

## SUPPLEMENTARY METHOD

### Covariates

**Sociodemographic characteristics:** (1) Age (years). (2) Sex (men/women). (3) Marital status (married or not). Marital status was classified into 2 groups: married and other marital status (never married, separated, divorced, widowed and never married). (4) Living place (urban or rural, only available in CHARLS). (5) Education (received education or not). (6) Household income (having household income or not).

**The health behaviors:** (1) Smoking (nonsmoker, former smoker, and current smoker). (2) Leisure physical activity (doing any vigorous physical activity or exercise or not). (3) Alcohol consumption are divided into ever drinks any alcohol before or not. “ Ever drinking ” means that the respondent reports ever having had any alcohol, and “ never drinking ” means that the respondent reported not having any kind of alcohol in the past.

**Other potential confounders:** (1) Body mass index was calculated as the weight in kg divided by height in m<sup>2</sup>. (2) Self-reported or regular use of any related medications (only in CHARLS) were defined as hypertension, cancer and diabetes.

**Supplementary Table S1.** The numbers (percentages) of participants with missing covariates in CHARLS

Covariates	<i>n</i>	%
Age	17	0.19
Smoke	1	0.01
Drink	6	0.07
Bmi	1,060	11.96
Cancer	26	0.29
Diabetes	64	0.72
Hypertension	40	0.45

**Supplementary Table S2.** The numbers (percentages) of participants with missing covariates in HRS

Covariates	<i>n</i>	%
smoke	24	0.33
bmi	69	0.95
cancer	252	3.46
diabetes	360	4.94
hypertension	1,718	23.59

**Supplementary Table S3.** Association between cumulative depressive symptoms and risk of cardiovascular outcomes after excluding participants with missing covariate data

Outcomes	CHARLS ( <i>n</i> = 7,686)			HRS ( <i>n</i> = 5,181)		
	Events/total	HR (95% CI) <sup>a</sup>	<i>P</i> Value	Events/total	HR (95% CI)	<i>P</i> Value
Cardiovascular disease						
Quartile 1	229/1,754	reference		339/1,048	reference	
Quartile 2	292/1,990	1.10 (0.92, 1.31)	0.291	524/1,567	1.12 (0.98, 1.29)	0.096
Quartile 3	302/1,884	1.22 (1.03, 1.46)	0.022	439/1,239	1.21 (1.05, 1.40)	0.009
Quartile 4	442/2,058	1.62 (1.38, 1.91)	< 0.001	464/1,327	1.33 (1.15, 1.53)	< 0.001
Per quartile increase <sup>b</sup>	/	1.18 (1.12, 1.24)	< 0.001	/	1.10 (1.05, 1.15)	< 0.001
Per SD increase <sup>c</sup>	/	1.22 (1.16, 1.29)	< 0.001	/	1.11 (1.05, 1.17)	< 0.001
Heart disease						
Quartile 1	166/1,754	reference		290/1,048	reference	
Quartile 2	216/1,990	1.11 (0.91, 1.36)	0.309	459/1,567	1.13 (0.98, 1.31)	0.098
Quartile 3	211/1,884	1.15 (0.94, 1.42)	0.170	374/1,239	1.18 (1.01, 1.38)	0.032
Quartile 4	343/2,058	1.68 (1.39, 2.04)	< 0.001	402/1,327	1.35 (1.16, 1.58)	< 0.001
Per quartile increase	/	1.19 (1.12, 1.27)	< 0.001	/	1.10 (1.05, 1.15)	< 0.001
Per SD increase	/	1.24 (1.16, 1.32)	< 0.001	/	1.12 (1.06, 1.18)	< 0.001
Stroke						
Quartile 1	78/1,754	reference		99/1,048	reference	
Quartile 2	94/1,990	1.04 (0.77, 1.41)	0.781	149/1,567	1.06 (0.82, 1.37)	0.635
Quartile 3	111/1,884	1.35 (1.01, 1.81)	0.044	131/1,239	1.16 (0.89, 1.51)	0.276
Quartile 4	138/2,058	1.50 (1.13, 2.00)	0.006	122/1,327	1.10 (0.83, 1.44)	0.518
Per quartile increase	/	1.16 (1.06, 1.27)	0.001	/	1.04 (0.95, 1.13)	0.424
Per SD increase	/	1.21 (1.10, 1.33)	< 0.001	/	1.03 (0.94, 1.14)	0.505

