



MACQUARIE  
University



# Multidimensional Healthy Life Expectancy of Elderly Population in China

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# 1. Introduction



## DRAMATIC DEMOGRAPHIC TRANSITION WORLDWIDE

- Life expectancy has been increasing steadily worldwide and in China, seeing substantial expanding size of elderly population. However, what is less understood is whether (and how long) the extended life expectancy is spent with disability or in healthy status.

- Healthy life expectancy (HLE)** is used to analyze this issue. HLE represents the expected healthy or specific-disease-free time in the remaining life at a certain age.
- This indicator integrates the information of mortality and morbidity, having been widely used for public health evaluation as population aged substantially in the past decades.

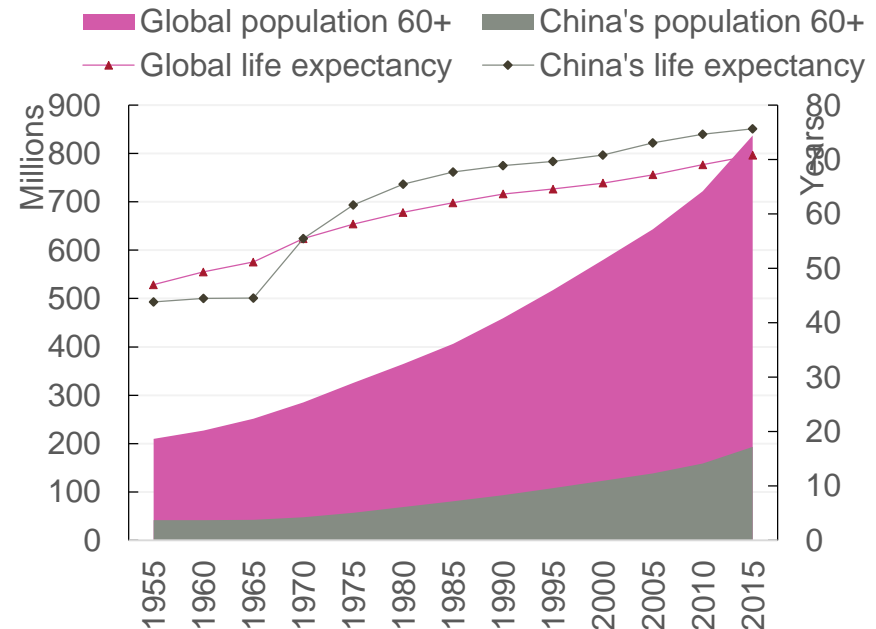


Figure 1 Demographic transition in the world since 1955 <https://esa.un.org/unpd/wpp/Download/Standard/Population/>

## 2. Literature review



### PREVIOUS RESEARCH

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- Since the concept of HLE was firstly proposed in the 1970s by Sanders (1964) and calculated by Sullivan (1971), a growing body of research have been conducted on elderly HLE in USA and European countries, identifying massive difference by country, gender, race and educational level.
- --It is reported that HLE at age 60 are much higher in the developed world than that in the developing world (eg, 17.4 years in Europe, 12.5 in Africa in 2016).
- --Elderly male's HLE account for a higher proportion in total life expectancy than that of females (at least 1%).
- --Higher education years correlate longer HLE in later life.
- --In the US, White American have longer HLE at age 65 than other races (by 0.6 years)

