Are Older Adults in China Living Longer Happy Years? A Cohort-Based Multistate Analysis, 2002–2018

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Abstract

As China's older population expands and longevity increases, a critical question emerges: are later-born cohorts living longer happy years than their predecessors? Using the Chinese Longitudinal Healthy Longevity Survey (2002–2018), we employed cohort-based multistate life tables to estimate partial-cohort happy life expectancy (PC-HapLE) across four age ranges (68–73, 74–79, 80–85, and 86–91), comparing cohorts born 10 years apart and stratified by gender, education, and urban-rural residence. We found that later-born cohorts experienced significant increases in both absolute happy years and their proportion of life spent happy through a "compression of unhappiness," while total life expectancy remained largely stable. However, these gains were substantially unequal. Urban residents achieved substantial improvements across all age ranges, whereas rural residents showed modest gains that were often statistically insignificant. This widening "happiness gap" was mirrored by education and gender, with literate individuals and women experiencing considerably larger improvements than their illiterate and male counterparts. While China's older adults are living longer happy years, this aggregate progress masks a deepening inequality in life quality, with the benefits of socioeconomic development disproportionately benefiting urban, educated, and female populations. Our findings suggest that policy priorities should shift from simply extending longevity to promoting more equitable gains in later-life well-being.

Keywords: Happy life expectancy, Cohort analysis, Population aging, Socioeconomic disparities, China

1. Introduction

Over the past few decades, China has undergone a rapid process of population aging. In 2023, the number of individuals aged 65 and older reached 210 million, accounting for more than 15.3% of the total population, a proportion that has doubled in just over two decades (National Bureau of Statistics of China, 2023). Projections estimate this figure will climb to 390 million by 2050, comprising nearly 30% of the nation's population (United Nations, 2024). This demographic shift has been accompanied by increases in life expectancy (LE). In 2023, LE at birth in China stood at 78.0 years, up from just 43.8 years in 1950. Over the same period, LE at age 65 nearly doubled, rising from 9.1 years in 1950 to 17.5 years in 2023 (United Nations, 2024). However, these gains in longevity raise a critical question: are these added years of life also high-quality years? Answering this question is crucial for shaping effective aging policies that move beyond merely extending longevity to enhancing the quality of those added years.

To assess the quality of added life-years, scholars have developed summary measures that integrate quantity and quality of life. The most established of these, healthy life expectancy (HLE), decomposes total LE into years lived in good and poor health (Sanders, 1964). This measure has been instrumental in the long-standing debate on whether populations are experiencing a "compression of morbidity", where longer lives are accompanied by a shorter period of ill-health before death (Fries, 1980)—or an "expansion of morbidity," where the extra years are spent in poorer health(Gruenberg, 1977). However, while health is a fundamental component of life quality, it does not encompass the full spectrum of it (Y. Yang, 2008). Recognizing this, the World Health Organization defines quality of life as a broad concept encompassing not only physical health but also psychological states and social relationships (The WHOQOL Group, 1998). Happiness is a cognitive, global judgment of the quality of life, which is defined as the extent to which an individual positively evaluates their overall life as a whole (Veenhoven, 1996). As an analogy and complement to HLE, happy life expectancy (HapLE) has emerged as a summary measure that integrates longevity with happiness, which reflects not only how long people live but also how long they live in a happy state. By examining HapLE, we can move beyond the narrow focus on disease and disability to assess whether societies are fostering environments where older adults not only survive but also thrive (Y. Yang, 2008).

Research on HapLE raises a critical question: as people are living longer, are they universally succeeding in converting longer lives into happy ones? The case of China provides a compelling context for understanding HapLE dynamics. The country's path has been marked by the "Easterlin paradox"—the observation that massive economic growth may not lead to a corresponding rise in life satisfaction (Easterlin, 1974). This phenomenon was prominent in China from the 1990s to the early 2000s, often attributed to the social disruptions of market reforms (Easterlin et al., 2012; Graham et al., 2017; Knight & Gunatilaka, 2011). More recent evidence, however, suggests a reversal of this trend since the early 2000s, with happiness levels rising in tandem with the maturation of China's social security systems (H. Cai et al., 2023; P. Wang, 2023). Mirroring this positive aggregate trend, a period-based analysis on HapLE trends in China documented an overall "compression of unhappiness" (Duan & Chen, 2020). However, this narrative of aggregate improvement may conceal possible inequalities in these dynamics. Socioeconomic status acts as a fundamental cause of life chances, shaping access to the resources required for a happy and healthy life (Link & Phelan, 1995). In China, the most prominent fault line is the institutionalized urban-rural divide, which creates significant gaps in income, healthcare, and educational opportunities (Guo & Li, 2024; Liu et al., 2019). Alongside this, education serves as another key stratifying mechanism, equipping individuals with the knowledge and capital to better manage their lives in a complex society (Cheng & Yan, 2021). A recent analysis of HapLE in China confirmed that disparities exist, with urban and more educated older adults living significantly longer happy lives (Wan & Jiang, 2024).

Two important gaps can be identified from the existing literature. First, the reliance on period-based analyses provides an incomplete examination. Period estimates, which aggregate data across cohorts at a single point in time, are useful for monitoring population-level shifts but do not fully capture the lived experiences of actual generations (Payne, 2022). A cohort perspective is essential to examine whether later-born Chinese are living longer happy lives than their predecessors. Second, while research has established the existence of significant socioeconomic disparities in HapLE at a single period of time (Wan & Jiang, 2024), these static analyses leave a crucial question unanswered: have these happiness gaps narrowed or widened across cohorts? A dynamic analysis, which examines trends in inequality, is required to assess whether the benefits of China's development have been distributed equitably or have disproportionately benefited those with more resources (Liu et al., 2019).

To address these limitations, this study poses two research questions. First, from a cohort perspective, are later-born older Chinese adults living more happy years than their predecessors? Second, how have socioeconomic disparities in HapLE—specifically by urban-rural residence and educational attainment—evolved across these successive birth cohorts? In other words, have these happiness gaps widened or narrowed over time? To answer these questions, we employ a cohort-based multistate life table approach using nationally representative data from the Chinese Longitudinal Healthy Longevity Survey (CLHLS) from 2002 to 2018. By investigating both the overall cohort trend and its inequalities, this study aims to provide a more comprehensive understanding of population life quality in aging China.

2. Data and Methods

2.1 Data

This study used data from CLHLS, a longitudinal study of older adults in China (Center for Healthy Aging and Development Studies, 2020). The CLHLS covers 23 of China's 31 provinces, municipalities, and autonomous regions, accounting for approximately 85% of the nation's total population, making it a robust data source for examining trends in aging (Gu, 2008; Zeng, 2008).

Happiness was assessed using a single-item measure of life satisfaction in CLHLS. The terms subjective well-being, life satisfaction, and happiness are often considered interchangeable in relevant literature (Easterlin et al., 2021; Y. Yang, 2008). This measurement has been widely applied in large-scale surveys due to its simplicity and effectiveness and has demonstrated high reliability and validity in assessing individual well-being (Baur & Okun, 1983; Lucas et al., 2018). Specifically, CLHLS evaluated respondents' life satisfaction through the question: "How do you feel about your life at present?" Responses were rated on a five-point scale. In line with previous research (Duan & Chen, 2020; Wan & Jiang, 2024), respondents answering "very good" or "good" were classified as "happy," while those answering "so so", "bad" or "very bad" were categorized as "unhappy." Mortality information in CLHLS was primarily obtained from official death certificates. In their absence, data were collected from local residential committees or reports from close relatives. Urban-rural residence was determined at baseline, with "city" and "town" responses combined into "urban". Education was classified into two categories: individuals with any years of schooling were categorized as "literate", and those with none as "illiterate".

This study focused on comparing state-specific partial-cohort life expectancy (PC-LE), which calculates total LE within a specified age range for a given cohort, as well as the expected years lived in a happy or unhappy state. This method has been used to examine trends in healthy life expectancy (HLE), disability-free life expectancy (DFLE), and morbidity-free life expectancy (MFLE) across successive birth cohorts (Liu et al., 2019; Payne, 2022; Payne & Wong, 2019; Shen & Payne, 2023). Compared to estimates of full-cohort life expectancy, PC-LE estimates do not require data from fully extinct cohorts, making them more practical for contemporary demographic analyses. Furthermore, using cohort-based estimates helps mitigate biases arising from structural changes across generations, thereby providing clearer comparisons between different population groups (Payne, 2022).

We compared PC-LE and partial-cohort happy life expectancy (PC-HapLE) within four independent 6-year age ranges (68-73, 74-79, 80-85, and 86-91)[1] across two successive birth cohorts born 10 years apart. Table 1 shows the corresponding birth cohorts observed within a specific 6-year period, with "earlier cohorts" on the left and "later cohorts" on the right for each age range. Figure 1 provides a Lexis diagram to illustrate this structure for ages 68–73. As shown in the Supplementary Figure S1, all individuals from these birth cohorts with at least two consecutive observations of happiness status or mortality were included, excluding cases missing information on key variables. The Supplementary Table S3 presents the sample sizes and baseline characteristics of these birth cohorts.

