

Supplementary Online Content

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Table S1 **Questionnaire items and prevalence of each ACE indicator**

Types of ACE	Domain	Questionnaire Items	Prevalence (%)
Conventional ACEs	Physical abuse	When you were growing up, did your female/male guardian ever hit you? (often ^a , sometimes ^a , rarely, or never)	28.5
	Emotional neglect	How much love and affection did your female guardian give you while you were growing up? (often, sometimes, rarely ^a , or never ^a)	33.7
		How much effort did your female guardian put into watching over you? (a lot, some, a little ^a , or not at all ^a)	
	Household substance abuse	During the years you were growing up, did your female/male guardian ever have alcoholism or drug? (yes ^a or no)	7.2
	Household mental illness	Did your female/male guardian have abnormality of mind when you were young? (yes ^a or no)	12.1
		During the years you were growing up, had your female/male guardian often showed continued signs of sadness or depression? (during all ^a , most ^a , some, or only a little of the childhood)	
	Domestic violence	Have your father/mother ever beat up your mother/father? (often ^a , sometimes ^a , not very often, or never)	8.3
	Incarcerated household member	During the years you were growing up, have your female/male guardian ever been arrested or sent to prison? (yes ^a or no)	0.04
Parental separation or divorce	Were your biological parents divorced (including long separation due to emotional problems) before you were 17 years? (yes ^a or no)	0.5	
Expanded ACEs	Unsafe neighborhood	Was it safe being out alone at night in the neighborhood where you lived as a child? (very safe, somewhat safe, not very safe ^a , or not safe at all ^a)	8.1
	Bullying	When you were a child, how often were you picked on or bullied by kids in your neighborhood? (often ^a , sometimes ^a , not very often, or never)	14.5

When you were a child, how often were you picked on or bullied by kids in your school? (often ^a, sometimes^a, not very often, or never)

New ACEs	Parental death ^b	Either of the parents was dead before participant was 17 years. (yes ^a or no)	13.1
	Sibling death ^c	Any of the siblings was dead before participant was 17 years. (yes ^a or no)	5.2
	Parental disability	Did your female/male guardian have a long time being sick on bed when you were young? (yes ^a or no)	21.2
		Did your female/male guardian have a serious deformity when you were young? (yes ^a or no)	

ACEs = Adverse Childhood Experiences

^a The answers that considered as the respondent has ACE in that specific domain and scored as 1; otherwise scored as 0. The total score of the 12 ACE domains is the cumulative ACE score

^b Calculated based on dates of birth and their parental death

^c Calculated based on dates of birth and their sibling's death

Table S2 Sensitivity analysis of multiple imputation

Characteristics	Imputation before	Imputation after	<i>p</i> -value	Missing rate
Smoking status, n (%)			0.99	0.1%
Never smoker	6742 (60.2)	6748 (60.3)		
Former / Current smoker	4450 (39.8)	4452 (39.7)		
Drinking status, n (%)			0.99	0.1%
Never drinker	6732 (60.2)	6740 (60.2)		
Former / Current drinker	4456 (39.8)	4460 (39.8)		
Physical activity, n (%)			0.48	7.5%
Inactive	5304 (51.2)	5790 (51.7)		
Active	5052 (48.8)	5410 (48.3)		
Sleep, n (%)			0.68	5.9%
Insufficient	5285 (50.2)	5587 (49.9)		
Sufficient	5251 (49.8)	5613 (50.1)		
Childhood economic hardship, n (%)			0.98	0.2%
Yes	6948 (62.1)	6962 (62.2)		
No	4232 (37.9)	4238 (37.8)		
BMI, Mean \pm SD	23.62 \pm 4.21	23.66 \pm 3.91	0.47	18.3%
Annual per capita household expenditure (yuan), Mean \pm SD	7157.0 \pm 9925.1	7138.6 \pm 9352.6	0.89	15.2%

Note: BMI = Weight (kg) / Height (m)²

Table S3 Association between the number of adverse childhood experiences and cardiometabolic multimorbidity in the subgroups