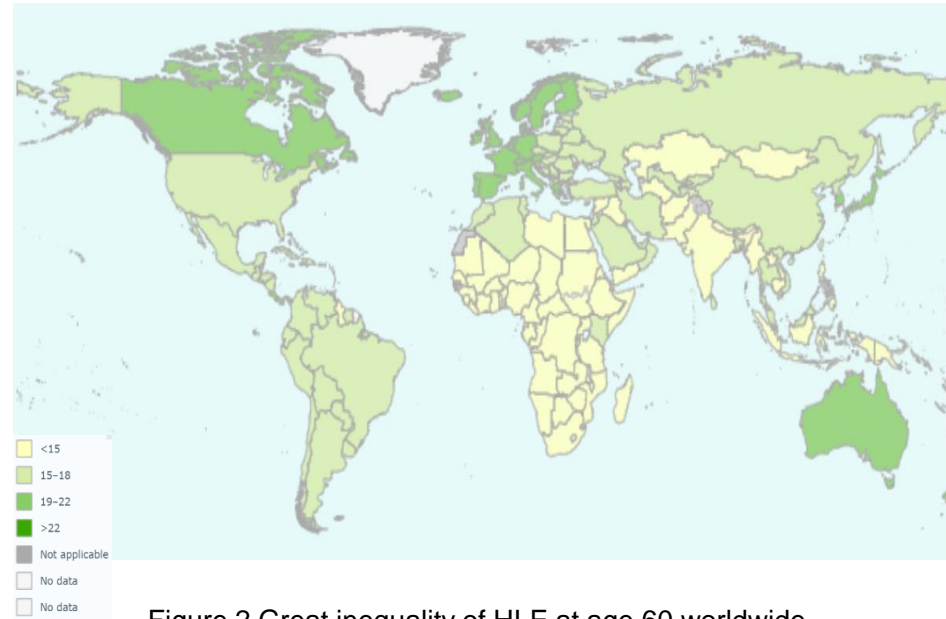


Figure 2 Great inequality of HLE at age 60 worldwide

[http://www.who.int/gho/mortality\\_burden\\_disease/life\\_tables/hale/en/](http://www.who.int/gho/mortality_burden_disease/life_tables/hale/en/)

## 2. Literature review



### GAPS OF EXISTING RESEARCH ON ELDERLY HLE

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#### Global research on elderly HLE

- **1.** Most research focused on the experiences of developed nations but the developing world has been less investigated. (90% vs 10%)
- **2.** Existing research on HLE tend to only focus on the physical aspect of health but ignore the aspect of cognition.

#### Research on China's elderly HLE

- **3.** Research on China's elderly HLE has been found inadequate and also overlooks the aspect of cognitive health.
- **4.** Other important aspects, such as differences of China's elderly HLE by marital status, educational level and initial health status at age 60 have also been missing in the literature.

## 2. Literature review



### OBJECTIVES OF THE PRESENT STUDY

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- **1.** Estimates and analyses the length of HLE of China's elderly population along with two sub-indicators, **active life expectancy (ALE)** and **cognitive-impairment-free life expectancy (CIFLE)**, based on the multistate life stable method.
- **2.** Examines socioeconomic differences of HLE of China's elderly population by gender, urban-rural divide, region, marital status, educational level as well as the health status at age 60.

***This is the first comprehensive study that measures CIFLE of China's elderly population. It is also the first study that examines the differences of China's elderly HLE from three socioeconomic dimensions at the same time: marriage, education and health status at age 60.***

# 3.Data



- **China Health and Retirement Longitudinal Study (CHARLS)**, a nationally representative longitudinal survey mainly conducted by Peking University of China in 2011, 2013 and 2015, was used, which collects data of social, economic and health aspects from 17,708 Chinese residents aged 45 years or over.
- **6,635 respondents** aged 60 or over with longitudinal data between 2011-13 have been included in this study
- **Physical function** was measured by **Activities of Daily Living (ADL)** scale, including six questions to detect people's abilities of showering, self-feeding, dressing, using toilet, getting into or out of bed, and controlling urination and defecation. (Cronbach's  $\alpha = 0.82$  in CHARLS 2011, and 0.84 in CHARLS 2013)
- **Cognitive function** was measured by the widely used **simplified Chinese version of the Mini-Mental State Examination scale**, including the measurement of the ability of words, orientation, recall, calculation, language and drawing a figure. (Cronbach's  $\alpha = 0.87$  in CHARLS 2011, and 0.88 in CHARLS 2013).

