Preplanned Studies

The Role of Childhood Circumstances in Healthy Aging Inequalities Among Older Adults — China, 2011–2020

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Summary

What is already known about this topic?

Addressing health disparities is a worldwide priority, with a well-established acknowledgment of the influence of childhood circumstances on these discrepancies. In China, particularly among the elderly, health inequalities are a notable concern.

What is added by this report?

The inequality in healthy aging has increased from 2011 to 2020, both in general and concerning childhood factors. Nevertheless, the impact of early-life healthcare access and parental health behaviors on healthy aging gaps has reduced among older adults in better health within the top segment of healthy aging.

What are the implications for public health practice?

Efforts towards reducing regional health disparities and improving healthcare access for children, along with promoting the health and well-being of parents, especially in economically disadvantaged households, are crucial policy considerations.

In response to the global push for health equity following the World Health Organization (WHO) report on the Commission for Social Determinants of Health, reducing health disparities has become a primary goal of public health policies worldwide. In China, inequalities in health, especially among older populations, are widespread (*1*). Healthy aging (HA) is crucial for achieving Sustainable Development Goals (*1–2*). However, limited research assesses the inequality of HA, specifically concerning childhood circumstances and its impact on HA inequality, termed inequality of opportunity (IOp) (*3*). Most studies use a mean-based approach to identify sources of IOp in health (*3*). Thus, understanding the role of childhood circumstances in HA inequality across the entire HA distribution in China, especially among individuals with poorer health, is critical but currently unknown. To bridge this gap, we used data from the China Health and Retirement Longitudinal Study (CHARLS) to develop a composite HA index for assessing changes in HA inequality. We explored how childhood circumstances affect IOp in HA across the entire HA distribution. Our findings reveal an increase in both total HA inequality and inequality explained by childhood circumstances from 2011 to 2020. Factors such as household socioeconomic status in childhood and regional/urban-rural status at birth were identified as key drivers of IOp in HA. Notably, the influence of early-life access to healthcare and parental health behaviors decreased as the HA distribution moved towards individuals with better health. These results highlight the significant role of childhood circumstances in HA determination and advocate for policies enhancing childhood nutrition and health, especially within disadvantaged families.

The CHARLS is a nationally representative survey conducted by the National School of Development at Peking University, focused on individuals aged 45 and above. Since its initiation in 2011, the survey has been followed up in 2013, 2015, 2018, and 2020. For this study, data from the 2014 Life History Survey was utilized, concentrating on individuals aged 60 and older. The analysis involved 23,409 participants, with varying numbers from the CHARLS surveys conducted in 2011 (3,317), 2013 (4,038), 2015 (4,919), 2018 (4,781), and 2020 (6,354), respectively. Sample weights were applied to adjust for design effects and survey nonresponses (Supplementary Figure S1, available at https://weekly.chinacdc.cn) (*4*).

The Healthy Ageing Index (HAI) consists of five domains: physical capabilities, cognitive function, physiological health, psychological well-being, and social well-being (*5*). A total of 26 indicators were used, each categorized into quintiles with a code from 0 to 100. The sum of all indicator scores divided by the total number of indicators yielded the HAI score, which ranges from 0 to 100 (Supplementary Table S1, available at https://weekly.chinacdc.cn). A higher HAI score indicates better aging status.

The variables listed in Supplementary Table S2 (available at https://weekly.chinacdc.cn) were categori-

zed into two groups (*6*). The first group comprised demographic variables like age and sex. The second group included six domains: war exposure; childhood household socioeconomic status (SES) encompassing self-reported family financial status, parental educational levels, political status, and housing conditions; geographical location (east, central, west) and urban/rural status at birth; parental health status and behaviors during childhood (e.g., parental bedridden condition, alcohol consumption, smoking); childhood health and nutritional status (e.g., self-reported health compared to peers before age 15, childhood experiences of hunger before age 17); and childhood access to healthcare (e.g., vaccination status and type of initial doctor visit).