2.2 Methods

This study applied the multi-state life table (MSLT) method to estimate PC-LE and PC-HapLE. As shown in the Supplementary Figure S2, three discrete states were defined: happy, unhappy, and dead. Four potential transitions were considered: happy to unhappy, unhappy to happy, happy to dead, and unhappy to dead. The estimation of MSLT functions was performed using a modified version of the Stochastic Population Analysis for Complex Events (SPACE) program (L. Cai et al., 2010) in SAS 9.4 (SAS Institute Inc., 2016). Subsequent data processing and all visualizations were conducted in R (R Core Team, 2023).

The SPACE computation process consisted of three sequential steps. First, data preprocessing was conducted to accommodate the varying intervals between CLHLS survey waves. SPACE converted CLHLS data into person-years format and imputed annual state values, filling missing years with pseudo-data to represent consecutive years of observation. Second, annual transition probabilities were estimated for each age range using multinomial logistic regression. The base model incorporated age, age-squared, gender, cohort, and interactions between age, gender, and birth cohorts. Two additional models were fitted to examine subgroup differences: one incorporating urban-rural residence and another including education attainment, along with their respective interaction terms with age, gender, and cohort. Third, microsimulation was employed to compute PC-LE and PC-HapLE based on the estimated transition probability matrices. A synthetic cohort of 100,000 individuals was created, with each person assigned an initial happiness state according to the weighted distribution observed at the starting age of each age range. Annual transitions were simulated by comparing random uniform numbers against age-specific transition probabilities until individuals reached the upper bound of their respective age range. PC-LE was calculated as the mean survival years within the age range, while PC-HapLE and partial-cohort unhappy life expectancy (PC-UnHapLE) represented the mean years spent in the happy and unhappy states, respectively. The proportion of life spent in a happy state (HapLE%) and in an unhappy state (UnHapLE%) were calculated as the percentage of PC-HapLE and PC-UnHapLE in PC-LE. Confidence intervals (CIs) were derived through bootstrap resampling with 300 iterations to capture uncertainty in both parameter estimation and microsimulation processes.

Inverse probability weighting (IPW) was applied to adjust for potential biases arising from differential loss to follow-up. This method assigned higher weights to individuals who completed follow-up, where weights are inversely proportional to the probability of completing follow-up. The propensity score models included all baseline sociodemographic variables (age, gender, education, and urban-rural residence), baseline happiness status, and a disability status variable defined by activities of daily living (ADL), where individuals with dependency in one or more ADL items were classified as disabled (Liu et al., 2019; Payne, 2022; Shen & Payne, 2023). IPW weights were estimated separately for each period and birth cohort, and the final analytical weight was derived by multiplying the IPW weight by the combined respondent weight from CLHLS (DuGoff et al., 2014; Liu et al., 2019). Balance diagnostics (Supplementary Table S1) and detailed propensity score model estimates (Supplementary Table S2) demonstrated adequate covariate balance and model performance.

To test the robustness of our findings to the dichotomization of the happiness statevariable, we conducted a sensitivity analysis using a four-state model: happy (comprising "very good" and "good" responses), neutral (comprising "so so" responses), unhappy (comprising "bad" and "very bad" responses), and dead[2], as shown in the Supplementary Figure S3. Consequently, in addition to PC-HapLE and PC-UnHapLE, this model allowed us to estimate partial-cohort neutral life expectancy (PC-NLE), defined as the expected number of years lived in a "neutral" state within each age range. The models were re-estimated using this expanded state space, following the same analytical procedures described above.

3. Results

The Supplementary Table S3 presents the baseline characteristics of each birth cohort within the four age ranges examined in this study. Gender distribution remained relatively stable across cohorts, with men comprising approximately 50%-56% of each cohort. Urban-rural residence distribution varied across cohorts without consistent patterns. There was a clear trend of increasing educational attainment in the three younger age ranges, with the proportion of literate individuals rising notably, while the oldest age range showed a slight decline. Baseline happiness levels showed mixed patterns across age ranges, with modest changes ranging from slight decreases to small increases across cohorts.

3.1 Overall Cohort Differences in PC-LE and PC-HapLE

As presented in Figure 2 and Supplementary Table S4, cohort comparisons across four age ranges (68–73, 74–79, 80–85, and 86–91) showed that later-born cohorts of Chinese older adults experienced significant increases in both the absolute number and relative proportion of happy years. This overall cohort improvement was not driven by substantial extensions in total longevity. PC-LE demonstrated relative stability across birth cohorts in most age ranges, with only a modest but significant increase of 0.21 years observed at ages 86–91.

Instead, the improvement emerged from substantial gains in happy years achieved through a compression of unhappiness. Later cohorts experienced significant increases in PC-HapLE across all four age ranges, with improvements ranging from 0.39 to 0.60 years and peaking at ages 68–73. These gains were accompanied by corresponding significant reductions in PC-UnHapLE, with the most pronounced decreases in younger age ranges. The proportional improvements were also remarkable: HapLE% rose significantly by 7.0 to 11.5 percentage points across cohorts, with the largest gains (11.5 percentage points) observed at ages 68–73.

These cohort gains in PC-HapLE were not evenly distributed across gender. Women experienced substantially larger and more consistent improvements than men. Women's PC-HapLE increased significantly across all four age ranges (0.52-0.90 years), with the most pronounced gains at ages 68–73, while men showed significant improvements only at older ages (80–85 and 86–91) with more modest gains (0.35-0.43 years). Consequently, women's HapLE% rose by 8.8 to 15.3 percentage points, compared to men's more limited and less consistent gains.

3.2 Socioeconomic Disparities in Gains of PC-LE and PC-HapLE

We further examined whether cohort improvements in PC-HapLE differed by socioeconomic status, specifically urban-rural residence and educational attainment. The results revealed that gains in happy years were unequally distributed across socioeconomic groups, with widening happiness gaps between more and less advantaged populations.

As detailed in Figure 3 and Supplementary Table S5, the most pronounced disparities in cohort trends were observed between urban and rural residents. Urban older adults experienced substantial and significant improvements in PC-HapLE across all age ranges, with gains ranging from 0.46 to 1.04 years. These improvements translated into significant increases in HapLE%, ranging from 6.9 to 16.9 percentage points across cohorts. In contrast, rural residents demonstrated significant improvements in PC-HapLE only at the two oldest age ranges (80–85 and 86–91), showing more limited gains of approximately 0.43-0.45 years. At younger ages (68–73 and 74–79), although point estimates among rural adults suggested potential modest improvements, the changes did not reach statistical significance due to considerable uncertainty reflected in wide confidence intervals.

This urban-rural divide in cohort gains was not driven by substantial differences in total longevity improvements, as PC-LE demonstrated relatively similar stability patterns across both residential groups for most age ranges. Rather, the disparity emerged from different improvements in happy years, with urban residents achieving significantly larger reductions in unhappy years across successive cohorts.

Educational disparities mirrored these urban-rural patterns (Figure 4 and Supplementary Table S6). Literate older adults achieved consistently larger and often more statistically significant gains in PC-HapLE and HapLE% compared to their illiterate peers across the majority of age ranges. This parallelism likely reflected the strong overlap between urban-rural residence and educational attainment in China, where access to schooling has historically been concentrated in urban areas.

3.3 Sensitivity Analysis

A sensitivity analysis using a four-state model corroborated the robustness of our primary findings (Supplementary Tables S7, S8, and S9). The overall compression of unhappiness was re-confirmed, as the significant increase in PC-HapLE for later cohorts was driven not by extended longevity but by a concurrent reduction in years spent in both the "neutral" (PC-NLE) and "unhappy" (PC-UnHapLE) states. For instance, in the 80–85 age range, the 0.55-year gain in happy years was matched by a significant 0.37-year reduction in unhappy years and a 0.08-year reduction in neutral years. This analysis likewise reinforced the finding of a widening happiness gap. Improvements in PC-HapLE were consistently larger and more statistically significant among advantaged groups—women, the literate, and urban residents—attributable to their greater success in compressing time spent in both neutral and unhappy states.

4. Discussion

Using nationally representative longitudinal data and a cohort-based multistate life table approach, this study addressed the critical question of whether older adults in China are living longer happy years. Our findings revealed a significant and positive trend: later-born cohorts are expected to live both a greater number of years and a higher proportion of their remaining life in a happy state compared to their predecessors. This improvement was primarily achieved through a compression of unhappiness—a notable reduction in PC-UnHapLE—while PC-LE remained largely stable. However, this optimistic aggregate trend concealed substantial and widening disparities. The gains in happy years were not equitably distributed, with improvements substantially larger for women, literate individuals, and especially urban residents, creating a widening happiness gap.