**Note.** <sup>a</sup>Cox proportional hazards models were applied with adjustment for age(years), sex, marital status, living place(only in CHARLS), education, household income, BMI, smoking status, alcohol consumption, self-reported(both CHARLS and HRS) or regular use of any related medications(only in CHARLS) were defined as hypertension, cancer and diabetes. <sup>b</sup>Performed by treating cumulative CES-D score quantiles as a numeric variable. <sup>c</sup>Estimated as the beta coefficient for standardized cumulative CES-D score using the z-score.CI, confidence interval; HR, hazard ratios.

**Supplementary Table S4.** Association between cumulative depressive symptoms and risk of cardiovascular outcomes after excluding participants who developed CVD in the first 2 years of follow-up

Outcomes	CHARLS (n = 8,275)			HRS (n = 6,799)		
	Events/total	HR (95% CI) <sup>a</sup>	P Value	Events/total	HR (95% CI)	P Value
Cardiovascular disease						
Quartile 1	168/1,938	reference		424/1,370	reference	
Quartile 2	207/2,182	1.09 (0.88, 1.33)	0.431	617/2,031	1.10 (0.96, 1.27)	0.181
Quartile 3	211/1,991	1.27 (1.03, 1.56)	0.023	500/1,575	1.17 (1.01, 1.36)	0.042
Quartile 4	299/2,164	1.66 (1.36, 2.02)	< 0.001	610/1,823	1.30 (1.11, 1.52)	0.001
Per quartile increase <sup>b</sup>	/	1.19 (1.12, 1.27)	< 0.001	/	1.09 (1.04, 1.14)	< 0.001
Per SD increase <sup>c</sup>	/	1.23 (1.15, 1.31)	< 0.001	/	1.11 (1.05, 1.17)	< 0.001
Heart disease						
Quartile 1	102/1,949	reference		362/1,381	reference	
Quartile 2	136/2,196	1.17 (0.90, 1.51)	0.233	550/2,050	1.12 (0.96, 1.31)	0.151
Quartile 3	127/2,007	1.25 (0.96, 1.62)	0.101	441/1,602	1.17 (1.00, 1.38)	0.056
Quartile 4	217/2,198	1.97 (1.54, 2.52)	< 0.001	546/1,858	1.36 (1.15, 1.60)	< 0.001
Per quartile increase	/	1.25 (1.16, 1.36)	< 0.001	/	1.10 (1.05, 1.16)	< 0.001
Per SD increase	/	1.29 (1.19, 1.39)	< 0.001	/	1.13 (1.07, 1.20)	< 0.001
Stroke						
Quartile 1	83/2,023	reference		132/1,423	reference	
Quartile 2	90/2,304	0.94 (0.70, 1.27)	0.703	180/2,132	0.94 (0.75, 1.18)	0.576
Quartile 3	106/2,110	1.28 (0.95, 1.71)	0.101	155/1,661	1.03 (0.81, 1.30)	0.807
Quartile 4	124/2,341	1.32 (0.99, 1.77)	0.057	173/1,956	1.05 (0.83, 1.34)	0.658
Per quartile increase	/	1.12 (1.03, 1.23)	0.012	/	1.03 (0.95, 1.11)	0.452
Per SD increase	/	1.17 (1.07, 1.29)	0.001	/	1.05 (0.97, 1.14)	0.268

**Note.** <sup>a</sup>Cox proportional hazards models were applied with adjustment for age(years), sex, marital status, living place(only in CHARLS), education, household income, BMI, smoking status, alcohol consumption, self-reported(both CHARLS and HRS) or regular use of any related medications(only in CHARLS) were defined as hypertension, cancer and diabetes. <sup>b</sup>Performed by treating cumulative CES-D score quantiles as a numeric variable. <sup>c</sup>Estimated as the beta coefficient for standardized cumulative CES-D score using the z-score. *CI*, confidence interval; *HR*, hazard ratios.