# 3.Data



Table 1 Definition of different health statuses among elderly people

Health statuses	Definition
Physically inactive	With any ADL disabilities
Physically active	No any ADL disabilities
Cognition-impaired	MMSE scores under 12 in CHARLS
Cognitive-impairment-free	MMSE scores at least 12 in CHARLS
Healthy	No any ADL disabilities and MMSE scores at least 12
Unhealthy	Any ADL disabilities or MMSE scores under 12
Death	Individual passed away

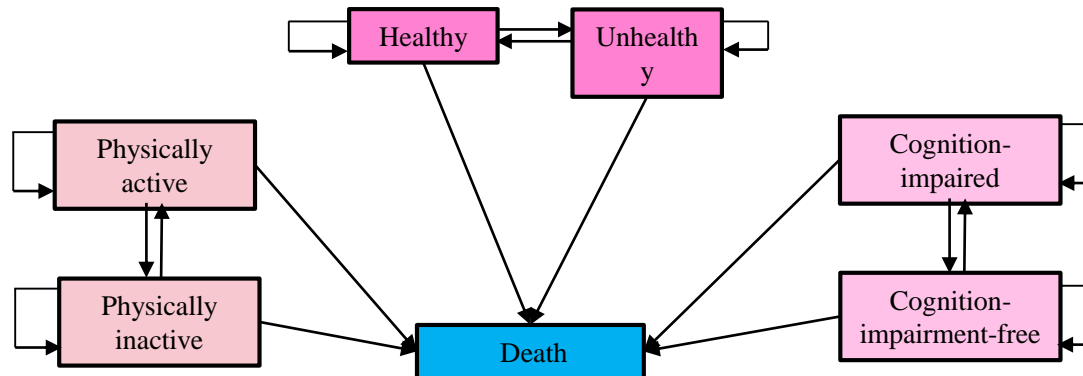


Figure 3 Transition relationships between different health statuses

# 4. Methods



**Calculation process** of the multistate life table method:

$$p_{x,x+t}^{i,j} = \frac{H_{x+t}^j}{H_x^i}$$

$$\ln \frac{p_{x,x+t}^{i,j}}{p_{x,x+t}^{i,i}} = \alpha_{i,j}(t) + \beta_{i,j}(t)x, i \neq j$$

$$P_{x,x+t} = (P_{x,x+t}^{i,j}) = \begin{pmatrix} P_{x,x+t}^{1,1} & P_{x,x+t}^{1,2} & P_{x,x+t}^{1,3} \\ P_{x,x+t}^{2,1} & P_{x,x+t}^{2,2} & P_{x,x+t}^{2,3} \\ 0 & 0 & 1 \end{pmatrix}$$

$$l_{x,x+t} = \begin{pmatrix} l_{x,x+t}^{1,1} & 0 & 0 \\ 0 & l_{x,x+t}^{2,2} & 0 \\ 0 & 0 & 0 \end{pmatrix}$$

$$l(x+t) = P_{x,x+t} * l(x)$$

$$L(x+t) = \frac{t}{2} * [l(x+t) + l(x)]$$

$$T(x) = \sum_{k=x}^{\omega} L(k)$$

$$e(x) = T(x) * \bar{l}(x+t)$$

This study chose **the multistate life table method** instead of the most widely used Sullivan method for the following reasons.

- **Firstly**, the multistate life table method is able to reflect the reversal possibilities of health statuses, either from or to ill-health, while the Sullivan method is incapable.
- **Secondly**, multistate life table method allows the comparison of HLE between different subpopulation groups such as by region and educational level, which is unachievable by Sullivan method in most situations.
- **Finally**, multistate life table method can explicitly estimate the transition rates to and from ill-health. Therefore the corresponding contributions of prevalence of ill-health can be calculated