One of the main strengths of this study is that it provides the first cohort-based analysis of HapLE in China, offering evidence that matches more closely with individuals' lived experiences than period-based estimates and clearer insights into cohort changes in happy longevity (Payne, 2022). The observed compression of unhappiness across birth cohorts extended previous research and offered a cohort-based perspective on a widely debated topic in China. Our finding was consistent with the period-based analysis of HapLE trend in China (Duan & Chen, 2020), who also documented an "unhappiness compression" pattern in the general adult population. Our use of a cohort design provides stronger evidence that this is a generational phenomenon rather than a simple period effect (Payne, 2022). This optimistic cohort trend also offered a nuanced counterpoint to the Easterlin paradox, which posited that China's rapid economic growth during the 1990s and early 2000s did not uniformly translate into greater life satisfaction (Easterlin et al., 2012; Graham et al., 2017; Knight & Gunatilaka, 2011). Our results aligned more closely with recent studies indicating that Chinese happiness levels have been rising since the early 2000s, as the benefits of development became more widespread (H. Cai et al., 2023; P. Wang, 2023).

The compression of unhappiness across birth cohorts reflects three interrelated mechanisms. First, educational improvements of later-born cohorts may contribute to their happiness gains. As shown in Supplementary Table S3, later-born cohorts exhibited higher educational attainment than earlier-born cohorts. Education equips individuals with enhanced cognitive resources and adaptive capabilities to navigate complex social environments, factors closely linked to happiness (Chen, 2012; Cheng & Yan, 2021; D. Yang et al., 2022). Second, improvements in cohort health likely played an important role. Prior longitudinal research using CLHLS data demonstrated that successive Chinese oldest-old cohorts are experiencing compression of disability, with later-born cohorts living significantly more disability-free years at the same ages (Liu et al., 2019). This improvement in functional health has direct implications for happiness, as better physical health is associated with higher happiness levels among older adults (George, 2010). Third, these cohort advantages intersected with differential period contexts. Later cohorts at ages 68–91 (observed 2012–2018) encountered a substantially transformed socioeconomic environment compared to earlier cohorts at the same ages (observed 2002–2008). The intervening decade brought near-universal health insurance coverage with improved benefit levels (Tao et al., 2020; Yip et al., 2019), expanded pension schemes providing greater income security (Zhu & Walker, 2018), and sustained investment in community infrastructure and elderly services (Sahoo et al., 2010). These improvements created more materially secure and supportive conditions for late-life well-being. However, our cohort-based design inherently conflates cohort and period effects. These represent plausible contributing mechanisms rather than definitive causal pathways, and alternative mechanisms—such as reporting biases (Tay et al., 2014) and selective survival (Payne, 2022)—cannot be ruled out.

Another main strength is that it moves beyond static descriptions of inequality to examine dynamic trends, which further extends the literature by showing not just that disparities exist, but how they are evolving across cohorts. While previous research confirmed static inequalities at a single time point (Wan & Jiang, 2024), our results revealed a more troubling dynamic: the disparity was actively growing, creating a widening happiness gap. Such widening gaps may indicate that the benefits of China's development have been unequally distributed across cohorts, with the urban-rural divide most striking. This pattern of diverging trajectories mirrors documented trends in disability-free life expectancy, where similar urban-rural and educational disparities have widened over cohorts (Liu et al., 2019), suggesting that inequalities in happy longevity are part of a broader pattern of unequal life quality gains.

Several factors may help explain this widening happiness gap. Urban residents in later cohorts benefited from mature, comprehensive health insurance schemes with high reimbursement rates, alongside rapid improvements in community infrastructure and healthcare facilities. Rural health insurance, though achieving near-universal coverage by 2012, featured substantially lower reimbursement rates, more restricted access to higher-tier medical facilities, and lower pension levels (Liu et al., 2019; Yip et al., 2019; Zhu & Walker, 2018). This suggests that the pace of improvement differed dramatically by residence: comparing individuals of the same age across cohorts, urban residents in the later cohorts experienced far greater improvement in healthcare coverage, pension income, and community services than their rural counterparts. Beyond healthcare disparities, several factors likely contributed to this growing divide. The urban-rural economic gap had not only persisted but widened in recent decades, with urban areas experiencing more rapid infrastructure development and income growth (Y. Wang et al., 2016). Additionally, large-scale rural-to-urban migration has created a population of "left-behind" older adults in rural areas, who experience reduced family support networks and increased emotional health problems (Scheffel & Zhang, 2019). Educational disparities followed a similar pattern, with literate older adults achieving consistently larger gains in HapLE than illiterate peers. In these older cohorts, education and urban-rural residence were highly intertwined, as access to schooling in early-to-mid 20th century China was heavily concentrated in urban areas (Guo & Li, 2024). Beyond this overlap, education may have exerted independent effects by equipping individuals with skills to access information about new policies and navigate enrollment procedures, capacities that became particularly valuable during the rapid expansion of social security programs (Cheng & Yan, 2021; D. Yang et al., 2022). Due to sample size limitations, we analyzed residence and education separately and could not fully disentangle their effects, though both showed similar patterns of widening inequality across cohorts.

An interesting finding was the significant gender disparity in cohort differences, with older women experiencing substantially larger and more consistent gains in PC-HapLE than men. This finding contrasted with previous period-based evidence from China, which suggested that while women had a longer HapLE, this advantage was primarily driven by their lower mortality rather than a higher prevalence of happiness in later life (Duan & Chen, 2020). Our study revealed a fundamental shift: the gains in HapLE for women were driven by a compression of unhappiness, indicating an improvement in the quality, not just the quantity, of later-life years. One possible explanation for this phenomenon is that the trend is driven less by women's objective conditions improving faster than men's (the composition effect), and more by women deriving greater subjective well-being from the same life improvements (the coefficient effect) (J. Yang et al., 2024). Furthermore, women's deeper embeddedness in family and community life suggests they may have gained more from improvements in community environments and social support systems, which are central to their daily routines and well-being (Feng & Zheng, 2024).

Several limitations should be considered when interpreting the findings. First, our analysis is constrained by the measurement and classification of happiness. Our measurement of happiness relies on a single-item life satisfaction question, which, although widely validated and used in large-scale surveys, cannot capture the full multidimensional nature of well-being and may partly reflect reporting biases (George, 2010; Tay et al., 2014). Furthermore, our primary analysis dichotomizes responses into two states, which could be viewed as subjective. To test the robustness of this classification, we conducted a sensitivity analysis using a four-state model and the results strongly corroborate our main conclusions. Second, our model specification was limited by sample size. We did not control potential confounders such as health status. Similarly, we analyzed education and residence in separate models and could not explore their interaction. Future research with larger datasets is needed to disentangle these complex relationships. Third, our analysis focuses on life expectancies within bounded age ranges rather than complete life-course measures. While this approach enables the examination of living cohorts, the results should not be directly extrapolated to full lifetime happiness trajectories, particularly given the potential for major social or policy disruptions that could alter later-life patterns (Payne, 2022). Fourth, the multistate life table model employed in this study is based on a first-order Markov assumption, meaning that happiness transitions depend only on the current state and not on the duration spent in that state or past emotional trajectories (Payne, 2022; Shen & Payne, 2023). This simplifies the complex psychological dynamics of well-being in reality. Related to this, the panel nature of CLHLS data, with surveys conducted every three or four years, assumes only annual transitions between waves, potentially missing short-term fluctuations or multiple transitions in happiness states that may occur between survey periods. However, prior work suggests such limitations may not severely compromise the overall life expectancy estimates (Liu et al., 2019).

5. Conclusion

In conclusion, this study provided evidence that older adults in China are indeed living longer happy years across birth cohorts, largely driven by a significant compression of unhappiness rather than an extension of total lifespan. This optimistic aggregate trend, however, conceals a crucial and troubling counter-narrative: the substantial widening of a happiness gap. The benefits of China's rapid socioeconomic development have not been equitably distributed, disproportionately benefiting urban, educated, and female older adults. While these advantaged groups are experiencing accelerated gains in happiness, their rural and less-educated counterparts are being left behind, creating a deepening divide in the quality of later life. These findings suggest that policymakers should look beyond extending longevity and address the structural inequalities that prevent the gains of national progress from translating into universal well-being. To foster a truly equitable aging society, future policy should shift from simply adding years to life, to ensuring that those added years are happy ones for all.

Author Notes

[1] Two higher age ranges (92–97 and 98–103) were also analyzed but excluded from the final models. This decision was due to insufficient statistical power, stemming from small sample sizes and a low number of observed transitions between happiness states, which resulted in unreliable model estimates and non-significant overall model fit.

[2] We present this as a sensitivity analysis rather than our primary model for two main reasons. First, the "unhappy" state in the four-state model has a small sample size (as shown in Supplementary Table S3), which could affect the statistical power and stability of the transition probability estimates. Second, the main three-state model ensures consistency with prior literature, facilitating direct comparisons.