**Supplementary Table S5.** Associations of time-average cumulative depressive symptoms with cardiovascular outcomes

Outcomes	CHARLS ( <i>n</i> = 8,861)			HRS ( <i>n</i> = 7,284)		
	Events/total	HR (95% CI) <sup>a</sup>	<i>P</i> Value	Events/total	HR (95% CI)	<i>P</i> Value
Cardiovascular disease						
Quartile 1	264/2,034	reference		655/1,937	reference	
Quartile 2	344/2,319	1.13 (0.96, 1.33)	0.142	569/1,643	1.08 (0.96, 1.21)	0.192
Quartile 3	350/2,130	1.29 (1.10, 1.51)	0.002	576/1,588	1.16 (1.04, 1.30)	0.009
Quartile 4	513/2,378	1.68 (1.44, 1.95)	< 0.001	836/2,116	1.41 (1.27, 1.57)	< 0.001
Per quartile increase <sup>b</sup>	/	1.19 (1.13, 1.25)	< 0.001	/	1.12 (1.08, 1.16)	< 0.001
Per SD increase <sup>c</sup>	/	1.23 (1.17, 1.29)	< 0.001	/	1.14 (1.09, 1.18)	< 0.001
Heart disease						
Quartile 1	187/2,034	reference		566/1,937	reference	
Quartile 2	259/2,319	1.19 (0.98, 1.43)	0.075	505/1,643	1.09 (0.97, 1.23)	0.143
Quartile 3	250/2,130	1.27 (1.05, 1.54)	0.015	497/1,588	1.16 (1.03, 1.31)	0.018
Quartile 4	397/2,378	1.77 (1.48, 2.12)	< 0.001	724/2,116	1.42 (1.26, 1.59)	< 0.001
Per quartile increase	/	1.21 (1.14, 1.28)	< 0.001	/	1.12 (1.08, 1.16)	< 0.001
Per SD increase	/	1.24 (1.17, 1.31)	< 0.001	/	1.14 (1.10, 1.19)	< 0.001
Stroke						
Quartile 1	94/2,034	reference		193/1,937	reference	
Quartile 2	105/2,319	0.97 (0.73, 1.28)	0.815	160/1,643	1.01 (0.82, 1.25)	0.922
Quartile 3	126/2,130	1.32 (1.01, 1.73)	0.044	154/1,588	0.97 (0.78, 1.21)	0.799
Quartile 4	161/2,378	1.47 (1.13, 1.91)	0.004	245/2,116	1.30 (1.06, 1.58)	0.010
Per quartile increase	/	1.16 (1.07, 1.27)	< 0.001	/	1.08 (1.02, 1.16)	0.015
Per SD increase	/	1.22 (1.12, 1.33)	< 0.001	/	1.09 (1.01, 1.17)	0.022

**Note.** <sup>a</sup>Cox proportional hazards models were applied with adjustment for age(years), sex, marital status, living place(only in CHARLS), education, household income, BMI, smoking status, alcohol consumption, self-reported(both CHARLS and HRS) or regular use of any related medications(only in CHARLS) were defined as hypertension, cancer and diabetes. <sup>b</sup>Performed by treating cumulative CES-D score quantiles as a numeric variable. <sup>c</sup>Estimated as the beta coefficient for standardized cumulative CES-D score using the z-score. *CI*, confidence interval; *HR*, hazard ratios.

**Supplementary Table S6.** Association between cumulative depressive symptoms and risk of cardiovascular outcomes after excluding participants who developed severe depressive symptoms at baseline