Subgroup	OR (95% CI) by number of ACEs a					<i>p</i> -value for trend	<i>p</i> -value for interaction
	0 (n=2746)	1 (n=3576)	2 (n=2535)	3 (n=1394)	≥4 (n=949)		
Age, y							
<65	1 [Reference]	1.11 (0.91-1.36)	1.32 (1.07-1.64)	1.37 (1.06-1.76)	1.44 (1.08-1.90)	0.001*	0.735
≥65	1 [Reference]	0.82 (0.60-1.12)	1.08 (0.78-1.50)	1.43 (1.00-2.05)	1.14 (0.74-1.74)	0.038*	
Sex							
Male	1 [Reference]	0.94 (0.73-1.22)	1.19 (0.90-1.56)	1.08 (0.77-1.50)	1.54 (1.09-2.18)	0.016*	0.537
Female	1 [Reference]	1.05 (0.85-1.31)	1.28 (1.02-1.62)	1.64 (1.26-2.13)	1.14 (0.83-1.57)	0.003*	
Ethnicity							
Han ethnicity	1 [Reference]	1.01 (0.85-1.21)	1.25 (1.04-1.51)	1.42 (1.15-1.77)	1.37 (1.07-1.75)	<0.001*	0.242
Ethnic minority populations	1 [Reference]	1.05 (0.61-1.80)	1.21 (0.70-2.10)	1.05 (0.53-2.11)	0.92 (0.40-2.14)	0.882	
Marital status							
Unmarried	1 [Reference]	0.85 (0.56-1.29)	1.14 (0.74-1.77)	1.22 (0.72-2.05)	1.52 (0.90-2.59)	0.05	0.81
Married	1 [Reference]	1.04 (0.87-1.25)	1.26 (1.04-1.53)	1.42 (1.13-1.77)	1.28 (0.99-1.67)	0.001*	
Educational level completed							
Primary school or below	1 [Reference]	1.06 (0.86-1.30)	1.26 (1.02-1.57)	1.42 (1.11-1.81)	1.26 (0.95-1.68)	0.003*	0.963
Middle school or above	1 [Reference]	0.92 (0.69-1.23)	1.21 (0.89-1.65)	1.34 (0.91-1.96)	1.48 (0.97-2.27)	0.014*	
Area of residence							
Urban	1 [Reference]	0.99 (0.77-1.27)	1.20 (0.92-1.58)	1.50 (1.09-2.06)	1.32 (0.90-1.93)	0.007*	0.486
Rural	1 [Reference]	1.04 (0.83-1.30)	1.28 (1.02-1.62)	1.31 (1.00-1.71)	1.35 (1.00-1.83)	0.005*	
Childhood economic hardship							
No	1 [Reference]	1.02 (0.83-1.25)	1.34 (1.07-1.67)	1.46 (1.11-1.92)	1.46 (1.04-2.05)	<0.001*	0.203
Yes	1 [Reference]	0.99 (0.74-1.32)	1.10 (0.83-1.47)	1.24 (0.91-1.70)	1.18 (0.84-1.66)	0.095	

Annual per capita household
expenditure level

Tertile 1	1 [Reference]	0.99 (0.75-1.31)	1.19 (0.89-1.60)	0.93 (0.65-1.32)	0.92 (0.61-1.40)	0.87	
Tertile 2	1 [Reference]	1.25 (0.90-1.74)	1.45 (1.03-2.04)	2.07 (1.42-3.03)	1.77 (1.14-2.75)	<0.001*	0.086
Tertile 3	1 [Reference]	0.91 (0.69-1.20)	1.22 (0.91-1.64)	1.42 (1.01-2.00)	1.57 (1.06-2.31)	0.002*	

Abbreviations: ACE = Adverse Childhood Experience; CMM = Cardiometabolic Multimorbidity, OR = Odds Ratio; CI=confidence interval.

a The model was adjusted for age, sex, ethnicity, marital status, educational level, rural or urban residence, annual per capita household expenditure level, childhood economic hardship, and 5 unhealthy lifestyles