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Table 1. Information on age-group, period, and birth cohort comparisons

Age Range	Period	
	2002–2008 Earlier cohort	2012–2018 Later cohort
68–73	1932–1937	1942–1947
74–79	1926–1931	1936–1941
80–85	1920–1925	1930–1935
86–91	1914–1919	1924–1929

Figure 1. Lexis diagram used for cohort comparisons for ages 68-73

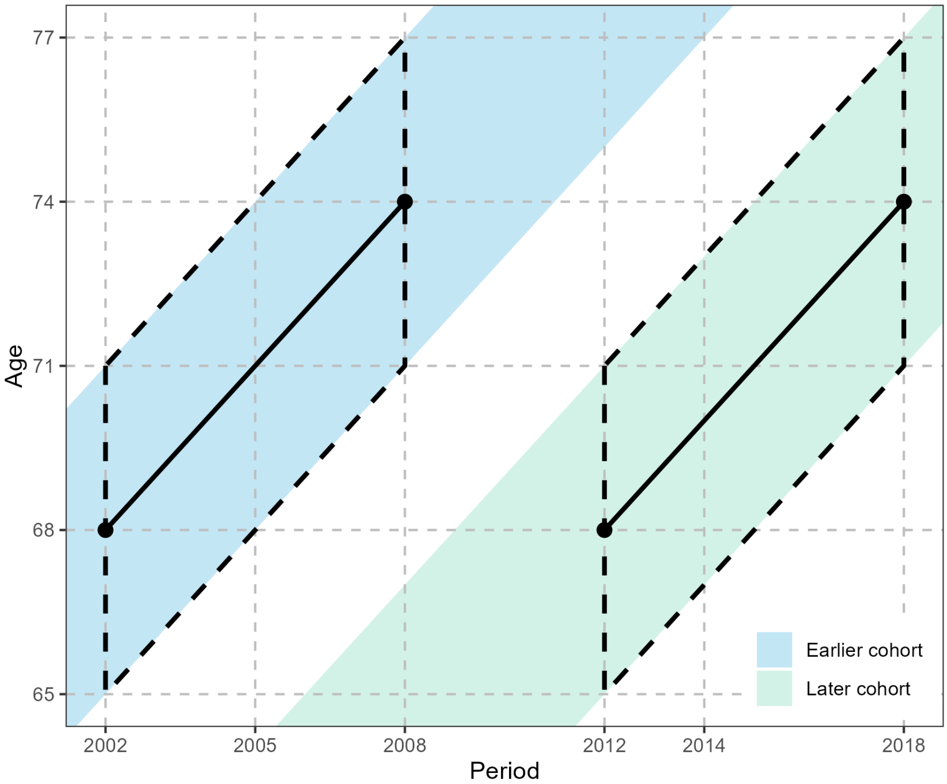


Figure 2. Estimated PC-LE, PC-HapLE, and PC-UnHapLE by age range, birth cohort, and gender.

Notes: Each bar represents total partial-cohort life expectancy (PC-LE) within the specified age range, decomposed into years spent happy (PC-HapLE, light shading) and unhappy (PC-UnHapLE, dark shading). Numbers inside bars indicate the proportion of life spent in a happy state (HapLE%). Vertical black lines show 95% confidence intervals for PC-LE and PC-HapLE. Detailed estimates are provided in Supplementary Table S4.

Source: Authors' calculations based on CLHLS, 2002–2018.

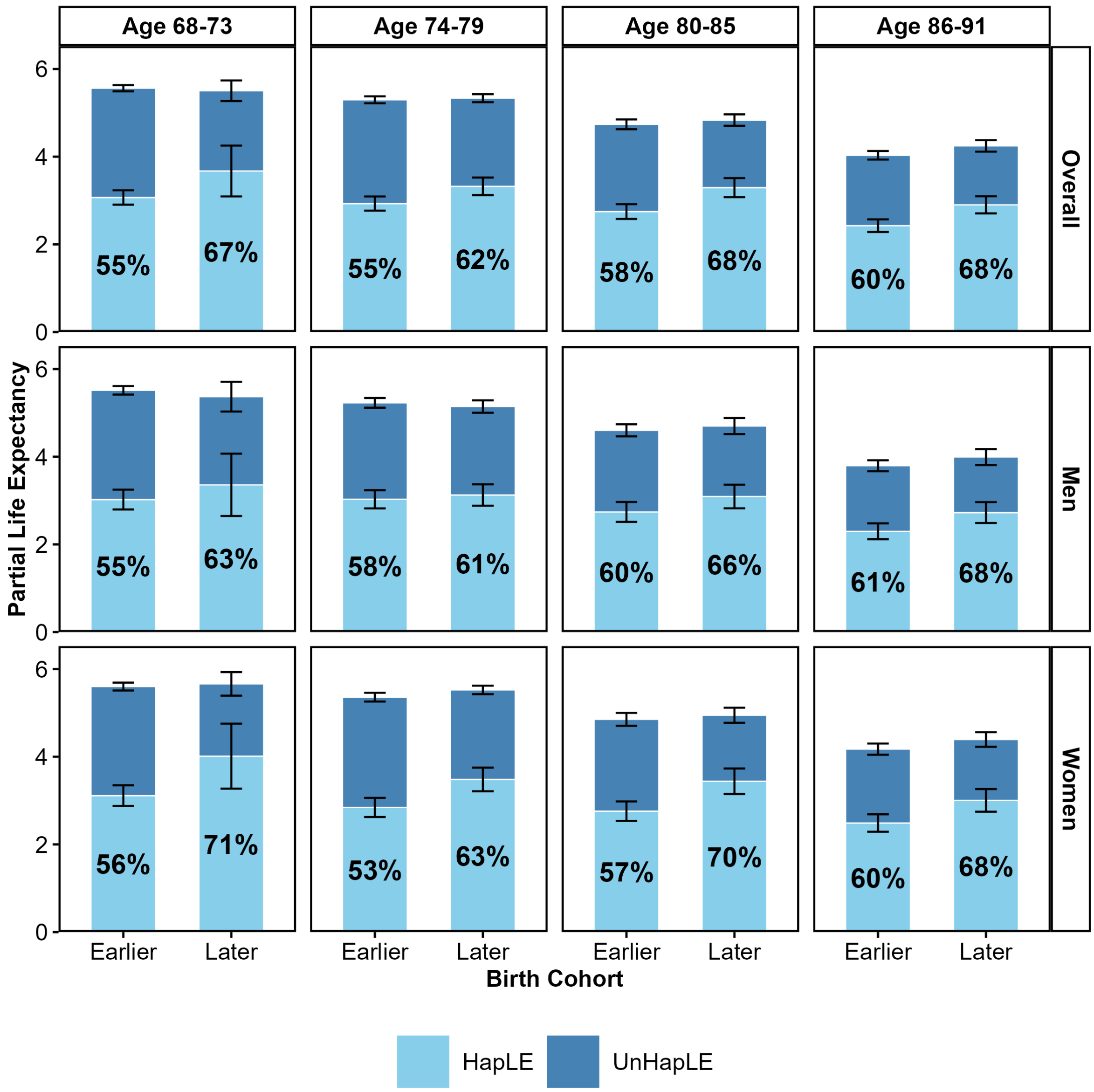


Figure 3. Estimated PC-LE, PC-HapLE, and PC-UnHapLE by age range, birth cohort, and urban-rural residence, both genders combined.

Notes: Each bar represents total partial-cohort life expectancy (PC-LE) within the specified age range, decomposed into years spent happy (PC-HapLE, light shading) and unhappy (PC-UnHapLE, dark shading). Numbers inside bars indicate the proportion of life spent in a happy state (HapLE%). Vertical black lines show 95% confidence intervals for PC-LE and PC-HapLE. Detailed estimates are provided in Supplementary Table S5.

Source: Authors' calculations based on CLHLS, 2002–2018.