Outcomes	CHARLS (n = 6,941)			HRS (n = 6,536)		
	Events/total	HR (95% CI) <sup>a</sup>	P Value	Events/total	HR (95% CI)	P Value
Cardiovascular disease						
Quartile 1	215/1,660	reference		655/1,937	reference	
Quartile 2	213/1,565	1.00 [0.83, 1.21]	0.987	304/870	1.08 [0.94, 1.24]	0.255
Quartile 3	292/1,809	1.26 [1.05, 1.50]	0.011	685/1,941	1.12 [1.00, 1.25]	0.043
Quartile 4	346/1,907	1.41 [1.19, 1.68]	< 0.001	695/1,788	1.38 [1.23, 1.54]	< 0.001
Per quartile increase <sup>b</sup>	/	1.14 [1.08, 1.20]	< 0.001	/	1.10 [1.07, 1.14]	< 0.001
Per SD increase <sup>c</sup>	/	1.15 [1.08, 1.22]	< 0.001	/	1.11 [1.07, 1.16]	< 0.001
Heart disease						
Quartile 1	151/1,660	reference		566/1,937	reference	
Quartile 2	161/1,565	1.08 [0.86, 1.35]	0.512	264/870	1.07 [0.93, 1.24]	0.337
Quartile 3	215/1,809	1.30 [1.05, 1.60]	0.015	599/1,941	1.13 [1.01, 1.27]	0.034
Quartile 4	253/1,907	1.43 [1.16, 1.76]	0.001	612/1,788	1.40 [1.24, 1.57]	< 0.001
Per quartile increase	/	1.13 [1.06, 1.21]	< 0.001	/	1.11 [1.07, 1.15]	< 0.001
Per SD increase	/	1.15 [1.07, 1.23]	< 0.001	/	1.12 [1.08, 1.17]	< 0.001
Stroke						
Quartile 1	79/1,660	reference		193/1,937	reference	
Quartile 2	67/1,565	0.85 [0.62, 1.18]	0.346	89/870	1.06 [0.82, 1.36]	0.667
Quartile 3	93/1,809	1.09 [0.81, 1.48]	0.564	183/1,941	0.96 [0.78, 1.18]	0.686
Quartile 4	120/1,907	1.37 [1.03, 1.83]	0.033	200/1,788	1.23 [1.00, 1.50]	0.049
Per quartile increase	/	1.14 [1.03, 1.25]	0.009	/	1.05 [0.99, 1.13]	0.124
Per SD increase	/	1.14 [1.03, 1.27]	0.012	/	1.06 [0.98, 1.14]	0.136

**Note.** <sup>a</sup>Cox proportional hazards models were applied with adjustment for age(years), sex, marital status, living place(only in CHARLS), education, household income, BMI, smoking status, alcohol consumption, self-reported(both CHARLS and HRS) or regular use of any related medications(only in CHARLS) were defined as hypertension, cancer and diabetes. <sup>b</sup> Performed by treating cumulative CES-D score quantiles as a numeric variable. <sup>c</sup> Estimated as the beta coefficient for standardized cumulative CES-D score using the z-score. *CI*, confidence interval; *HR*, hazard ratios.

**Supplementary Table S7.** Reclassification and discrimination statistics for cumulative depressive symptoms compared with baseline depressive symptoms

Outcomes	C statistics		IDI		NRI	
	Estimate (95% CI)	P	Estimate (95 % CI)	P	Estimate (95% CI)	P
<b>Cardiovascular disease</b>						
CHARLS						
Conventional model+cumulative depressive symptoms	0.645 (0.629, 0.661)	0.000	2.40 (1.40, 3.90)	0.000	50.7 (44.4, 57.2)	0.000
Conventional model <sup>a</sup> + baseline depressive symptoms	0.641 (0.625, 0.657)		reference		reference	
HRS						
Conventional model+cumulative depressive symptoms	0.645 (0.633, 0.657)	0.000	0.700 (-0.100, 4.00)	0.059	9.40 (-26.4, 105.4)	0.317
Conventional model <sup>a</sup> + baseline depressive symptoms	0.643 (0.631, 0.655)		reference		reference	
<b>Heart disease</b>						
CHARLS						
Conventional model+cumulative depressive symptoms	0.644 (0.626, 0.662)	0.000	2.00 (0.900, 3.20)	0.000	51.9 (36.6, 61.6)	0.000
Conventional model <sup>a</sup> + baseline depressive symptoms	0.639 (0.621, 0.657)		reference		reference	
HRS						
Conventional model+cumulative depressive symptoms	0.635 (0.623, 0.647)	0.000	0.500 (-1.80, 2.80)	0.436	11.1 (-49.0, 48.3)	0.594
Conventional model <sup>a</sup> + baseline depressive symptoms	0.631 (0.619, 0.643)		reference		reference	
<b>Stroke</b>						
CHARLS						
Conventional model+cumulative depressive symptoms	0.675 (0.650, 0.700)	0.000	1.20 (0.700, 2.10)	0.000	47.9 (43.1, 54.2)	0.000
Conventional model <sup>a</sup> + baseline depressive symptoms	0.674 (0.649, 0.699)		reference		reference	
HRS						
Conventional model+cumulative depressive symptoms	0.691 (0.671, 0.711)	0.000	0.300 (-1.20, 56.9)	0.475	29.5 (-41.5, 56.9)	0.535
Conventional model <sup>a</sup> + baseline depressive symptoms	0.692 (0.672, 0.712)		reference		reference	

**Note.** <sup>a</sup> Conventional model: Adjusted covariates included age(years), sex, marital status, living place(only in CHARLS), education, household income, BMI, smoking status, alcohol consumption, self-reported(both CHARLS and HRS) or regular use of any related medications(only in CHARLS) were defined as hypertension, cancer and diabetes.