b Reference: No ACE exposure

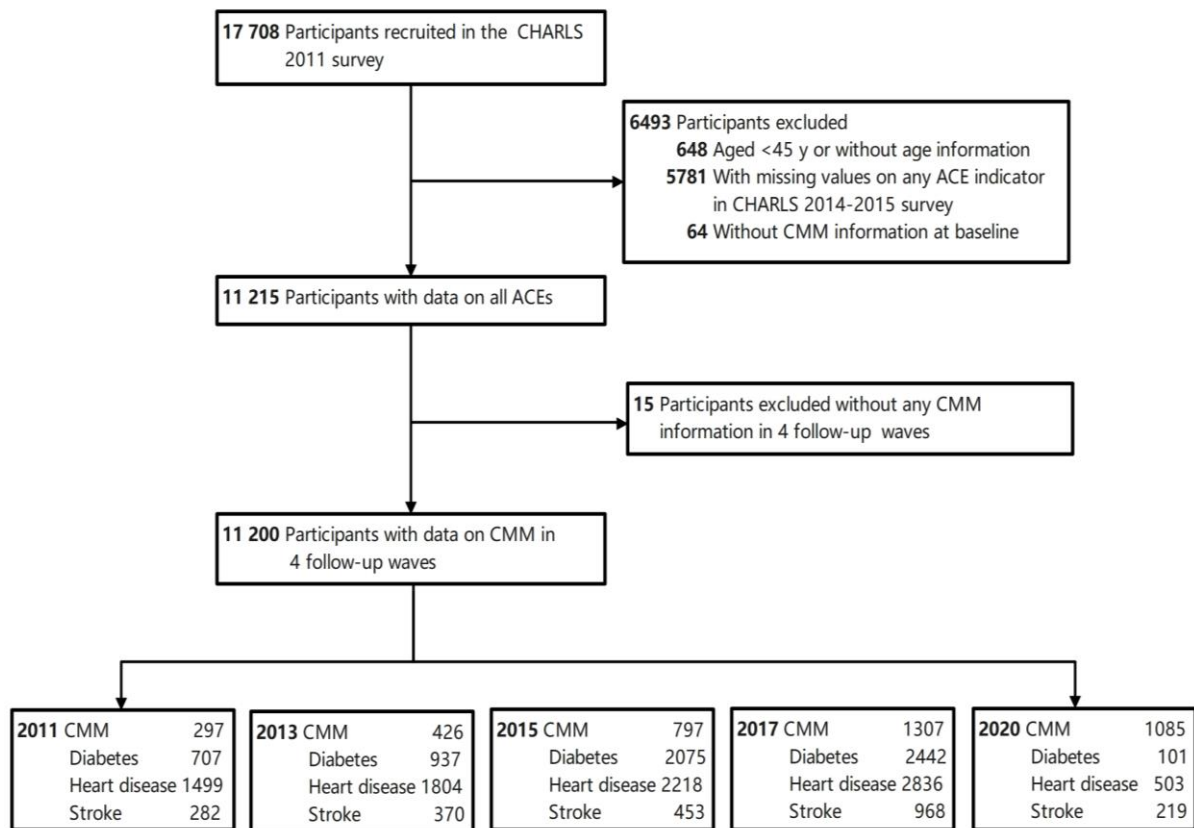
* $p < 0.05$ is considered as statistically significant

Table S4 Proportion of association of adverse childhood experiences with cardiometabolic multimorbidity mediated by individual unhealthy lifestyles, CHALRS 2011 - 2020

Unhealthy lifestyles	Unadjusted analysis		Adjusted analysis*	
	Estimate (95% CI)	<i>p</i> -value	Estimate (95% CI)	<i>p</i> -value
Smoking				
TE, OR	1.08 (1.04,1.13)	<0.001*	1.08 (1.03,1.13)	0.001*
NDE, OR	1.09 (1.04,1.13)	<0.001*	1.08 (1.03,1.13)	0.001*
NIE, OR	1.00 (1.00,1.00)	0.013*	1.00 (1.00,1.00)	0.863
PM	-3.54 (-6.88, -0.19)	0.038*	0.03 (-0.27,0.32)	0.863
Drinking				
TE, OR	1.08 (1.04,1.13)	<0.001*	1.08 (1.03,1.13)	0.001*
NDE, OR	1.09 (1.04,1.13)	<0.001*	1.08 (1.03,1.13)	0.001*
NIE, OR	1.00 (0.99,1.00)	0.003*	1.00 (1.00,1.00)	0.672
PM	-5.91 (-10.87,-0.94)	0.020*	-0.53 (-3.00,1.94)	0.675
Inactive physical activity				
TE, OR	1.08 (1.04,1.13)	<0.001*	1.08 (1.03,1.13)	0.001*
NDE, OR	1.09 (1.05,1.14)	<0.001*	1.09 (1.04,1.14)	<0.001*
NIE, OR	0.99 (0.98,0.99)	<0.001*	0.99 (0.99,1.00)	<0.001*
PM	-13.81 (-24.09,-3.53)	0.009*	-11.53 (-20.41,-2.65)	0.011*
Insufficient sleep				
TE, OR	1.08 (1.04,1.13)	<0.001*	1.08 (1.03,1.13)	0.001*
NDE, OR	1.08 (1.03,1.12)	0.001*	1.08 (1.03,1.12)	0.001*
NIE, OR	1.01 (1.00,1.01)	<0.001*	1.00 (1.00,1.01)	0.006*
PM	9.06 (2.59,15.54)	0.006*	5.79 (0.68,10.89)	0.026*
Unhealthy body shape				
TE, OR	1.08 (1.04,1.13)	<0.001*	1.08 (1.04,1.13)	0.001*
NDE, OR	1.10 (1.05,1.14)	<0.001*	1.09 (1.04,1.14)	<0.001*
NIE, OR	0.99 (0.98,1.00)	0.001*	1.00 (0.99,1.00)	0.155
PM	-13.98 (-25.49,-2.47)	0.017*	-5.94 (-15.13,3.26)	0.206