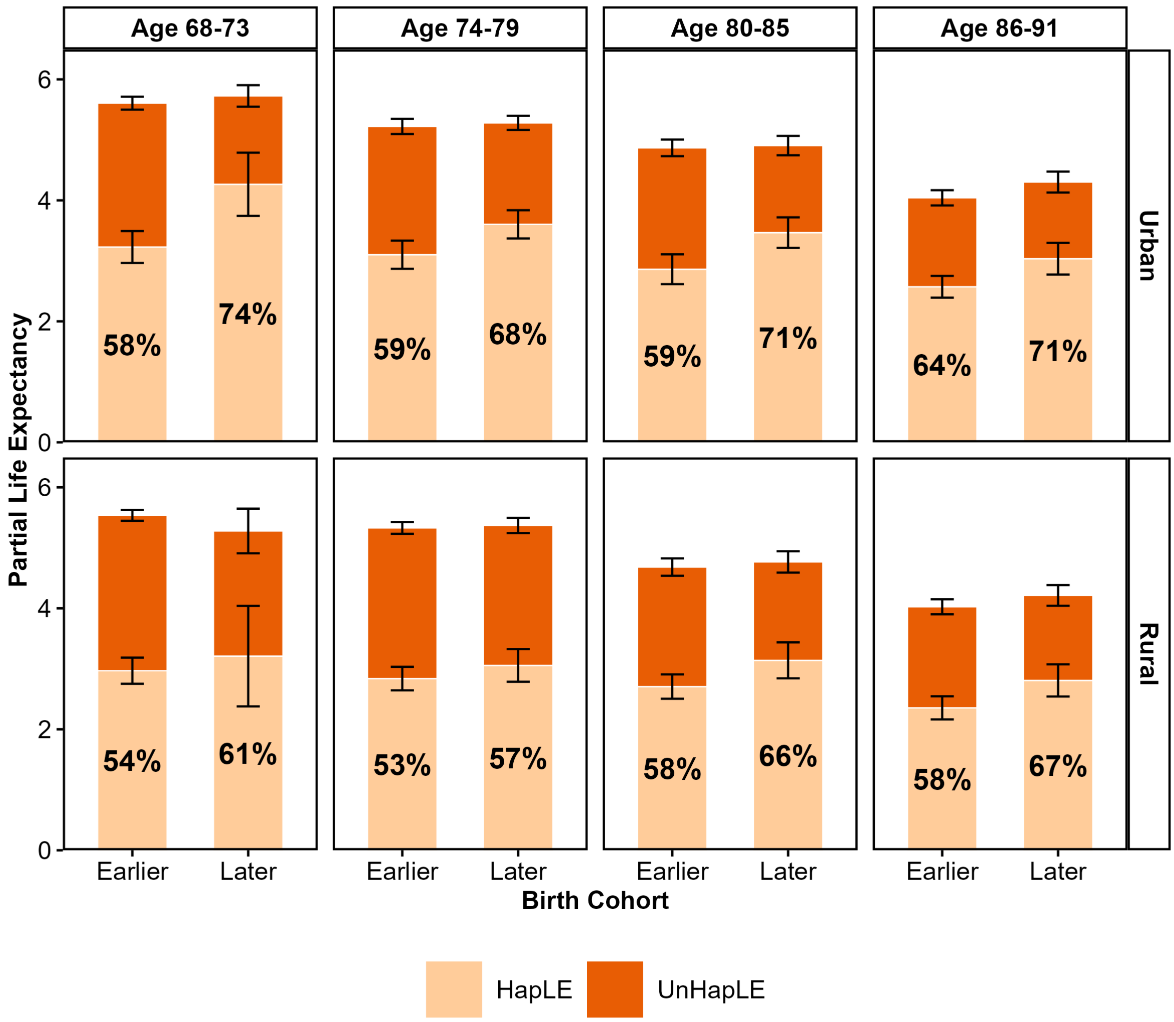
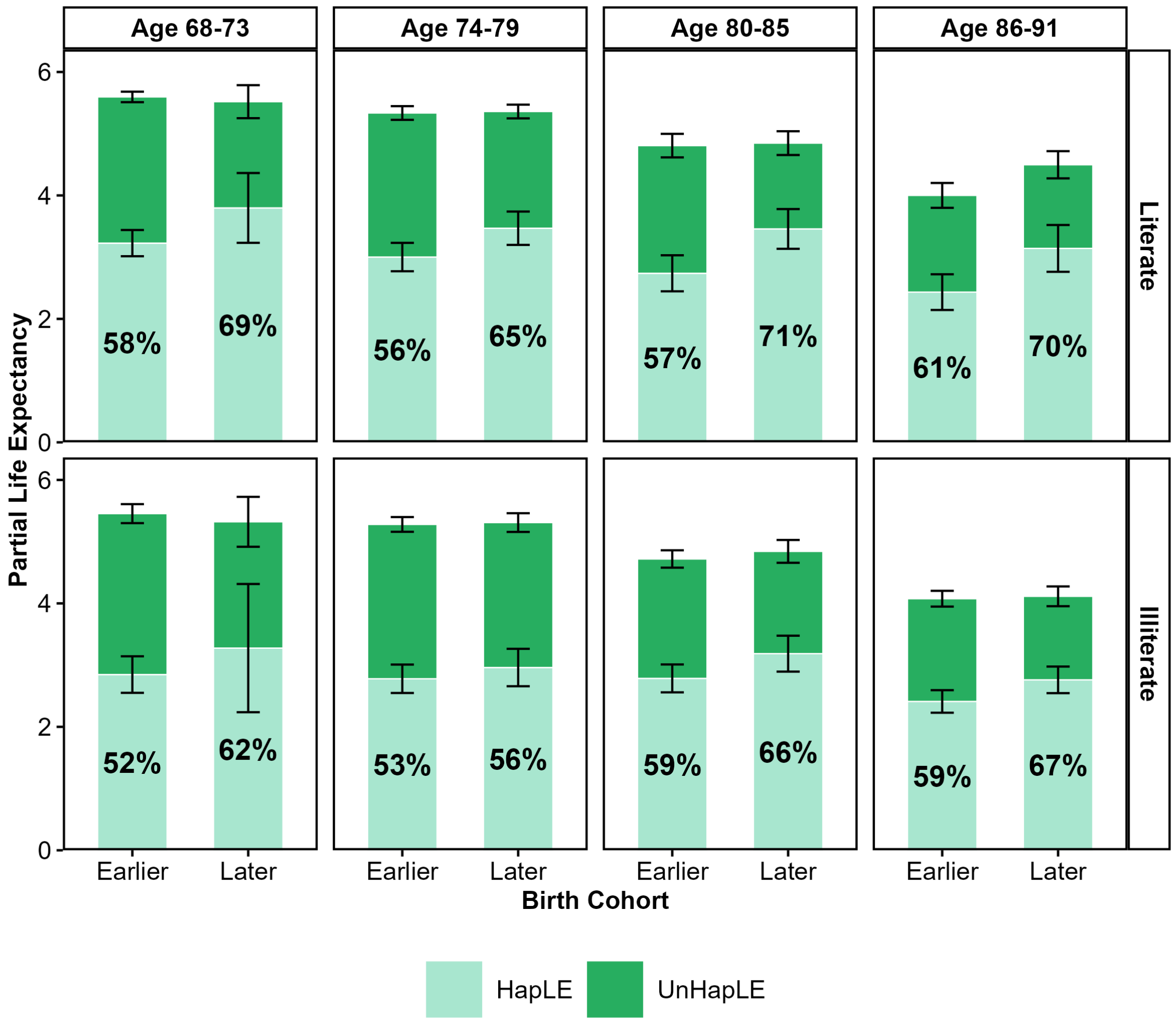


Figure 4. Estimated PC-LE, PC-HapLE, and PC-UnHapLE by age range, birth cohort, and education level, both genders combined.

Notes: Each bar represents total partial-cohort life expectancy (PC-LE) within the specified age range, decomposed into years spent happy (PC-HapLE, light shading) and unhappy (PC-UnHapLE, dark shading). Numbers inside bars indicate the proportion of life spent in a happy state (HapLE%). Vertical black lines show 95% confidence intervals for PC-LE and PC-HapLE. Detailed estimates are provided in Supplementary Table S6.