We conducted descriptive statistical analyses to compare the circumstances and HAI scores across the years 2011, 2013, 2015, 2018, and 2020 within our sample cohort. Our sample was selected without biases related to observables, and detailed results are available upon request. To measure the IOp in HA, we employed the direct parametric method using ordinary least squares (OLS) regressions, where HAI scores served as the dependent variable and the circumstances as the independent variables. We measured inequality utilizing the mean logarithmic deviation (MLD) index (*7*). The proportion of absolute IOp to overall HA inequality was calculated to determine relative IOp values. We also applied unconditional quantile regression (UQR) to explore disparities in HAI scores due to circumstances at specific points in the HAI score distribution. This involved regressing the re-centered influence function (RIF) of the HAI percentile's ranks against the circumstance variables. To ascertain the relative impact of each contextual element, we used the Shapley value decomposition technique in our regression analyses. All statistical procedures were performed using STATA (version 17.0; StataCorp, College Station, TX, US).

Supplementary Table S3 (available at https://weekly.chinacdc.cn) presents the descriptive statistics of the study sample. The average scores for HAI were similar in 2011 (79.2) and 2013 (79.8), with a significant decrease observed in 2020 (75.9). Throughout this period, the overall inequality in HAI ranged from 0.010 to 0.016, with childhood circumstances accounting for 10.9%–14.8% of this inequality. Furthermore, the total inequality in HAI and the proportion explained by childhood circumstances increased from 2011 to 2020. Among the various childhood circumstances, household socioeconomic status (21.9%–27.6%) and regional and urban/rural status at birth (11.8%–22.1%) were the major contributing factors (Figure 1).

Figure 2 shows a significant IOp across various quantiles, demonstrating a consistent decrease towards the higher end of the HA distribution, irrespective of utilizing the complete dataset or different time points. Furthermore, the impact of parental health status, health-related behaviors, and access to healthcare during childhood on IOp escalates towards the lower end of the HA spectrum, where individuals with the most severe health conditions are predominant (Figure 3).

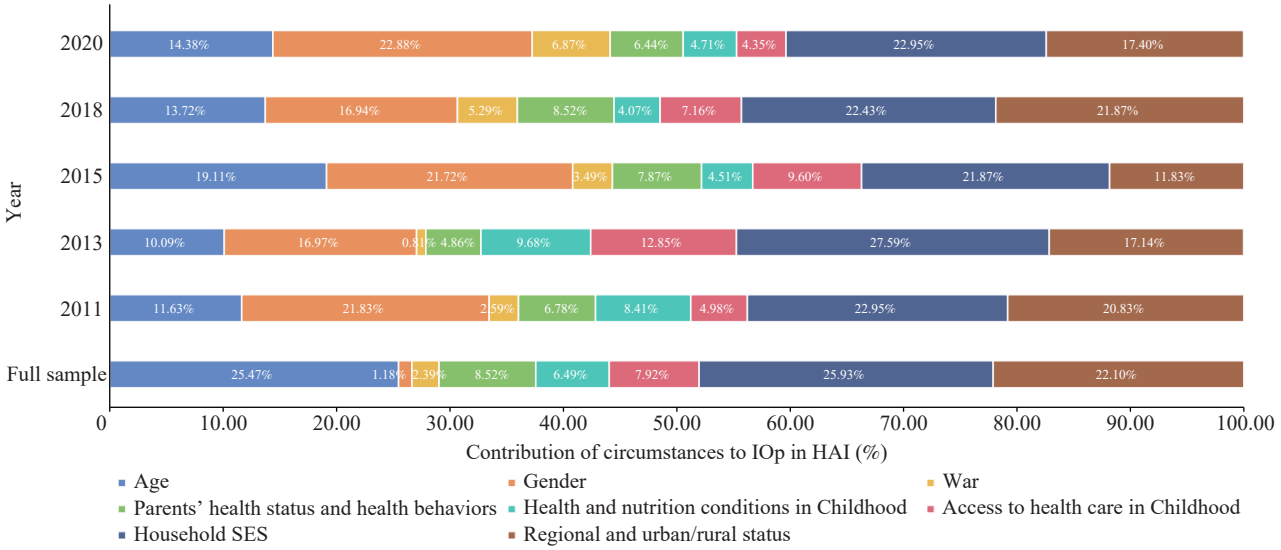

FIGURE 1. Contributions of circumstances to IOp in HAI: Mean-based Shapley decomposition.
Abbreviation: IOp=inequality of opportunity; HAI=healthy aging index; SES=socioeconomic status.

