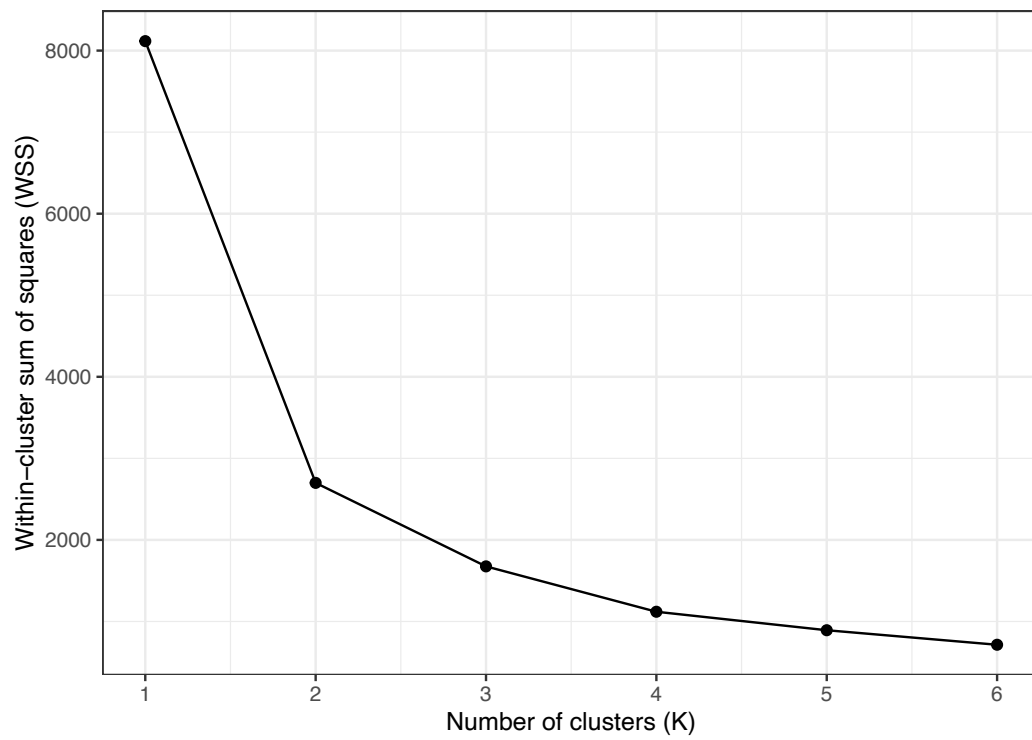
Age, sex, residence, household expend, marriage, education level, BMI level, smoking status, current drinking, sleep duration, and renal function measured by eGFR were adjusted in the multivariable-adjusted models.

eTable 9. The predictive performance of eGDR metrics and cardiometabolic multimorbidity risk evaluated through ROC curve analysis, NRI, and IDI.

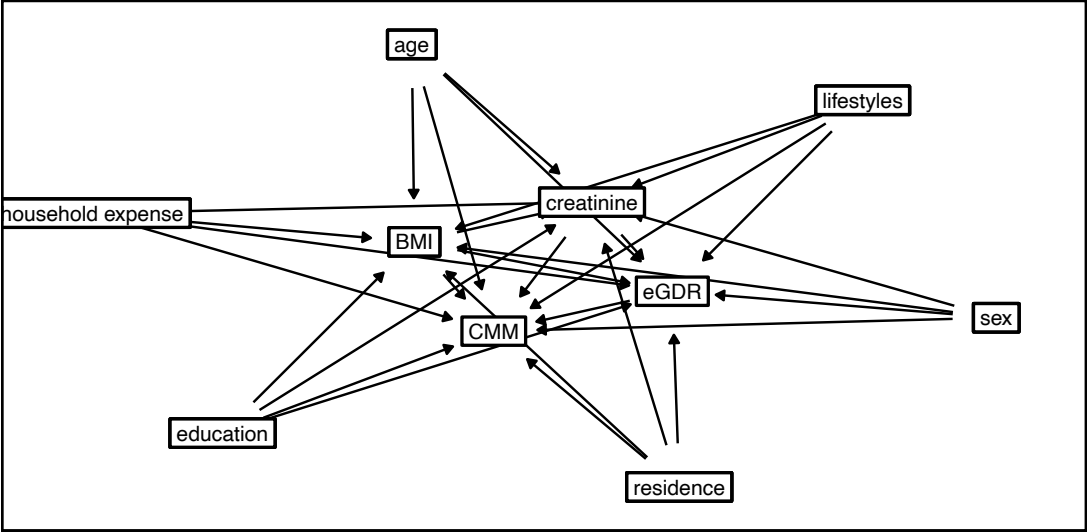
	AUC (95% CI)	NRI (95% CI)	IDI (95% CI)
Basic model	0.592 (0.566-0.618)		
plus cumulative eGDR	0.625 (0.599-0.651)	0.127 (0.062-0.182)	0.015 (0.010-0.030)
plus eGDR change	0.632 (0.606-0.658)	0.147 (0.078-0.188)	0.017 (0.011-0.032)

The basic model was adjusted for age, sex, residence, household expenditure, marital status, educational level, BMI, smoking status, current drinking, sleep duration, and renal function.

