Supplemental material

Lai R, *et al. J Epidemiol Community Health* 2022;0:1–8. doi: 10.1136/jech-2022-219702

Supplementary Methods

Recategorizing SES indicators

In both baseline survey and resurvey, the initial categories of each SES indicator were as follows: highest level of education was divided into 6 categories including no formal school, primary school, middle school, high school, technical school/college, and university; occupation was divided into 10 categories including agriculture and related worker, factory worker, administrator/manager, professional/technical, sales and service worker, retired, housewife/househusband, self-employed, unemployed, and other or not stated; household income was divided into 6 categories including <2500 yuan, 2500-4999 yuan, 5000-9999 yuan, 10000-19999 yuan, 20000-34999 yuan, and ≥35000 yuan; health care cover was divided into 2 categories: with or without health care categories. Notably, in 608 individuals, highest level of education was found to be in lower category at resurvey than at baseline, which we presumed to be measurement error. In these individuals, their highest level of education at baseline was recoded according to the results from resurvey.

For a better model fit and easier interpretation of the result, after trying different recategorizing plans, we recategorized highest level of education into 3 levels: no formal school, primary, middle or high school graduated, and technical school/college or university graduated. Annual household income was recategorized into 3 levels: less than 10000 yuan, 10000-19999 yuan, and 20000 yuan or above. According to standard international socio-economic index of occupational status by Ganzeboom et al,[1] each occupation was assigned an index score according to the major group that it belonged to, ranging from 25 to 67. Unemployment was assigned a score of 0. Occupation was then further categorized into three levels with index score equals to 0, <50, and ≥50.

Recategorizing result of SES indicators (each occupation is followed by their socio-economic index score)

SES indicators	level	initial categories
Education	low	No formal school
	medium	Primary school, middle school, high school
	high	Technical school/college, university
Occupation	low	Unemployed (0)
	medium	Agriculture and related worker (25), factory worker (34), retired (43), housewife/househusband (43.5), other or not stated
	high	Administrator/manager (67), professional/technical (67), sales and service worker (51), self-employed (55)
Annual household income	low	<2500 yuan, 2500-4999 yuan, 5000-9999 yuan
	medium	10000-19999 yuan
	high	20000-34999 yuan, ≥35000 yuan
Health care cover	no	No health care cover
	yes	Has health care cover

Assessing SES using latent class analysis

We had tried fitting latent class models using data with initial categories and different ways of recategorizing. In the end, the model fit from data that recategorized education, occupation, and

household income into 3 categories was the best among all recategorizing plans. Balancing both model fits and model interpretability, we settled on the model with 4 latent classes, with education, occupation and household each divided into 3 categories.

Latent class analysis model fits for baseline data, using different categorizing plans of SES measurement items

Categorizing plan	N of latent classes	Log-likelihood	G-squared	AIC	BIC
Initial categories	3	-95471.77	4432.56	4556.56	5042.90
	4	-94687.04	2863.10	3029.10	3680.16
	5	-94329.46	2147.94	2355.94	3171.72
	6	-93952	1394.67	1644.67	2625.17
Occupation divided into 6 categories	3	-90615.67	2745.26	2845.26	3237.46
	4	-90137.07	1788.07	1922.07	2447.62
	5	-89945.19	1404.30	1572.30	2231.20
	6	-89681.71	877.34	1079.34	1871.59
Occupation divided into 4 categories	3	-83778.98	1809.84	1897.84	2242.98
	4	-83433.65	1119.19	1237.19	1699.99
	5	-83237.31	726.51	874.51	1454.97
	6	-83130.13	512.14	690.14	1388.26
Occupation divided into 3 categories	3	-75824.67	2364.90	2446.90	2768.50
	4	-74943.45	602.46	712.46	1143.88
	5	-74795.72	307.00	445.00	986.24
	6	-74731.50	178.57	344.57	995.62
Education, occupation, household income each divided into 3 categories	3	-50943.28	828.03	874.03	1054.23
	4	-50603.16	147.81	209.81	452.69
	5	-50550.06	41.59	119.59	425.15
	6	did not converge			

Covariates

In accelerated failure time analysis to explore association between SES shift and survival time ratio, we included age at baseline, gender, BMI group, marital status, region of residence, smoking status, alcohol

consumption status, self-rated health status, family history of cardiovascular diseases, diagnosis of hypertension, diagnosis of diabetes mellitus, total daily physical activity, and baseline SES as covariates because these can influence survival and cardiovascular outcomes. Age was included as continuous variable. BMI groups were stratified according to 2019 guideline for primary care of obesity in China[2]. Marital status was divided into married and unmarried, including individuals who were divorced or separated, widowed, and never married. Region of residence included urban or rural. Smoking status was divided into never, previous or current. Alcohol consumption status was divided into never regular, previous or current. Self-rated health status was reported by individuals, based on their subjective judgement. Family history of cardiovascular diseases, diagnosis of hypertension and diabetes mellitus were also self-reported. Total daily physical activity was included in the form of metabolic equivalent of task (MET) hours/day.