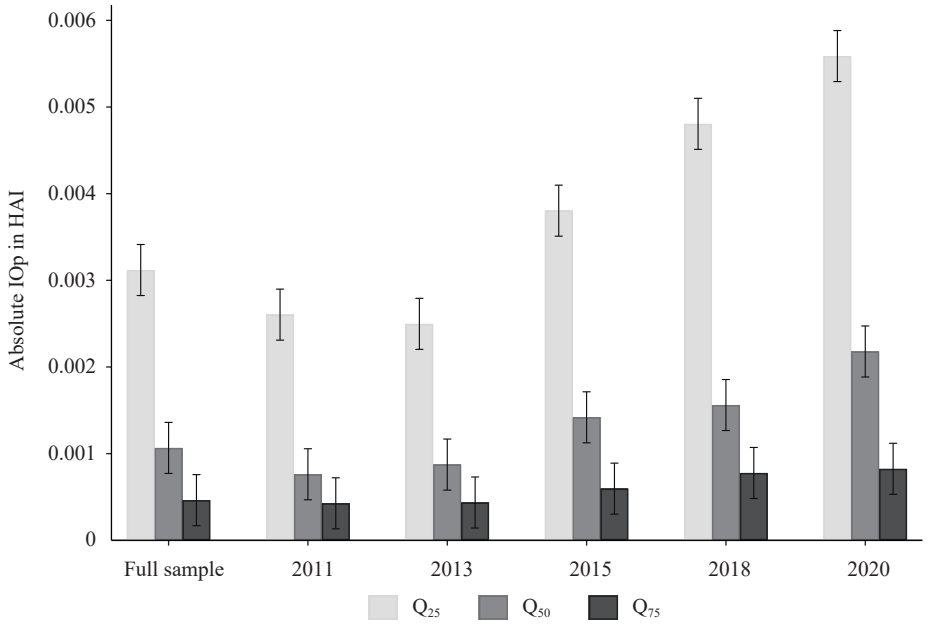

FIGURE 2. IOp in HAI at different quantiles (MLD index).
Abbreviation: IOp=inequality of opportunity; HAI=healthy aging index; MLD=mean logarithmic deviation.

DISCUSSION

The present study has demonstrated a significant and progressive increase in IOp in the HA from 2011 to 2020. Among all variables analyzed, early-life household SES emerges as the most substantial factor contributing to this disparity. This underscores the pivotal influence of household SES in shaping the health status of elderly individuals. A plausible explanation is that a higher level of parental education, typically associated with improved household SES, correlates with increased health literacy and adoption of healthier behaviors among both parents and their offspring, encompassing aspects like dietary habits and medication adherence (*8*). Moreover, enhanced household SES, reflected in superior financial stability, facilitates access to better healthcare services and improved nutrition, thereby limiting children's exposure to detrimental substances and environmental hazards. These elements collectively play a role in promoting better health outcomes in later life (*8*). Hence, enhancing household SES through measures such as elevating parents' educational attainment, improving financial resources within families, and creating healthier living environments during childhood emerges as a viable strategy to mitigate healthcare disparities among the elderly population.

The findings underscore the importance of improving access to healthcare for children and enhancing the health and behaviors of parents in socioeconomically disadvantaged families to reduce health disparities in the Chinese population. Disparities among older adults in China are significantly influenced by geographic location and urban/rural distinctions, possibly due to unequal allocation of healthcare resources, primary healthcare services, and welfare support (*9*). Additionally, our study reveals that health inequality is influenced not only by age and gender but also by differences in childhood experiences.

Moreover, the study revealed that IOp had a greater impact on individuals with poor HA, emphasizing the influence of early-life conditions on disparities, especially in the context of limited household assets. Thus, utilizing distributional decompositions indicated that concentrating solely on mean-based decomposition would neglect crucial aspects associated with early-life conditions, notably when investigating disparities in household assets at the lower spectrum. This aspect is significant as individuals in this bracket are generally perceived as less healthy (*10*).

This study is subject to some limitations. First, data on childhood circumstances relied on retrospective self-reporting, which may lead to recall bias. Second, the mechanisms by which childhood circumstances influence HA are not yet understood.

