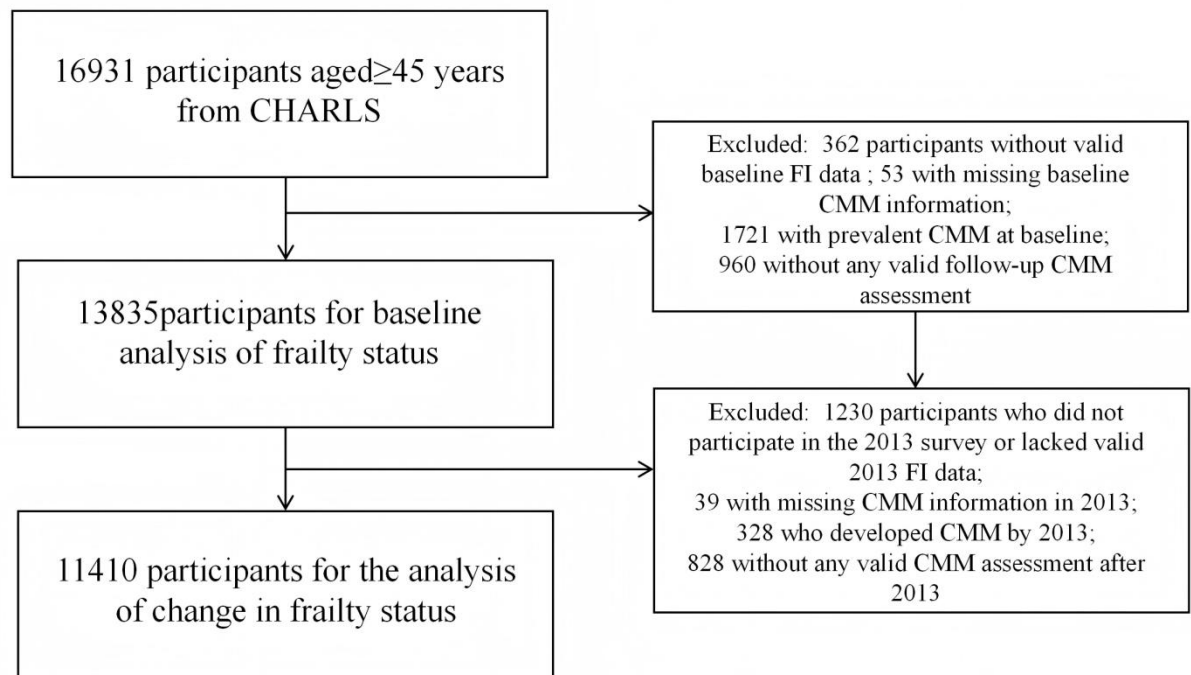
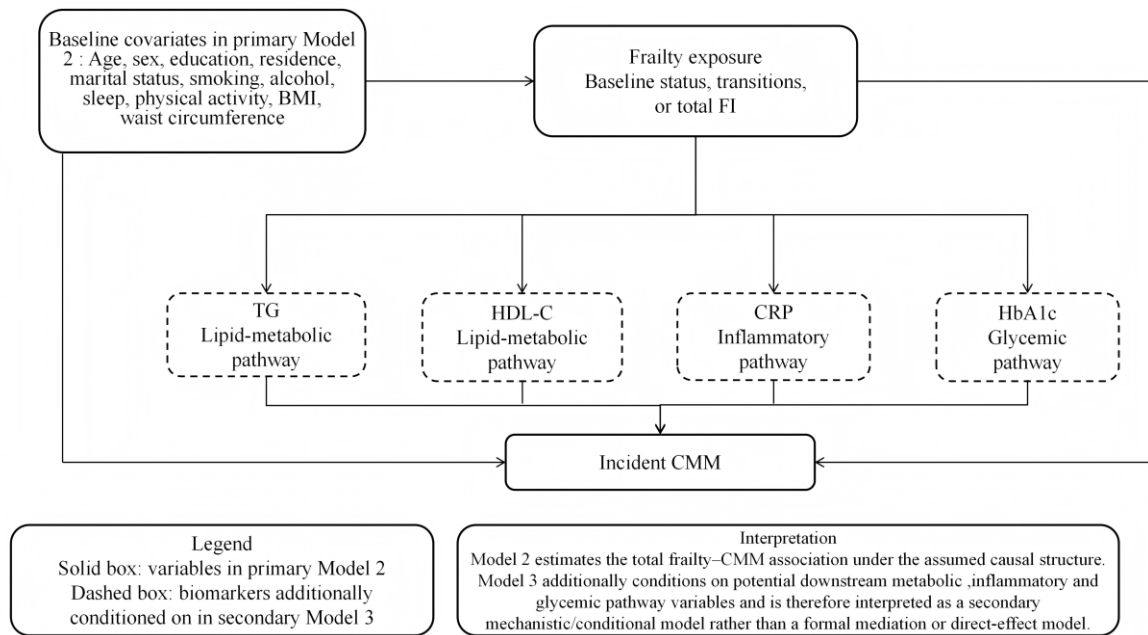