# 5. Results



## SEX-AGE-SPECIFIC HLE AMONG CHINA'S ELDERLY PEOPLE

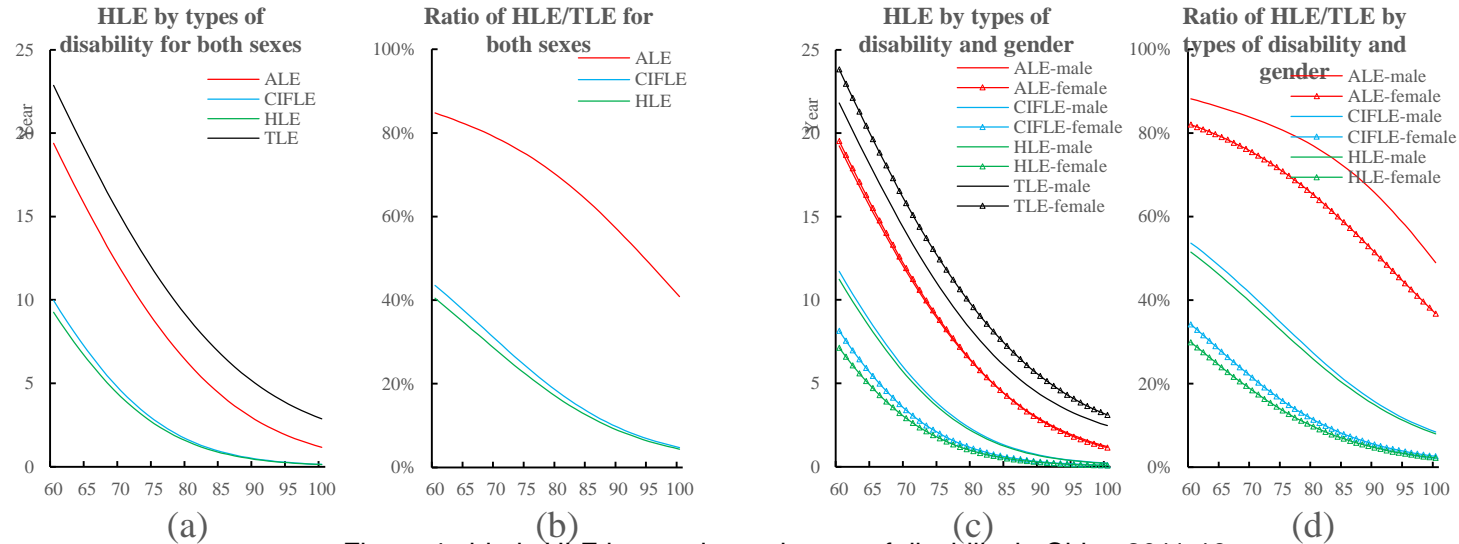


Figure 4 elderly HLE by gender and types of disability in China 2011-13

- For both sexes, the TLE at age 60 stands at **22.55 years**, ALE at **19.4**, CIFLE at **9.96**, and HLE at **9.26**.
- ALE is much higher than CIFLE, and CIFLE surpluses HLE by a substantially smaller extent.
- Male CIFLE and HLE are higher than females in absolute terms.
- Male ALE, CIFLE and HLE account higher proportions in TLE than that of females.