Our study utilized data from the 2011–2020 CHARLS dataset as our analytical sample. It is crucial in life course research to incorporate thorough

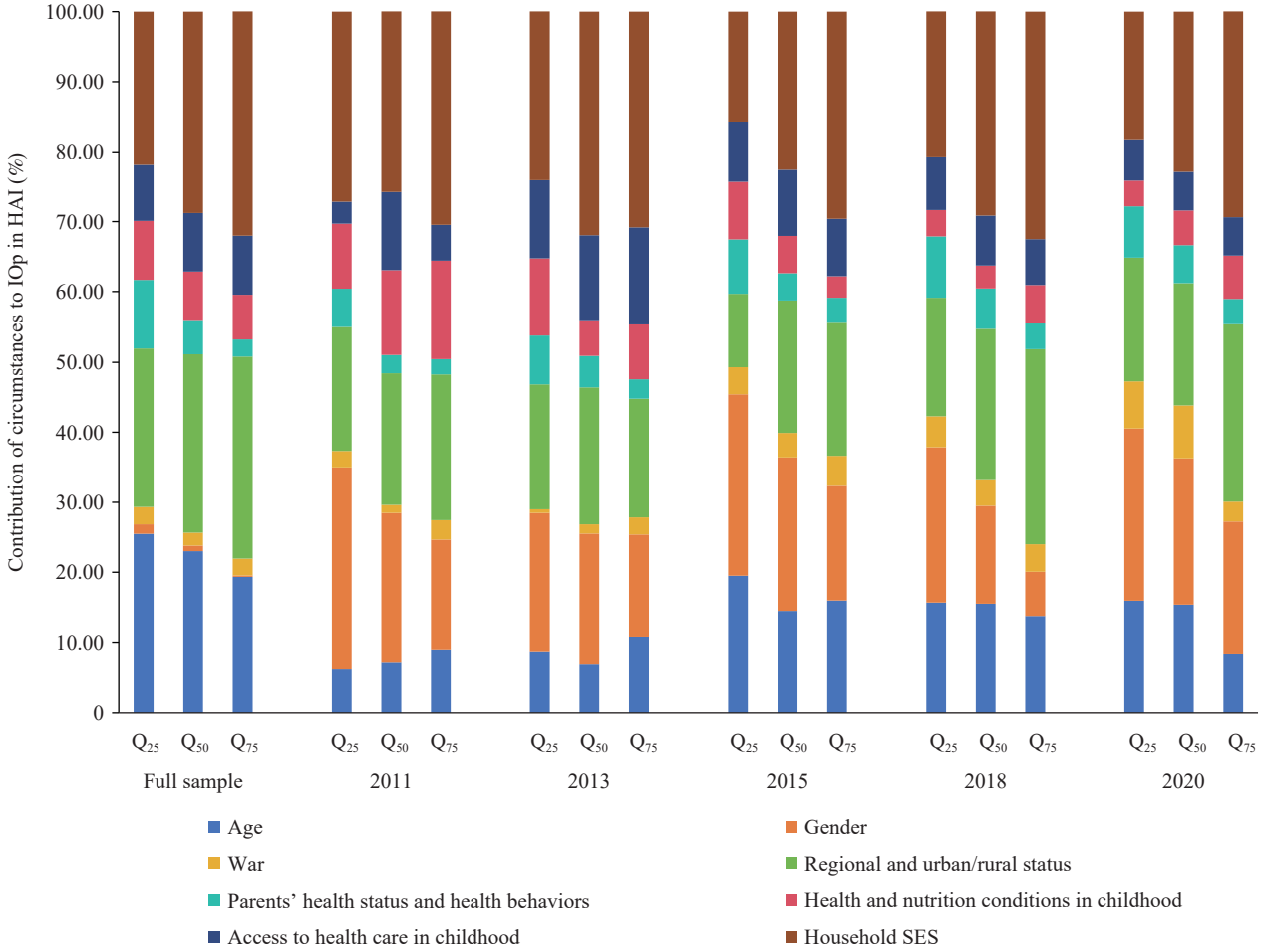

FIGURE 3. Contributions of circumstances to IOp in HAI: RIF-based Shapley decomposition.
Abbreviation: IOp=inequality of opportunity; HAI=healthy aging index; RIF=re-centered influence function; SES=socioeconomic status.

assessments of early-life determinants instead of solely focusing on current adult health status, especially when examining older populations. Therefore, our study contributes significant insights for life course research targeting the reduction of health disparities. Furthermore, our distribution analysis presents valuable findings that can inform the development of targeted public health strategies to tackle health disparities.