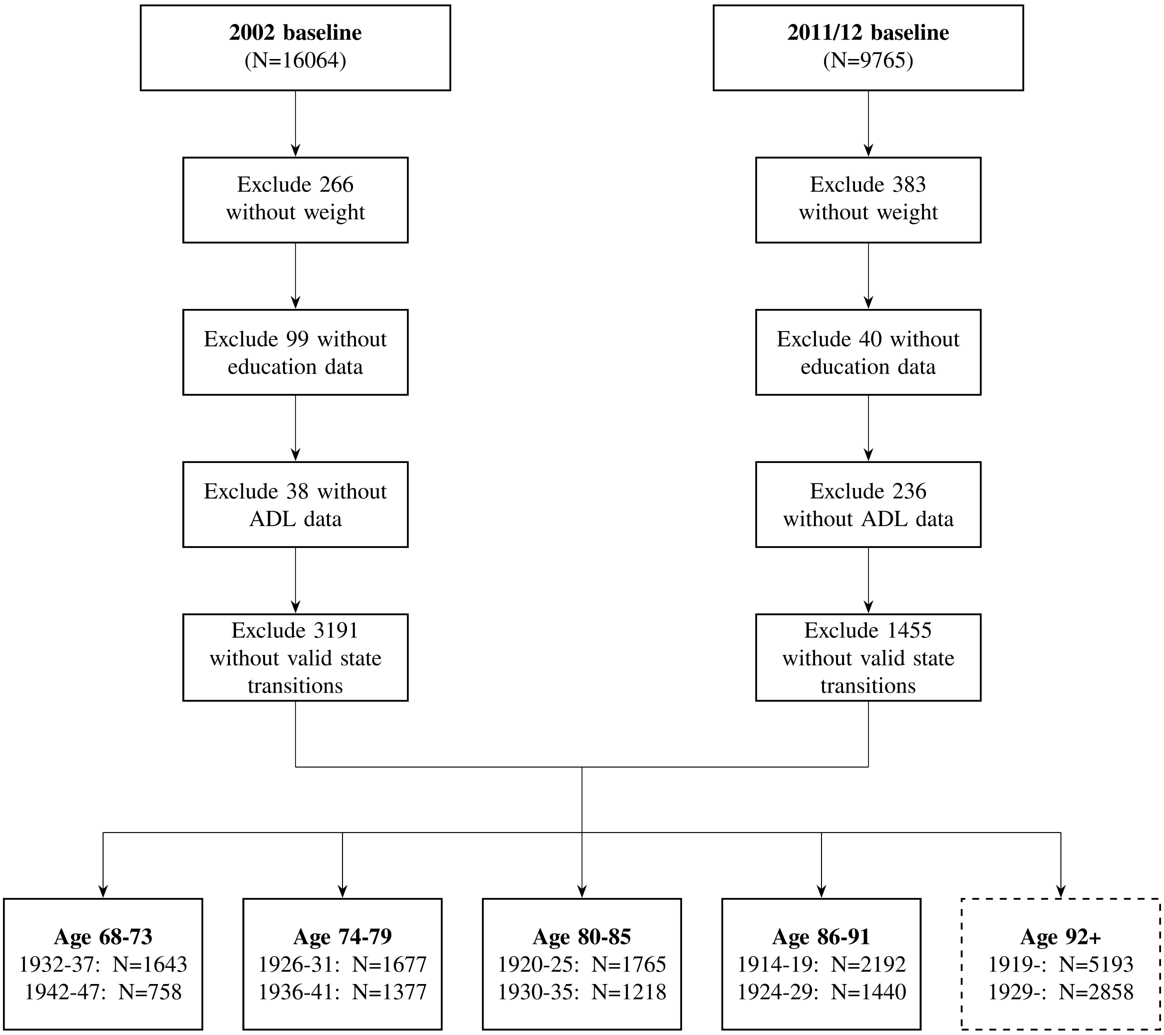
Source: Authors' calculations based on CLHLS, 2002–2018.



Supplementary Material

1. Sample Selection Process

Figure S1. Sample selection flowchart



2. State Space Diagrams

Figure S2. State space in the multi-state model

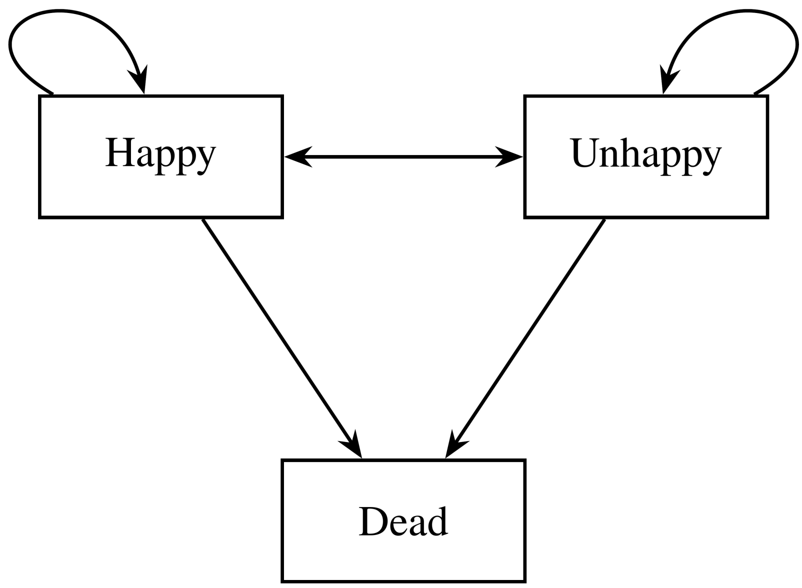
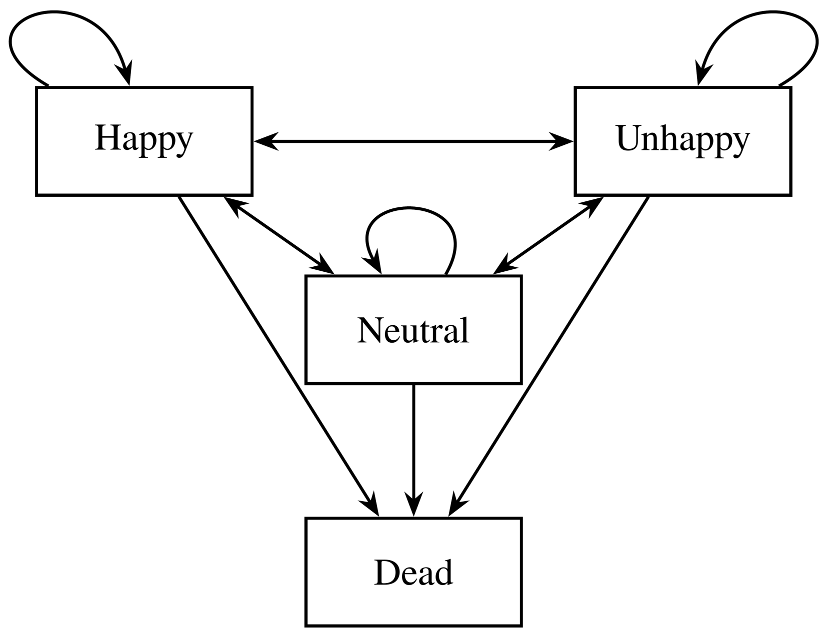


Figure S3. State space in the 4-state model for sensitivity analysis



3. Inverse Probability Weighting (IPW) Diagnostics

Table S1. Propensity score models statistics

Age Range	Cohort	Total N	Lost N	Lost%	AUC	H-L *p*
68–73	1932–37	1951	308	15.8	0.637	0.293
	1942–47	861	103	12.0	0.576	0.053
74–79	1926–31	1941	264	13.6	0.635	0.731
	1936–41	1511	134	8.9	0.626	0.794
80–85	1920–25	2076	311	15.0	0.647	0.468
	1930–35	1325	107	8.1	0.570	0.510
86–91	1914–19	2503	311	12.4	0.603	0.259
	1924–29	1573	133	8.5	0.590	0.907

Notes: AUC = Area Under the Curve from the receiver operating characteristic curve, measuring the propensity score model's discrimination ability (values range from 0.5 to 1.0, with higher values indicating better discrimination). H-L p = Hosmer-Lemeshow test p-value, assessing model calibration (values > 0.05 indicate adequate model fit).

Source: Authors' calculations based on CLHLS, 2002–2018.

Table S2. Standardized mean differences (SMD) before and after inverse probability weighting (IPW)

Variable	Unweighted SMD	Weighted SMD
Age	0.034	0.001
Gender (Women)	0.020	0.003
Education (Illiterate)	0.037	0.005
Residence (Rural)	0.134	0.006
Happiness (Unhappy)	0.013	0.001
Disability (1+ ADL)	0.043	0.002

Notes: SMD = Standardized mean difference, measuring covariate balance between individuals who completed follow-up and those who were lost to follow-up. Values are averaged across all age ranges and cohorts. SMD < 0.1 indicates adequate balance.

Source: Authors' calculations based on CLHLS, 2002–2018.