# 5. Results



## SEX-AGE-SPECIFIC HLE BY PLACES OF RESIDENCE

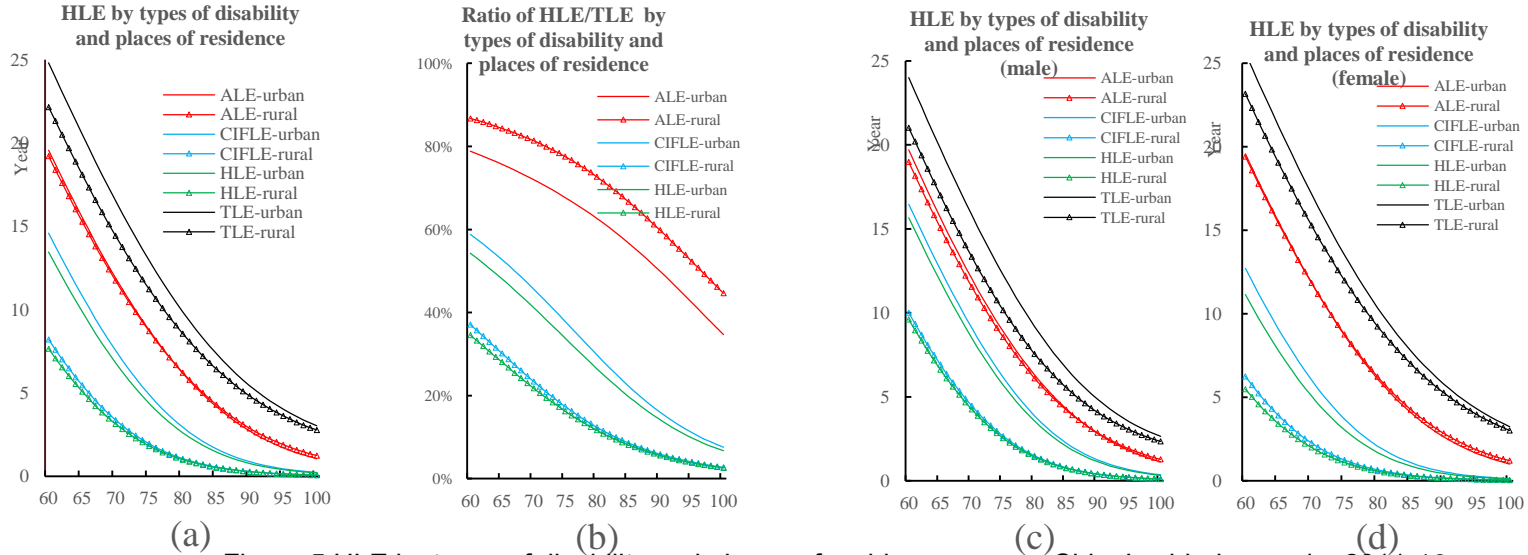


Figure 5 HLE by types of disability and places of residence among China's elderly people, 2011-13

- In absolute terms, elderly people in urban areas have longer all types of life expectancy than those in rural areas except ALE.
- In relative terms, elderly people in rural areas have higher proportion of ALE in TLE while elders in urban areas are advantaged in CIFLE and HLE.
- In terms of ALE, rural males and females perform better than their counterparts in urban areas.
- In CIFLE and HLE, figures of urban males and females are much higher.