In Cox regression analysis, the above variables were all included as covariates, except that some violated the proportional hazards assumption, therefore were included as time-varying covariates instead. In analysis on association between SES shift and cardiovascular deaths, time-varying covariates included age and self-rated health status. In analysis on association between SES shift and stroke, time-varying covariates included self-rated health status and diagnosis of hypertension. All covariates passed the proportional hazards assumption in analysis on association between SES shift and MCEs.

Lai R, *et al. J Epidemiol Community Health* 2022;0:1–8. doi: 10.1136/jech-2022-219702

Supplementary Table 1. Baseline characteristics of SES indicators of participants according to SES shift patterns.

Characteristics	Total population (n = 18672)	Sharp SES downshift (n = 166)	Moderate SES downshift (n = 470)	SES stable (n = 10273)	Moderate SES upshift (n = 2449)	Sharp SES upshift (n = 5314)
Occupation[a]						
low	486(2.60)	1(0.60)	8(1.70)	153(1.49)	259(10.58)	65(1.22)
medium	15731(84.24)	132(79.52)	54(11.49)	8724(84.92)	1787(72.97)	5034(94.73)
high	2455(13.15)	33(19.88)	408(86.81)	1396(13.59)	403(16.46)	215(4.05)
Annual household income[b]						
low	6105(32.70)	3(1.81)	8(1.70)	1109(10.80)	227(9.27)	4758(89.54)
medium	5631(30.16)	98(59.04)	42(8.94)	3590(34.95)	1507(61.54)	394(7.41)
high	6936(37.15)	65(39.16)	420(89.36)	5574(54.26)	715(29.20)	162(3.05)
Education[c]						
low	4293(22.99)	124(74.70)	67(14.26)	2662(25.91)	82(3.35)	1358(25.56)
medium	13295(71.20)	35(21.08)	402(85.53)	6552(63.78)	2361(96.41)	3945(74.24)
high	1084(5.81)	7(4.22)	1(0.21)	1059(10.31)	6(0.24)	11(0.21)
Has health cover	13950(74.71)	164(98.80)	443(94.26)	9511(92.58)	863(35.24)	2969(55.87)

[a] Low-level occupation: unemployed; medium-level occupation: agriculture and related worker, factory worker, retired, housewife/househusband, and other or not stated; high-level occupation: administrator/manager, professional/technical, sales and service worker, self-employed.

[b] Low-level annual household income: <10000 yuan; medium-level annual household income: 10000-19999 yuan; high-level annual household income: ≥20000 yuan.

[c] Low-level education: no formal school; medium-level education: primary school, middle school, or high school; high-level education: technical school/college, or university.

Supplementary Table 2. Distribution of SES latent classes and characteristics of each latent class in baseline and resurvey

		Time 1 (baseline)				Time 2 (resurvey)			
		Latent class 1	Latent class 2	Latent class 3	Latent class 4	Latent class 1	Latent class 2	Latent class 3	Latent class 4
Latent class prevalence		0.28	0.21	0.40	0.11	0.12	0.06	0.70	0.13
Item-response probabilities									
occupation	low	0.01	0.10	0.00	0.00	0.00	0.23	0.02	0.00
	medium	0.98	0.75	0.97	0.20	1.00	0.51	0.95	0.28
	high	0.00	0.15	0.03	0.80	0.00	0.26	0.03	0.72
education	low	0.45	0.02	0.23	0.06	0.52	0.01	0.17	0.03
	medium	0.55	0.97	0.76	0.46	0.48	0.95	0.82	0.50
	high	0.00	0.01	0.01	0.48	0.00	0.03	0.00	0.47
Household income	low	0.75	0.27	0.16	0.00	0.76	0.22	0.10	0.01
	medium	0.18	0.56	0.31	0.10	0.22	0.44	0.31	0.03
	high	0.07	0.17	0.53	0.90	0.01	0.34	0.58	0.96
Health insurance	no	0.52	0.50	0.00	0.05	0.06	0.21	0.02	0.01
	yes	0.48	0.50	1.00	0.95	0.94	0.79	0.98	0.99

Numbering of latent classes was arranged in ascending order, with 1 representing the lowest.

Sums of all latent class prevalences or item-response probabilities for each item may not equal to 1 due to rounding error.

Supplementary Table 3. Adjusted hazard ratio for different cardiovascular outcomes according to SES shift (accounted for time-varying covariates)