4. Descriptive Statistics

Table S3. Baseline characteristics of study participants by age range and birth cohort

Age Range	**68–73**		**74–79**		**80–85**		**86–91**	
Cohort	**1932–37**	**1942–47**	**1926–31**	**1936–41**	**1920–25**	**1930–35**	**1914–19**	**1924–29**
N	1643	758	1677	1377	1765	1218	2192	1440
Gender (%)								
Men	51.7	56.0	50.4	53.2	51.4	51.6	50.6	51.5
Women	48.3	44.0	49.6	46.8	48.6	48.4	49.4	48.5
Education (%)								
Literate	57.6	72.7	49.3	60.2	43.7	48.0	43.3	40.1
Illiterate	42.4	27.3	50.7	39.8	56.3	52.0	56.7	59.9
Residence (%)								
Urban	41.3	41.9	40.9	51.0	43.4	50.0	49.9	48.2
Rural	58.7	58.1	59.1	49.0	56.6	50.0	50.1	51.8
Happiness (3-state model) (%)								
Happy	56.7	58.6	57.1	56.9	58.4	60.2	58.6	57.7
Unhappy	43.3	41.4	42.9	43.1	41.6	39.8	41.4	42.3
Happiness (4-state model) (%)								
Happy	56.7	58.6	57.1	56.9	58.4	60.2	58.6	57.7
Neutral	36.6	37.9	36.3	37.2	33.8	33.9	33.2	35.0
Unhappy	6.7	3.4	6.6	5.9	7.7	5.9	8.2	7.3
Disability (%)								
0 ADL	96.3	95.8	93.4	92.8	86.2	88.4	76.6	81.6
1+ ADL	3.7	4.2	6.6	7.2	13.8	11.6	23.4	18.4

5. Main Analysis Detailed Results

Table S4. Estimated PC-LE, PC-HapLE, PC-UnHapLE, HapLE% and UnHapLE% and cohort differences, by age range and gender

Age Range	Gender	Cohort	PC-LE	PC-HapLE	HapLE%	PC-UnHapLE	UnHapLE%
68-73	Overall	Earlier	5.56 (5.49, 5.63)	3.07 (2.91, 3.23)	55.2 (52.3, 58.1)	2.49 (2.33, 2.66)	44.8 (41.9, 47.7)
		Later	5.50 (5.27, 5.74)	3.67 (3.09, 4.25)	66.7 (57.6, 75.9)	1.83 (1.35, 2.31)	33.3 (24.1, 42.4)
		Diff.	*-0.06 (-0.30, 0.19)*	*0.60 (0.00, 1.21)**	*11.5 (2.0, 21.1)**	*-0.66 (-1.17, -0.16)**	*-11.5 (-21.1, -2.0)**
	Men	Earlier	5.51 (5.42, 5.61)	3.02 (2.80, 3.25)	54.8 (50.9, 58.8)	2.49 (2.27, 2.71)	45.2 (41.2, 49.1)
		Later	5.37 (5.03, 5.71)	3.36 (2.65, 4.07)	62.5 (51.1, 74.0)	2.01 (1.42, 2.60)	37.5 (26.0, 48.9)
		Diff.	*-0.15 (-0.50, 0.21)*	*0.34 (-0.41, 1.08)*	*7.7 (-4.4, 19.9)*	*-0.48 (-1.11, 0.15)*	*-7.7 (-19.9, 4.4)*
	Women	Earlier	5.60 (5.51, 5.69)	3.11 (2.88, 3.35)	55.6 (51.4, 59.7)	2.49 (2.25, 2.73)	44.4 (40.3, 48.6)
		Later	5.66 (5.39, 5.93)	4.01 (3.27, 4.75)	70.9 (59.5, 82.3)	1.65 (1.04, 2.26)	29.1 (17.7, 40.5)
		Diff.	*0.06 (-0.22, 0.34)*	*0.90 (0.12, 1.68)**	*15.3 (3.2, 27.4)**	*-0.84 (-1.50, -0.18)**	*-15.3 (-27.4, -3.2)**
74-79	Overall	Earlier	5.30 (5.22, 5.38)	2.93 (2.77, 3.09)	55.3 (52.5, 58.2)	2.37 (2.22, 2.52)	44.7 (41.8, 47.5)
		Later	5.33 (5.24, 5.43)	3.32 (3.12, 3.52)	62.3 (58.7, 65.9)	2.01 (1.81, 2.21)	37.7 (34.1, 41.3)
		Diff.	*0.04 (-0.08, 0.16)*	*0.39 (0.14, 0.65)***	*7.0 (2.4, 11.6)***	*-0.36 (-0.61, -0.11)***	*-7.0 (-11.6, -2.4)***
	Men	Earlier	5.23 (5.12, 5.34)	3.03 (2.82, 3.24)	57.9 (54.2, 61.6)	2.20 (2.01, 2.40)	42.1 (38.4, 45.8)
		Later	5.14 (5.00, 5.29)	3.13 (2.88, 3.37)	60.8 (56.3, 65.3)	2.02 (1.78, 2.26)	39.2 (34.7, 43.7)
		Diff.	*-0.08 (-0.26, 0.09)*	*0.10 (-0.22, 0.42)*	*2.9 (-3.0, 8.7)*	*-0.18 (-0.49, 0.13)*	*-2.9 (-8.7, 3.0)*
	Women	Earlier	5.36 (5.26, 5.46)	2.84 (2.63, 3.06)	53.1 (49.1, 57.0)	2.52 (2.30, 2.73)	46.9 (43.0, 50.9)
		Later	5.52 (5.43, 5.62)	3.48 (3.21, 3.75)	63.0 (58.2, 67.8)	2.04 (1.77, 2.31)	37.0 (32.2, 41.8)
		Diff.	*0.16 (0.02, 0.30)**	*0.64 (0.29, 0.99)****	*10.0 (3.8, 16.2)****	*-0.47 (-0.82, -0.13)***	*-10.0 (-16.2, -3.8)***
80-85	Overall	Earlier	4.74 (4.63, 4.85)	2.75 (2.58, 2.92)	58.0 (54.8, 61.2)	1.99 (1.83, 2.15)	42.0 (38.8, 45.2)
		Later	4.84 (4.71, 4.97)	3.29 (3.08, 3.51)	68.1 (64.3, 71.9)	1.54 (1.36, 1.72)	31.9 (28.1, 35.7)
		Diff.	*0.10 (-0.07, 0.27)*	*0.55 (0.27, 0.82)****	*10.1 (5.1, 15.1)****	*-0.45 (-0.69, -0.21)****	*-10.1 (-15.1, -5.1)****
	Men	Earlier	4.60 (4.46, 4.74)	2.74 (2.51, 2.97)	59.5 (55.0, 64.1)	1.86 (1.65, 2.08)	40.5 (35.9, 45.0)
		Later	4.70 (4.52, 4.88)	3.09 (2.82, 3.36)	65.8 (60.8, 70.8)	1.61 (1.36, 1.85)	34.2 (29.2, 39.2)
		Diff.	*0.10 (-0.13, 0.33)*	*0.35 (0.00, 0.70)**	*6.3 (-0.5, 13.0)*	*-0.25 (-0.58, 0.07)*	*-6.3 (-13.0, 0.5)*
	Women	Earlier	4.85 (4.71, 5.00)	2.76 (2.54, 2.98)	56.9 (52.7, 61.0)	2.09 (1.88, 2.30)	43.1 (39.0, 47.3)
		Later	4.95 (4.77, 5.12)	3.44 (3.15, 3.73)	69.6 (64.6, 74.5)	1.51 (1.27, 1.74)	30.4 (25.5, 35.4)
		Diff.	*0.09 (-0.13, 0.32)*	*0.68 (0.31, 1.05)****	*12.7 (6.2, 19.2)****	*-0.59 (-0.91, -0.27)****	*-12.7 (-19.2, -6.2)****
86-91	Overall	Earlier	4.03 (3.93, 4.13)	2.43 (2.28, 2.57)	60.2 (57.0, 63.4)	1.61 (1.47, 1.74)	39.8 (36.6, 43.0)
		Later	4.25 (4.11, 4.38)	2.90 (2.71, 3.10)	68.4 (64.6, 72.2)	1.34 (1.18, 1.50)	31.6 (27.8, 35.4)
		Diff.	*0.21 (0.05, 0.38)**	*0.48 (0.23, 0.72)****	*8.2 (3.2, 13.2)***	*-0.26 (-0.47, -0.05)**	*-8.2 (-13.2, -3.2)***
	Men	Earlier	3.79 (3.67, 3.92)	2.30 (2.12, 2.48)	60.6 (56.2, 64.9)	1.50 (1.32, 1.67)	39.4 (35.1, 43.8)
		Later	3.99 (3.81, 4.17)	2.73 (2.49, 2.96)	68.3 (63.5, 73.1)	1.27 (1.07, 1.46)	31.7 (26.9, 36.5)
		Diff.	*0.20 (-0.02, 0.42)*	*0.43 (0.13, 0.73)***	*7.7 (1.2, 14.2)**	*-0.23 (-0.49, 0.03)*	*-7.7 (-14.2, -1.2)**
	Women	Earlier	4.17 (4.05, 4.30)	2.49 (2.29, 2.69)	59.6 (55.3, 63.9)	1.68 (1.50, 1.87)	40.4 (36.1, 44.7)
		Later	4.39 (4.23, 4.56)	3.01 (2.75, 3.26)	68.4 (63.3, 73.5)	1.39 (1.16, 1.61)	31.6 (26.5, 36.7)
		Diff.	*0.22 (0.01, 0.43)**	*0.52 (0.19, 0.84)***	*8.8 (2.1, 15.4)***	*-0.30 (-0.58, -0.01)**	*-8.8 (-15.4, -2.1)***

Notes: PC-LE = Partial cohort life expectancy, PC-HapLE = Partial cohort happy life expectancy, PC-UnHapLE = Partial cohort unhappy life expectancy, HapLE% = Percentage of happy life expectancy in total life expectancy, UnHapLE% = Percentage of unhappy life expectancy in total life expectancy. The *Diff.* row represents the difference calculated as the later cohort's value minus the earlier cohort's value. Values in parentheses are 95% CI. Significance of the difference is denoted by: * p<0.05, ** p<0.01, *** p<0.001.