# 5.Results



## SEX-AGE-SPECIFIC HLE BY REGION

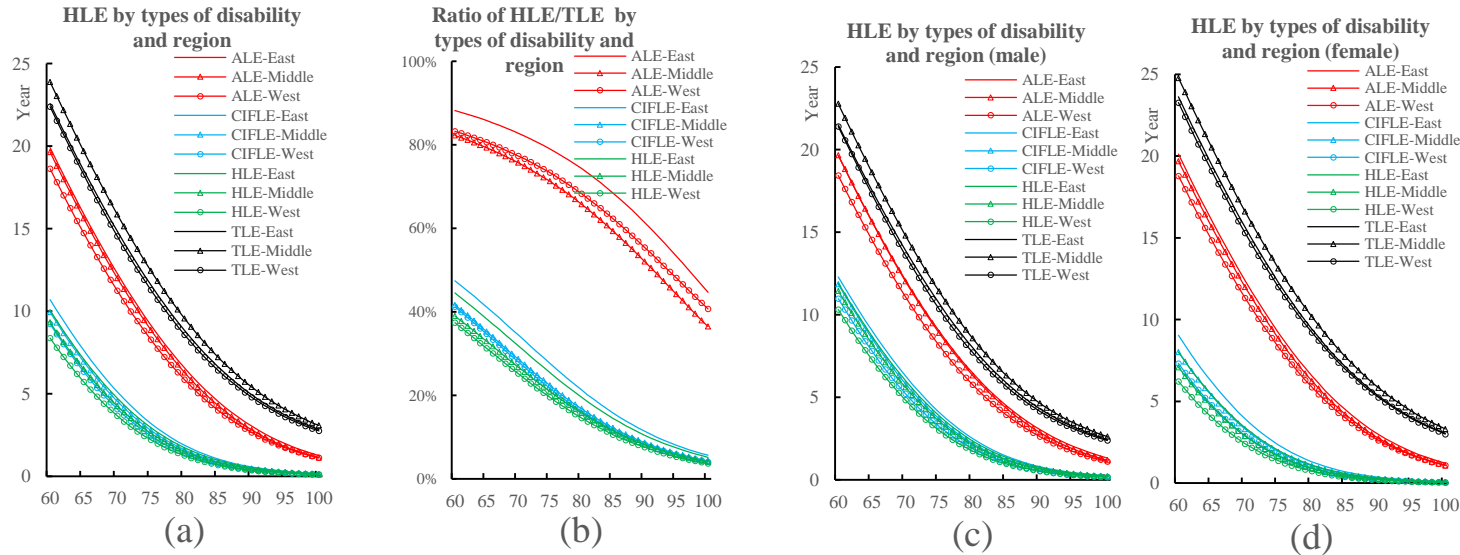


Figure 6 China's elderly HLE by types of disability and region 2011-13

- **East Region has the highest ALE(19.9), CIFLE (10.7) and HLE (10.0) and Middle Region has the highest TLE (23.9) while West Region ranks the lowest in all four indicators.**
- In relative terms, East Region ranks on the top of four indicators while Middle Region on the second and West Region on the bottle.

# 5. Results



## SEX-AGE-SPECIFIC HLE BY MARTIAL STATUS

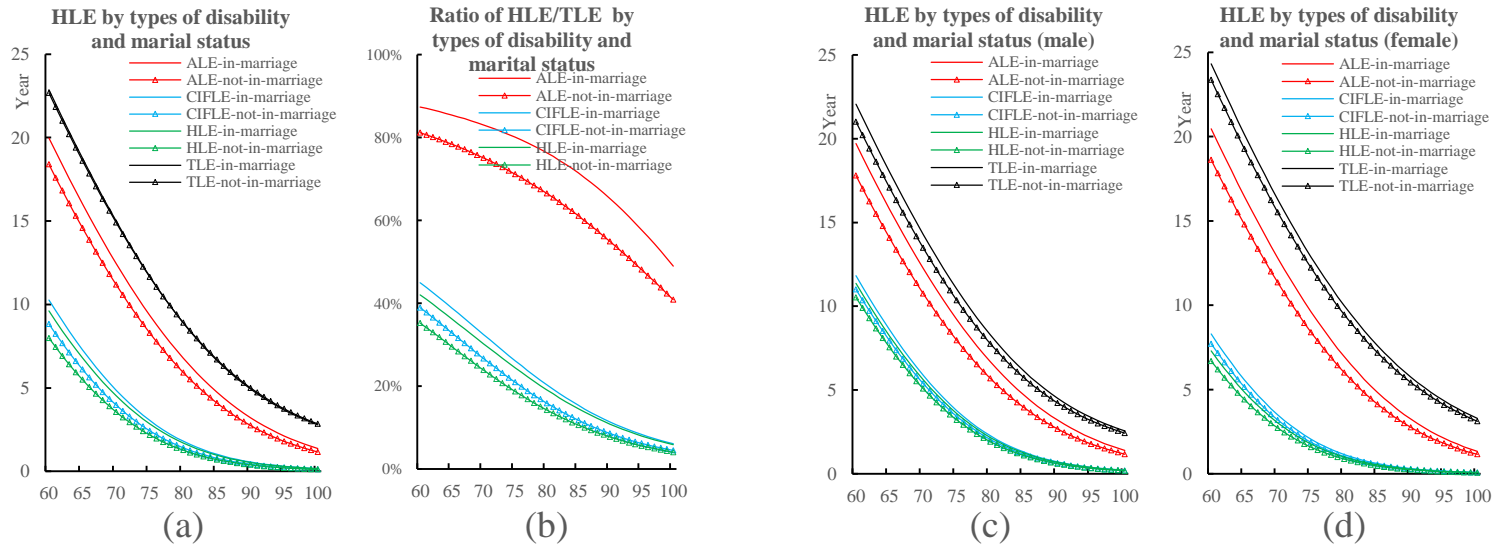


Figure 7 China's elderly HLE by types of disability and marital status 2011-13

- **Elderly people in marriage have higher figures in all four indicators than those not in marriage either absolutely or relatively and regardless of gender.**
- The marital difference tend to narrow with increasing age in particular after age 90