**Supplementary Table S8.** Baseline characteristics comparison between participants included and excluded from analysis in CHARLS

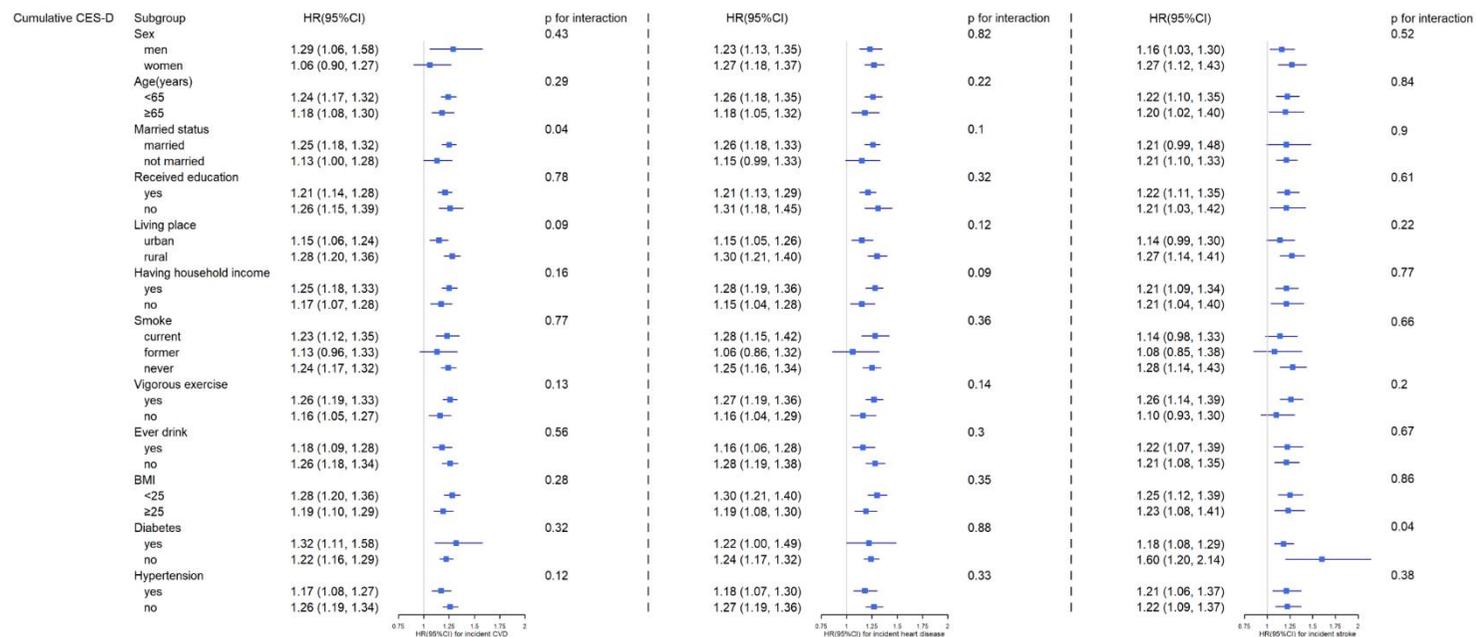
Outcomes	Overall ( <i>n</i> = 17,708)	Included ( <i>n</i> = 8,861)	Excluded ( <i>n</i> = 8,847)	<i>P</i> value
Age (mean (SD))	58.54 (10.20)	58.58 (8.66)	58.50 (11.54)	0.618
Sex (%)				
Male	8,478 (47.9)	4,307 (48.6)	4,171 (47.1)	0.054
Female	9,230 (52.1)	4,554 (51.4)	4,676 (52.9)	
Married (%)	14,178 (80.1)	7,506 (84.7)	6,672 (75.4)	< 0.001
Received education (%)	12,853 (72.6)	6,378 (72.0)	6,475 (73.2)	0.074
Living place (%)				
Rural	10,537 (59.5)	5,789 (65.3)	4,748 (53.7)	< 0.001
Urban	7,171 (40.5)	3,072 (34.7)	4,099 (46.3)	
Having household income (%)	12,773 (72.1)	6,541 (73.8)	6,232 (70.4)	< 0.001
Smoke (%)				
Current	4,892 (27.6)	2,862 (32.3)	2,030 (22.9)	< 0.001
Former	2,104 (11.9)	673 (7.6)	1,431 (16.2)	
Never	10,712 (60.5)	5,326 (60.1)	5,386 (60.9)	
Ever drink (%)	6,876 (38.8)	3,557 (40.1)	3,319 (37.5)	< 0.001
BMI (mean (SD))	24.35 (18.13)	24.92 (25.29)	23.77 (4.09)	< 0.001
Vigorous exercise (%)	13,172 (74.4)	6,586 (74.3)	6,586 (74.4)	0.871
Cancer (%)	197 (1.1)	82 (0.9)	115 (1.3)	0.021
Diabetes (%)	1,128 (6.4)	462 (5.2)	666 (7.5)	< 0.001
Hypertension (%)	4,848 (27.4)	1,970 (22.2)	2,878 (32.5)	< 0.001
Cumulative CES-D scores (mean (SD))	16.55 (10.61)	15.59 (10.05)	17.51 (11.06)	< 0.001