Conflict of interest: No conflicts of interest.

Funding: This study was supported by the National Natural Sciences Foundation of China (grant numbers 71804142 and 72074178) and the Start-up Fund for Young Talent Support Plan (grant number 11304222010701). The funding sources did not participate in the study design, data analysis, interpretation, or manuscript writing.

doi: 10.46234/ccdcw2024.042

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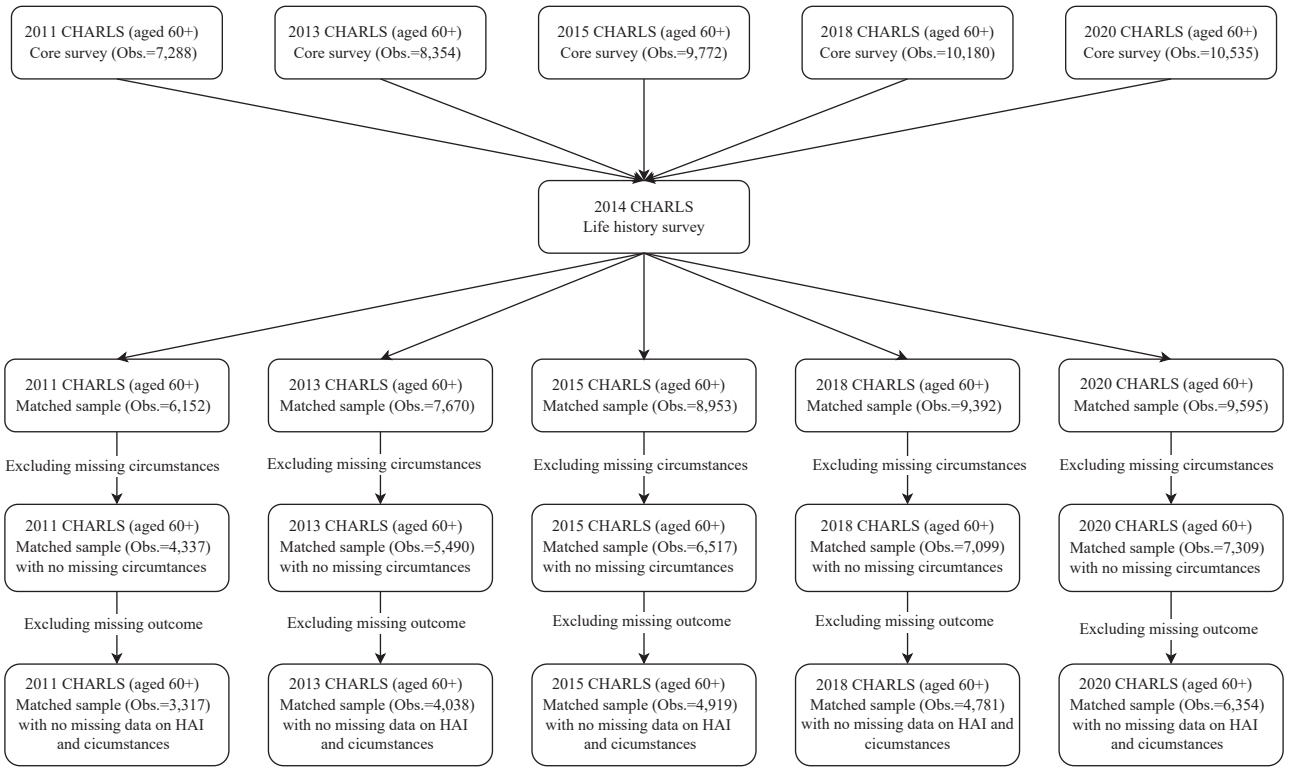
Submitted: September 02, 2023; Accepted: February 07, 2024