# 5.Results



## SEX-AGE-SPECIFIC HLE BY EDUCATION LEVELS

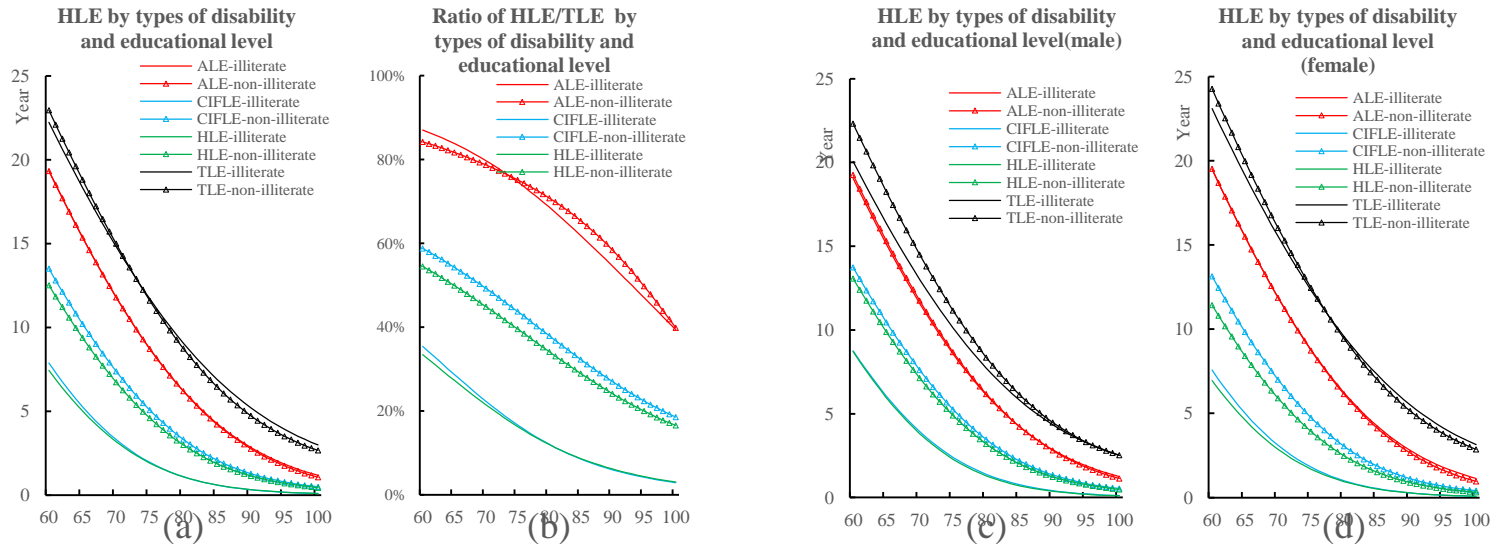


Figure 8 China's elderly HLE by types of disability and education level 2011-13

- **For illiteracy and non-illiteracy, TLE and ALE both stand at almost the same level.**
- **In terms of the comparisons of CIFLE and HLE, non-illiteracy have substantially higher figures than illiteracy.**

The significant difference of CIFLE by educational level has also been identified regardless of gender and remains significant at even every old ages.