**Note.** Definitions of cancer and other diseases were based on records of self-reported physician diagnosis or any medication used. *P* values are reported for differences between 2 groups using Student's t-test, chi-square test, or Wilcoxon rank test.

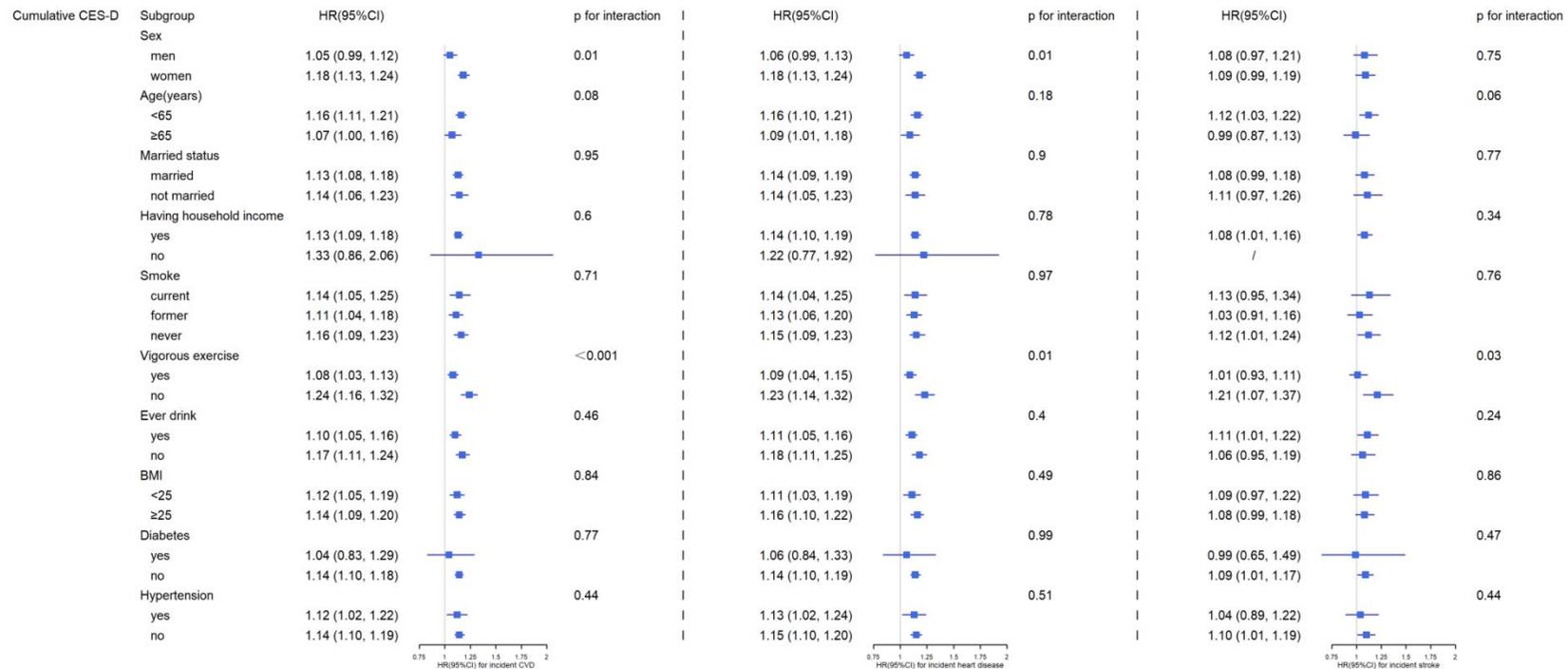
**Supplementary Table S9.** Baseline characteristics comparison between participants included and excluded from analysis in HRS