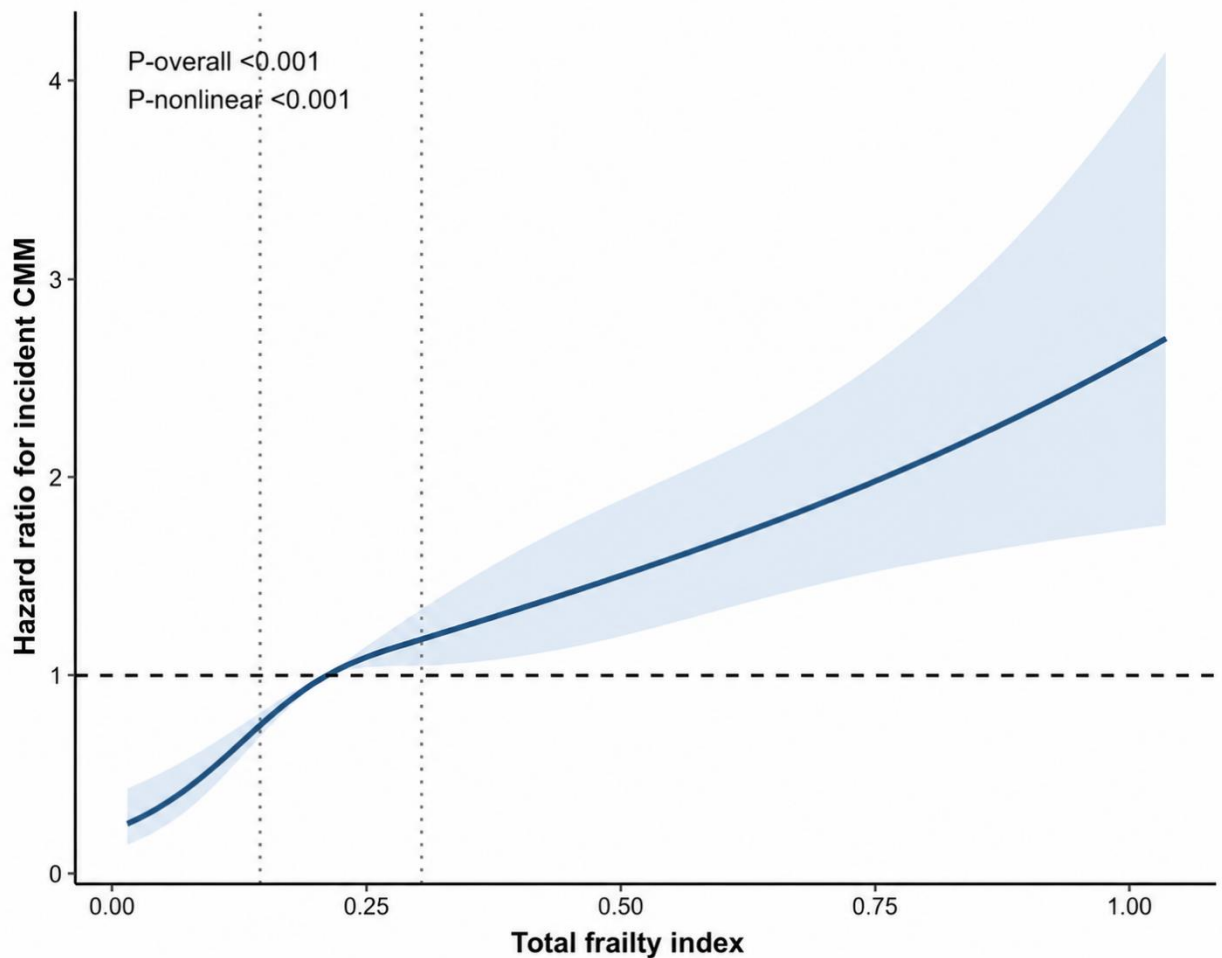
Supplementary Figure S1. Flowchart of participant selection.

The flowchart shows the derivation of the baseline frailty-analysis cohort comprising 13,835 participants and the frailty-transition and total frailty index analysis cohort comprising 11,410 participants. CHARLS, China Health and Retirement Longitudinal Study; CMM, cardiometabolic multimorbidity; FI, frailty index.



Supplementary Figure S2. Assumed directed acyclic graph for covariate adjustment and model interpretation.

Arrows represent assumed causal relationships based on prior evidence and subject-matter knowledge rather than associations estimated from the present data. Solid boxes indicate variables included in primary Model 2, whereas dashed boxes indicate biomarkers additionally included in secondary Model 3. Model 2 was intended to estimate the total association between frailty and incident CMM after adjustment for prespecified baseline covariates. Model 3 additionally conditioned on TG, HDL-C, CRP, and HbA1c, which were considered potential downstream lipid-metabolic, inflammatory, and glycemic pathway variables. Accordingly, Model 3 was interpreted as a secondary mechanistic/conditional model rather than a formal mediation or direct-effect model. BMI, body mass index; CMM, cardiometabolic multimorbidity; CRP, C-reactive protein; FI, frailty index; HbA1c, glycated hemoglobin; HDL-C, high-density lipoprotein cholesterol; TG, triglycerides.



Supplementary Figure S3. Restricted cubic spline association between total frailty index and incident cardiometabolic multimorbidity.

The solid curve represents the hazard ratio, and the shaded area represents the 95% confidence interval. Estimates were obtained from primary Model 2, adjusted for age, sex, education, residence, marital status, smoking, alcohol intake, sleep duration, physical activity, body mass index, and waist circumference. Four knots were placed at the 5th, 35th, 65th, and 95th percentiles of total FI, with the median value of 0.211 as the reference. The vertical dotted lines indicate tertile cut-off values of 0.145 and 0.304, and the horizontal dashed line indicates an HR of 1. CMM, cardiometabolic multimorbidity; FI, frailty index; HR, hazard ratio