REFERENCES

1. Nie P, Li Y, Zhang N, Sun XM, Xin B, Wang YF. The change and correlates of healthy ageing among Chinese older adults: findings from the China health and retirement longitudinal study. BMC Geriatr 2021;21(1):78. https://doi.org/10.1186/s12877-021-02026-y.
2. World Health Organization. China country assessment report on ageing and health. Geneva: World Health Organization; 2015. https://iris.who.int/handle/10665/194271.
3. Yan BJ, Chen X, Gill TM. Health inequality among Chinese older adults: the role of childhood circumstances. J Econ Ageing 2020;17:100237. https://doi.org/10.1016/j.jeoa.2020.100237.
4. Zhao YH, Hu YS, Smith JP, Strauss J, Yang GH. Cohort profile: the China health and retirement longitudinal study (CHARLS). Int J Epidemiol 2014;43(1):61 – 8. https://doi.org/10.1093/ije/dys203.
5. Lu WT, Pikhart H, Sacker A. Comparing socio-economic inequalities

in healthy ageing in the United States of America, England, China and Japan: evidence from four longitudinal studies of ageing. Ageing Soc 2021;41(7):1495 – 520. https://doi.org/10.1017/S0144686X19001740.
6. Yan BJ, Gao SF, Dai ML, Gill TM, Chen X. Early-life circumstances and cross-country disparities in cognition among older populations—China, the US, and the EU, 2008-2018. China CDC Wkly 2022; 4(45):1013 – 8. https://doi.org/10.46234/ccdcw2022.205.
7. Juárez FWC, Soloaga I. Iop: estimating ex-ante inequality of opportunity. Stata J 2014;14(4):830 – 46. https://doi.org/10.1177/1536867X1401400408.
8. Currie J, Goodman J. Chapter 18-Parental socioeconomic status, child health, and human capital. In: Bradley S, Green C, editors. The economics of education: a comprehensive overview. 2nd ed. Amsterdam: Elsevier. 2020; p. 239-48. http://dx.doi.org/10.1016/B978-0-12-815391-8.00018-5.
9. Wang T, Zeng R. Addressing inequalities in China's health service. Lancet 2015;386(10002):1441. https://doi.org/10.1016/S0140-6736(15)00402-X.
10. Ding LL, Jones AM, Nie P. Ex ante inequality of opportunity in health among the elderly in China: a distributional decomposition analysis of biomarkers. Rev Income Wealth 2022;68(4):922 – 50. https://doi.org/10.1111/roiw.12514.

SUPPLEMENTARY MATERIAL



SUPPLEMENTARY FIGURE S1. Flow chart of the study sample.
Abbreviation: CHARLS=China Health and Retirement Longitudinal Study; HAI=healthy aging index; Obs.=number of observations.

SUPPLEMENTARY TABLE S1. Indicators of healthy aging index and harmonizing strategies.

Domains	Variables	Categories	Scores
Cognitive functions	Verbal Memory - 10 words immediate recall	0–10	0–2=0 3–4=25 5–6=50 7–8=75 9–10=100
	Verbal Memory - 10 words delayed recall	0–10	0–2=0 3–4=25 5–6=50 7–8=75 9–10=100
	Orientation - date naming- month	0: incorrect 1: correct	0=0 1=100
	Orientation - date naming- day of month	0: incorrect 1: correct	0=0 1=100
	Orientation - date naming- year	0: incorrect 1: correct	0=0 1=100
	Orientation - date naming- day of week	0: incorrect 1: correct	0=0 1=100
Physical capabilities	ADLs: some difficulties in dressing	0: No 1: Yes	0=100 1=0