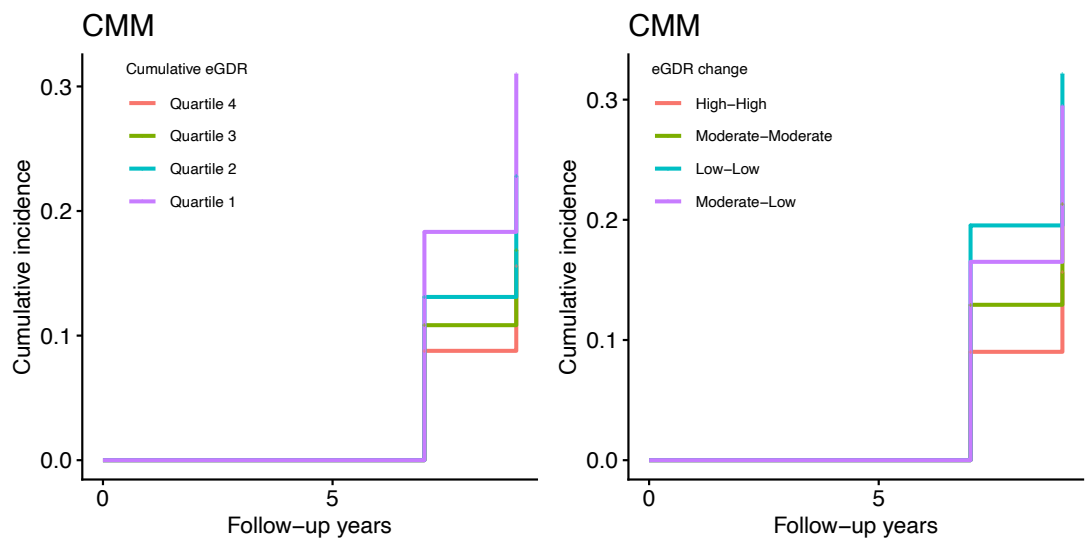
eFigure 1. Elbow Plot for Determining Optimal Number of Clusters (Within-Cluster Sum of Squares)



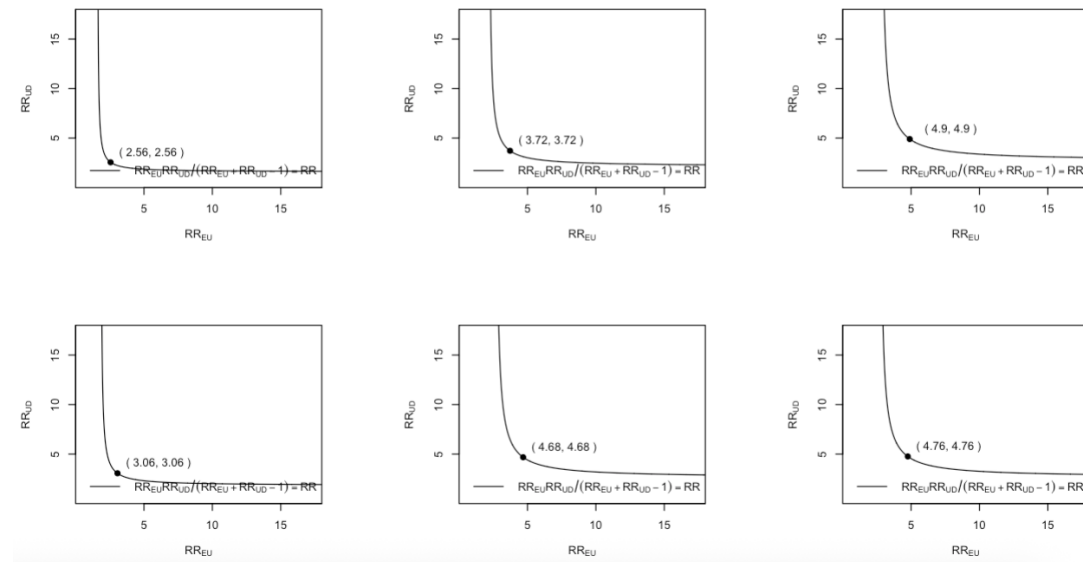
eFigure 2. Minimal confounding set of covariates included in the analysis



eFigure 3. Cumulative incidence of cardiometabolic multimorbidity (CMM) according to cumulative eGDR and eGDR change.



eFigure 4. Unmeasured Bias Analysis by E-value Method.



eFigure 5. Receiver operating characteristic curves for cardiometabolic multimorbidity prediction. The basic model was adjusted for age, sex, residence, household expenditure, marital status, educational level, BMI, smoking status, current drinking, sleep duration, and renal function.