Outcomes	Overall (n = 19,643)	Included (n = 7,284)	Excluded (n = 12,359)	P value
Age (mean (SD))	65.14 (11.43)	60.94 (8.70)	67.61 (12.11)	< 0.001
Sex (%)				
Male	8,227 (41.9)	2,552 (35.0)	5,675 (45.9)	< 0.001
Female	11,416 (58.1)	4,732 (65.0)	6,684 (54.1)	
Married (%)	13,266 (67.5)	5,345 (73.4)	7,921 (64.1)	< 0.001
Received education (%)	19,403 (98.8)	7,253 (99.6)	12,150 (98.3)	< 0.001
Having household income (%)	19,429 (98.9)	7,205 (98.9)	12,224 (98.9)	1
Smoke (%)				
Current	3,663 (18.6)	1,310 (18.0)	2,353 (19.0)	< 0.001
Former	7,906 (40.2)	2,784 (38.2)	5,122 (41.4)	
Never	8,074 (41.1)	3,190 (43.8)	4,884 (39.5)	
Ever drink (%)	9,906 (50.4)	4,210 (57.8)	5,696 (46.1)	< 0.001
BMI (mean (SD))	26.41 (5.12)	26.72 (4.86)	26.23 (5.26)	< 0.001
Vigorous exercise (%)	14,406 (73.3)	5,125 (70.4)	9,281 (75.1)	< 0.001
Cancer (%)	1,289 (6.6)	273 (3.7)	1,016 (8.2)	< 0.001
Diabetes (%)	1,448 (7.4)	247 (3.4)	1,201 (9.7)	< 0.001
Cumulative CES-D scores (mean (SD))	8.30 (9.17)	4.59 (5.70)	10.48 (10.08)	< 0.001
Hypertension (%)	5,346 (27.2)	1,200 (16.5)	4,146 (33.5)	< 0.001

**Note.** Definitions of cancer and other diseases were based on records of self-reported physician diagnosis or any medication used. *P* values are reported for differences between 2 groups using Student's t-test, chi-square test, or Wilcoxon rank test.



**Supplementary Figure S1.** Subgroup analyses for association between each CES-D increment in cumulative depressive symptoms and risk of incident CVD (left), heart disease (middle) and stroke (right) in CHARLS.Cox proportional hazards models were applied with adjustment for age(years), sex, marital status, living place, education, household income, BMI, smoking status, alcohol consumption, self-reported or regular use of any related medications were defined as hypertension, cancer and diabetes. *P*-interaction represents the significance of the interactions between each CES-D increment and the stratifying variables. The interactions were assessed with the likelihood-ratio test by modeling the cross-product term of the each CES-D increment and the stratifying variables in the multivariable-adjusted model.



**Supplementary Figure S2.** Subgroup analyses for association between each CES-D increment in cumulative depressive symptoms and risk of incident CVD (left), heart disease (middle) and stroke (right) in HRS. Cox proportional hazards models were applied with adjustment for age(years), sex, marital status, education, household income, BMI, smoking status, alcohol consumption, self-reported was defined as hypertension, cancer and diabetes. *P*-interaction represents the significance of the interactions between each CES-D increment and the stratifying variables. The interactions were assessed with the likelihood-ratio test by modeling the cross-product term of the each CES-D increment and the stratifying variables in the multivariable-adjusted model.