Continued

Domains	Variables	Categories	Scores
	ADLs: some difficulties in bathing and showering	0: No	0=100
		1: Yes	1=0
	ADLs: some difficulties in eating	0: No	0=100
		1: Yes	1=0
	ADLs: some difficulties in getting in/out bed	0: No	0=100
		1: Yes	1=0
	ADLs: some difficulties in using the toilet	0: No	0=100
		1: Yes	1=0
	IADLs: some difficulties in taking medications	0: No	0=100
		1: Yes	1=0
	IADLs: some difficulties in shopping for groceries	0: No	0=100
		1: Yes	1=0
	IADLs: some difficulties in preparing hot meal	0: No	0=100
		1: Yes	1=0
	IADLs: some difficulties in managing money	0: No	0=100
		1: Yes	1=0
Psychological wellbeing	CES-D score	0–30 (quintiles)	0–6=100
			7–13=75
			14–20=50
			21–26=75
			27–30=0
	Life satisfaction	0: Very satisfied	0=100
		1: Satisfied	1=75
		2: Somewhat satisfied	2=50
		3: Unsatisfied	3=25
		4: Very unsatisfied	4=0
Physiological health	Self-reported high blood pressure	0: No	0=100
		1: Yes	1=0
	Self-reported diabetes	0: No	0=100
		1: Yes	1=0
	Self-reported cancer	0: No	0=100
		1: Yes	1=0
	Self-reported lung disease	0: No	0=100
		1: Yes	1=0
	Self-reported stroke	0: No	0=100
		1: Yes	1=0
	Self-reported heart problem	0: No	0=100
		1: Yes	1=0
	Self-reported psychological problem	0: No	0=100
		1: Yes	1=0
	Self-reported arthritis	0: No	0=100
		1: Yes	1=0
Social wellbeing	Participations in social activities	0: No	0=0
		1: Yes	1=100

Abbreviation: ADLs=activities of daily living; IADLs=instrumental activities of daily living; CES-D=center for epidemiologic studies depression.

SUPPLEMENTARY TABLE S2. Definitions of demographic and circumstance variables.

Domain	Variable Description
Panel A: Demographics	
	Age
	Sex (1: male; 0: female)
Panel B: Childhood circumstances	
War	Born in the Anti-Japanese War era (1937–1945) (1: Yes; 0: No)
	Born in the Civil War era (1946–1949) (1: Yes; 0: No)
Parents' health status and health behaviors	Parents' health condition (1: long time in bed; 0: No)
	Father having drinking problem (1: alcoholism; 0: No)
	Mother smoking (1: Yes; 0: No)
	Father smoking (1: Yes; 0: No)
Health and nutrition conditions in Childhood	Self-reported health status before age 15 (1: much healthier; 2: somewhat healthier; 3: about average; 4: some less healthy; 5: much less healthy)
	Ever experienced hunger (1: No; 2: yes after age 5; 3: yes before age 5)
Access to healthcare in childhood	Received vaccination before age 15 (1: Yes; 0: No)
	When ill, first visited doctor (1: general/specialized hospital or township clinics; 2: community health centers/private clinics; 3: others)
Regional and urban/rural status	Rural or urban status at birth (0: rural; 1: urban)
	Regional status at birth (1: East; 2: Center; 3: West)
Household SES	Parents' political status (1: any party member; 0: No)
	Mother's literacy (1: literate; 0: illiterate)
	Father's literacy (1: literate; 0: illiterate)
	Family's financial status before age 17 (1: a lot worse; 2: somewhat worse; 3: same; 4: somewhat better; 5: a lot better)
	House type at birth (1: concrete; 2 adobe; 3 wood or others)

Note: Source: CHARLS Life History Survey 2014.
Abbreviation: CHARLS=China Health and Retirement Longitudinal Study; SES=socioeconomic status.

SUPPLEMENTARY TABLE S3. Descriptive statistics.