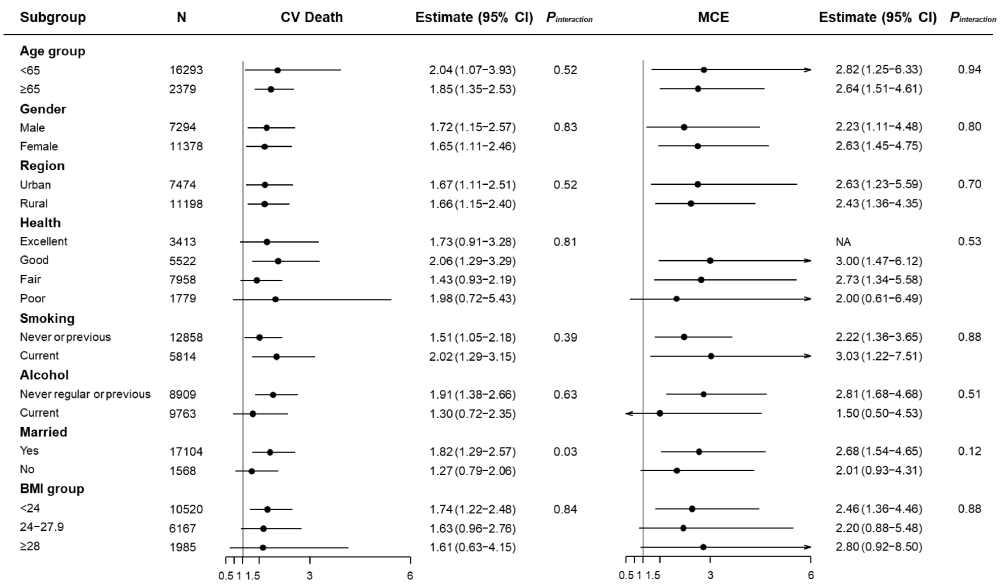
	Hazard ratio (95% CI)		
SES shift	Death from cardiovascular causes	Major coronary events	Stroke
Sharply downward	2.14(1.15-3.97)	3.70(1.77-7.76)	0.88(0.49-1.56)
Moderately downward	0.37(0.09-1.60)	0.36(0.05-2.73)	1.12(0.76-1.66)
Stable	1 (ref)	1 (ref)	1 (ref)
Moderately upward	0.39(0.21-0.74)	0.34(0.15-0.75)	0.77(0.57-1.02)
Sharply upward	0.61(0.48-0.78)	0.59(0.40-0.88)	0.94(0.77-1.14)

Hazard ratio for each SES shift pattern was adjusted for baseline age, gender, BMI group, marital status, region of residence, smoking status, alcohol consumption status, self-rated health status, family history of cardiovascular diseases, diagnosis of hypertension, diagnosis of diabetes mellitus, total daily physical activity, and baseline SES.

Supplementary Table 4. Adjusted survival time ratios for different cardiovascular outcomes according to each SES indicator shift

	Survival time ratio (95% CI)		
SES item shift	Death from cardiovascular causes	Major coronary events	Stroke
Occupation			
Sharply downward	0.69 (0.32-1.50)	0.60 (0.22-1.63)	0.80 (0.57-1.12)
Moderately downward	0.99 (0.78-1.26)	1.19 (0.75-1.90)	1.00 (0.88-1.13)
Stable	1 (ref)	1 (ref)	1 (ref)
Moderately upward	1.09 (0.84-1.41)	0.90 (0.63-1.30)	1.21 (1.04-1.42)
Sharply upward	0.78 (0.36-1.70)	0.65 (0.24-1.78)	1.53 (0.84-2.79)
Education			
Stable	1 (ref)	1 (ref)	1 (ref)
Upward	1.15 (0.97-1.35)	1.02 (0.77-1.35)	0.94 (0.84-1.04)
Household income			
Sharply downward	0.86 (0.66-1.11)	0.67 (0.44-1.02)	0.96 (0.79-1.17)
Moderately downward	0.95 (0.82-1.11)	0.73 (0.58-0.93)	1.00 (0.90-1.11)
Stable	1 (ref)	1 (ref)	1 (ref)
Moderately upward	1.04 (0.96-1.13)	0.93 (0.79-1.08)	1.01 (0.95-1.07)
Sharply upward	1.12 (0.96-1.30)	1.23 (0.88-1.71)	0.96 (0.86-1.07)
Health cover			
Downward	0.95 (0.69-1.30)	0.91 (0.51-1.63)	1.06 (0.82-1.36)
Stable	1 (ref)	1 (ref)	1 (ref)
Upward	1.04 (0.95-1.15)	1.01 (0.84-1.21)	1.10 (1.02-1.18)

Survival time ratio for each SES item shift pattern was adjusted for baseline age, gender, BMI group, marital status, region of residence, smoking status, alcohol consumption status, self-rated health status, family history of cardiovascular diseases, diagnosis of hypertension, diagnosis of diabetes mellitus, total daily physical activity, and baseline SES.



Supplementary Figure. Subgroup analysis based on baseline characteristics. Results were shown comparing sharp upshift SES group to sharp downshift SES group. Tests for interaction between covariates and SES shift were performed using likelihood ratio tests, which compared models with and without cross-product terms. Estimates for SES shift and MCE in 'excellent health' subgroup was not available due to zero case of event in sharp downshift SES group.

Supplementary References

1. Ganzeboom HBG, De Graaf PM, Treiman DJ. A standard international socio-economic index of occupational status. *Soc Sci Res* 1992;21(1):1-56.
2. Chinese Medical Association, Chinese Medical Journals Publishing House, Chinese Society of General Practice, et al. Guideline for primary care of obesity (2019). *Chin J Gen Pract* 2020;19(2):95-101.