# 5.Results



## SEX-AGE-SPECIFIC HLE BY HEALTH STATUS AT AGE 60

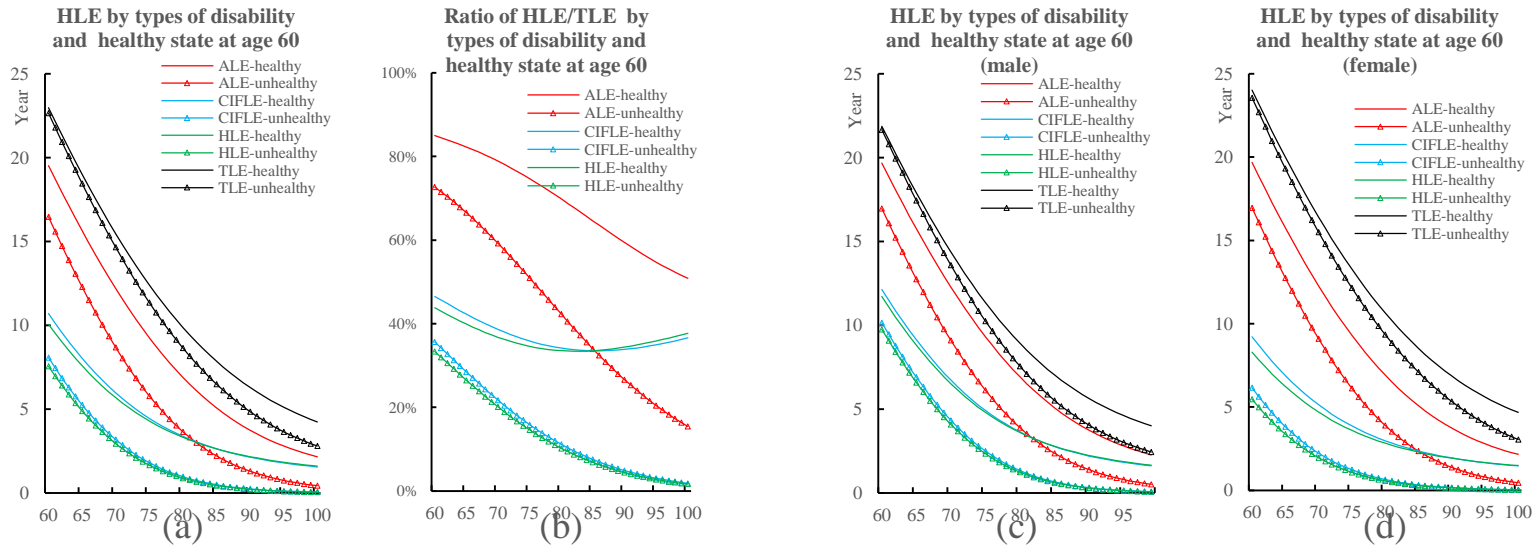


Figure 9 China's elderly HLE by types of disability and initial healthy state at age 60 2011-13

- **Elderly people who had unhealthy status at age 60 have a significantly lower HLE, either ALE or CIFLE.**
- **HLE of elderly people with unhealthy status at age 60, either ALE or CIFLE, deteriorates at a faster speed.**
- **The difference of ALE, CIFLE and HLE by health status at age 60 are still visible even at very old ages.**



## 6. Conclusions and discussions

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This study fills some major gaps in the literature by providing comprehensive analysis of China's elderly HLE and a detailed measurement of CIFLE among China's elderly population. The major findings are summarized below:

- **1.** China's elderly ALE, CIFLE and HLE between 2011-13 were identified at 19.39 years, 9.96 and 9.26 respectively in this study.
- **2.** Elderly people who are female, in West Region, not in marriage and less educated tend to have lower ALE, CIFLE and HLE in China;
- **3.** Elderly people in China's rural areas have higher ALE but lower CIFLE than their counterparts in urban areas.
- **4.** Unhealthy status at age 60 correlates with lower ALE, CIFLE and HLE in later life. HLE of those unhealthy at age 60 also decreases at faster speed than those who were healthy at age 60. Moreover, the difference of HLE by health status at age 60 still remain significant at very old ages.
- **5.** The early life experience of Chinese elderly people and the deepening socioeconomic inequality among them might provide explanations the findings above.



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*Thank you.*