Variables	Full sample		2011		2013		2015		2018		2020	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
HAI	77.644	11.397	79.178	10.620	79.763	10.163	77.692	10.994	77.585	11.583	75.860	12.141
Sex (1: male; 0: female)	0.833	0.666	0.537	0.499	0.547	0.498	0.530	0.499	0.543	0.498	1.494	0.500
Age	68.138	6.402	66.996	5.876	67.171	5.855	67.550	6.211	68.304	6.463	69.389	6.742
War												
Born in the Anti-Japanese War era	0.258	0.438	0.400	0.490	0.326	0.469	0.263	0.441	0.204	0.403	0.194	0.396
Born in the Civil War era	0.219	0.414	0.324	0.468	0.277	0.448	0.231	0.422	0.181	0.385	0.160	0.367
Parents' health status and health behaviosr												
Parents' health condition (1: long time in bed; 0: No)	0.173	0.378	0.168	0.374	0.174	0.379	0.178	0.383	0.172	0.377	0.172	0.377
Father having drinking problem (1: alcoholism; 0: No)	0.067	0.251	0.065	0.247	0.068	0.252	0.068	0.252	0.068	0.251	0.068	0.251
Mother smoking	0.113	0.316	0.111	0.314	0.115	0.319	0.110	0.313	0.114	0.318	0.113	0.316
Father smoking	0.497	0.500	0.478	0.500	0.488	0.500	0.489	0.500	0.515	0.500	0.501	0.500
Self-reported health status before age 15												
Much healthier	0.174	0.379	0.171	0.377	0.168	0.374	0.166	0.372	0.176	0.380	0.182	0.386
Somewhat healthier	0.207	0.405	0.210	0.408	0.208	0.406	0.203	0.403	0.210	0.407	0.204	0.403
About average	0.500	0.500	0.507	0.500	0.512	0.500	0.513	0.500	0.490	0.500	0.490	0.500
Somewhat less healthy	0.077	0.267	0.074	0.262	0.069	0.254	0.076	0.264	0.083	0.276	0.080	0.271
Much less healthy	0.042	0.200	0.038	0.191	0.042	0.201	0.042	0.200	0.042	0.201	0.043	0.204
Ever experienced hunger												
Yes after age 5	0.705	0.456	0.718	0.450	0.738	0.440	0.736	0.441	0.694	0.461	0.669	0.470
Yes before age 5	0.047	0.212	0.014	0.116	0.015	0.123	0.032	0.176	0.063	0.243	0.077	0.267
No	0.248	0.432	0.268	0.443	0.247	0.431	0.232	0.422	0.243	0.429	0.253	0.435
Received vaccination before age 15	0.842	0.365	0.810	0.392	0.818	0.386	0.836	0.370	0.867	0.339	0.854	0.354
When ill, first visited doctor at												
General/specialized hospital or township clinics	0.312	0.463	0.311	0.463	0.313	0.464	0.311	0.463	0.324	0.468	0.303	0.460
Community health centers/private clinics	0.290	0.454	0.278	0.448	0.290	0.454	0.283	0.450	0.295	0.456	0.296	0.457
Others	0.398	0.490	0.411	0.492	0.397	0.489	0.406	0.491	0.380	0.486	0.400	0.490
Rural or urban status at birth (1: urban; 0: rural)	0.244	0.429	0.217	0.412	0.225	0.418	0.232	0.422	0.264	0.441	0.259	0.438
Regional status at birth												
East	0.374	0.484	0.378	0.485	0.367	0.482	0.362	0.481	0.375	0.484	0.383	0.486
Center	0.317	0.465	0.307	0.461	0.325	0.468	0.327	0.469	0.318	0.466	0.311	0.463
West	0.309	0.462	0.315	0.465	0.308	0.462	0.311	0.463	0.307	0.461	0.306	0.461
Parents' political status (1: any party member; 0: No)	0.108	0.310	0.074	0.263	0.083	0.276	0.095	0.293	0.126	0.332	0.131	0.337
Mother's education (1: literate; 0: illiterate)	0.087	0.282	0.062	0.241	0.070	0.254	0.076	0.264	0.105	0.307	0.101	0.301
Father's education (1: literate; 0: illiterate)	0.423	0.494	0.393	0.488	0.404	0.491	0.409	0.492	0.454	0.498	0.433	0.496
Family financial status before age 17												
A lot worse	0.220	0.414	0.232	0.422	0.228	0.419	0.221	0.415	0.212	0.409	0.214	0.410
Somewhat worse	0.149	0.357	0.149	0.356	0.146	0.353	0.150	0.358	0.146	0.353	0.153	0.360
Same	0.093	0.290	0.090	0.287	0.090	0.286	0.088	0.283	0.097	0.296	0.095	0.293
Somewhat better	0.526	0.499	0.517	0.500	0.526	0.499	0.530	0.499	0.530	0.499	0.524	0.499
A lot better	0.013	0.112	0.011	0.106	0.010	0.100	0.011	0.102	0.015	0.121	0.014	0.118
House type at birth												
Concrete	0.158	0.365	0.153	0.360	0.150	0.357	0.153	0.360	0.166	0.372	0.162	0.368
Adobe	0.580	0.494	0.582	0.493	0.578	0.494	0.576	0.494	0.575	0.494	0.586	0.493
Wood or others	0.262	0.440	0.265	0.441	0.272	0.445	0.272	0.445	0.259	0.438	0.252	0.434

Note: Sampling weights are applied.
Abbreviation: HAI=healthy ageing index; SD=standard deviation.