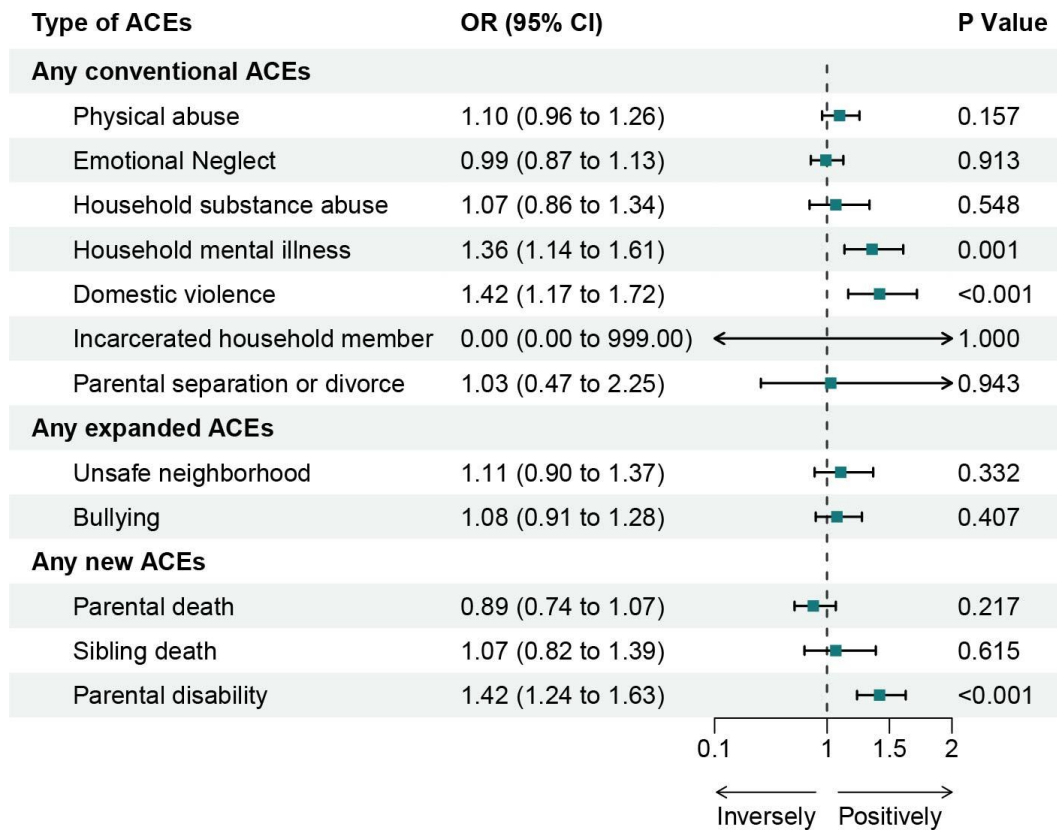
Abbreviations: TE = Total Effect; NDE = Natural Direct Effect; NIE = Natural Indirect Effect; PM = Percentage Mediated; OR = Odds Ratio; CI=confidence interval.

* $p < 0.05$ is considered as statistically significant



Abbreviations: ACE = Adverse Childhood Experience; CMM = Cardiometabolic Multimorbidity; CHARLS = China Health and Retirement Longitudinal Study

Figure S1 Flowchart of study participant selection



Abbreviations: ACE = Adverse Childhood Experience; OR = Odds Ratio; CI=confidence interval.

Figure S2 Association between individual adverse childhood experience indicator and cardiometabolic multimorbidity (adjusted for age, sex, ethnicity, and rural or urban residence)