Source: Authors' calculations based on CLHLS, 2002–2018.

Table S5. Estimated PC-LE, PC-HapLE, PC-UnHapLE, HapLE% and UnHapLE% and cohort differences, by age range and urban-rural residence

Age Range	Residence	Cohort	PC-LE	PC-HapLE	HapLE%	PC-UnHapLE	UnHapLE%
68-73	Urban	Earlier	5.61 (5.50, 5.71)	3.23 (2.96, 3.49)	57.6 (53.1, 62.1)	2.38 (2.12, 2.63)	42.4 (37.9, 46.9)
		Later	5.73 (5.55, 5.90)	4.27 (3.74, 4.79)	74.5 (65.6, 83.4)	1.46 (0.95, 1.98)	25.5 (16.6, 34.4)
		Diff.	*0.12 (-0.09, 0.33)*	*1.04 (0.45, 1.62)****	*16.9 (6.9, 26.9)****	*-0.92 (-1.49, -0.34)***	*-16.9 (-26.9, -6.9)****
	Rural	Earlier	5.54 (5.45, 5.63)	2.97 (2.75, 3.18)	53.6 (49.8, 57.4)	2.57 (2.35, 2.78)	46.4 (42.6, 50.2)
		Later	5.28 (4.91, 5.65)	3.21 (2.38, 4.04)	60.8 (47.4, 74.2)	2.07 (1.41, 2.73)	39.2 (25.8, 52.6)
		Diff.	*-0.26 (-0.64, 0.12)*	*0.24 (-0.62, 1.10)*	*7.2 (-6.8, 21.2)*	*-0.50 (-1.20, 0.20)*	*-7.2 (-21.2, 6.8)*
74-79	Urban	Earlier	5.22 (5.10, 5.35)	3.10 (2.87, 3.33)	59.4 (55.3, 63.5)	2.12 (1.90, 2.34)	40.6 (36.5, 44.7)
		Later	5.28 (5.16, 5.40)	3.60 (3.37, 3.84)	68.3 (64.1, 72.4)	1.68 (1.46, 1.90)	31.7 (27.6, 35.9)
		Diff.	*0.06 (-0.11, 0.23)*	*0.50 (0.17, 0.83)***	*8.8 (3.0, 14.7)***	*-0.44 (-0.75, -0.13)***	*-8.8 (-14.7, -3.0)***
	Rural	Earlier	5.33 (5.23, 5.43)	2.84 (2.64, 3.03)	53.3 (49.8, 56.7)	2.49 (2.30, 2.68)	46.7 (43.3, 50.2)
		Later	5.37 (5.24, 5.50)	3.06 (2.79, 3.33)	56.9 (52.0, 61.8)	2.31 (2.04, 2.58)	43.1 (38.2, 48.0)
		Diff.	*0.04 (-0.12, 0.20)*	*0.22 (-0.12, 0.55)*	*3.6 (-2.3, 9.6)*	*-0.18 (-0.50, 0.15)*	*-3.6 (-9.6, 2.3)*
80-85	Urban	Earlier	4.87 (4.73, 5.01)	2.86 (2.61, 3.11)	58.8 (54.1, 63.4)	2.01 (1.78, 2.24)	41.2 (36.6, 45.9)
		Later	4.91 (4.75, 5.07)	3.47 (3.21, 3.72)	70.7 (66.3, 75.0)	1.44 (1.22, 1.65)	29.3 (25.0, 33.7)
		Diff.	*0.04 (-0.17, 0.25)*	*0.61 (0.25, 0.96)****	*11.9 (5.5, 18.3)****	*-0.57 (-0.88, -0.25)****	*-11.9 (-18.3, -5.5)****
	Rural	Earlier	4.68 (4.54, 4.82)	2.71 (2.50, 2.91)	57.8 (53.8, 61.8)	1.98 (1.78, 2.17)	42.2 (38.2, 46.2)
		Later	4.77 (4.59, 4.94)	3.14 (2.84, 3.44)	65.9 (60.5, 71.2)	1.63 (1.37, 1.88)	34.1 (28.8, 39.5)
		Diff.	*0.09 (-0.14, 0.31)*	*0.43 (0.07, 0.79)**	*8.1 (1.4, 14.7)**	*-0.35 (-0.67, -0.03)**	*-8.1 (-14.7, -1.4)**
86-91	Urban	Earlier	4.04 (3.92, 4.17)	2.57 (2.39, 2.75)	63.6 (59.6, 67.6)	1.47 (1.30, 1.64)	36.4 (32.4, 40.4)
		Later	4.30 (4.13, 4.48)	3.04 (2.77, 3.30)	70.5 (65.6, 75.5)	1.27 (1.06, 1.48)	29.5 (24.5, 34.4)
		Diff.	*0.26 (0.05, 0.47)**	*0.46 (0.15, 0.78)***	*6.9 (0.5, 13.3)**	*-0.20 (-0.47, 0.07)*	*-6.9 (-13.3, -0.5)**
	Rural	Earlier	4.03 (3.90, 4.15)	2.35 (2.16, 2.55)	58.5 (54.3, 62.7)	1.67 (1.50, 1.84)	41.5 (37.3, 45.7)
		Later	4.21 (4.04, 4.38)	2.81 (2.54, 3.07)	66.6 (61.4, 71.9)	1.41 (1.19, 1.62)	33.4 (28.1, 38.6)
		Diff.	*0.19 (-0.02, 0.40)*	*0.45 (0.13, 0.78)***	*8.1 (1.4, 14.9)**	*-0.27 (-0.54, 0.01)*	*-8.1 (-14.9, -1.4)**

Notes: PC-LE = Partial cohort life expectancy, PC-HapLE = Partial cohort happy life expectancy, PC-UnHapLE = Partial cohort unhappy life expectancy, HapLE% = Percentage of happy life expectancy in total life expectancy, UnHapLE% = Percentage of unhappy life expectancy in total life expectancy. The *Diff.* row represents the difference calculated as the later cohort's value minus the earlier cohort's value. Values in parentheses are 95% CI. Significance of the difference is denoted by: * p<0.05, ** p<0.01, *** p<0.001.

Source: Authors' calculations based on CLHLS, 2002–2018.

Table S6. Estimated PC-LE, PC-HapLE, PC-UnHapLE, HapLE% and UnHapLE% and cohort differences, by age range and education level

Age Range	Education	Cohort	PC-LE	PC-HapLE	HapLE%	PC-UnHapLE	UnHapLE%
68-73	**Literate**	Earlier	5.60 (5.51, 5.68)	3.23 (3.01, 3.44)	57.7 (54.0, 61.4)	2.37 (2.16, 2.58)	42.3 (38.6, 46.0)
		Later	5.52 (5.25, 5.79)	3.80 (3.23, 4.36)	68.8 (59.8, 77.8)	1.72 (1.24, 2.21)	31.2 (22.2, 40.2)
		Diff.	*-0.08 (-0.36, 0.20)*	*0.57 (-0.03, 1.17)*	*11.1 (1.4, 20.8)**	*-0.65 (-1.17, -0.12)**	*-11.1 (-20.8, -1.4)**
	Illiterate	Earlier	5.45 (5.30, 5.61)	2.85 (2.55, 3.14)	52.2 (46.9, 57.4)	2.61 (2.31, 2.91)	47.8 (42.6, 53.1)
		Later	5.32 (4.92, 5.73)	3.28 (2.24, 4.31)	61.6 (45.6, 77.6)	2.05 (1.28, 2.81)	38.4 (22.4, 54.4)
		Diff.	*-0.13 (-0.57, 0.30)*	*0.43 (-0.65, 1.51)*	*9.4 (-7.5, 26.2)*	*-0.56 (-1.38, 0.26)*	*-9.4 (-26.2, 7.5)*
74-79	**Literate**	Earlier	5.34 (5.22, 5.45)	3.00 (2.77, 3.23)	56.3 (52.2, 60.4)	2.33 (2.11, 2.56)	43.7 (39.6, 47.8)
		Later	5.36 (5.25, 5.47)	3.47 (3.20, 3.74)	64.7 (59.9, 69.5)	1.89 (1.63, 2.15)	35.3 (30.5, 40.1)
		Diff.	*0.02 (-0.13, 0.18)*	*0.47 (0.11, 0.82)***	*8.5 (2.2, 14.8)***	*-0.44 (-0.78, -0.10)**	*-8.5 (-14.8, -2.2)***
	Illiterate	Earlier	5.28 (5.16, 5.40)	2.78 (2.55, 3.01)	52.6 (48.5, 56.8)	2.50 (2.28, 2.72)	47.4 (43.2, 51.5)
		Later	5.31 (5.16, 5.46)	2.96 (2.66, 3.26)	55.8 (50.1, 61.5)	2.35 (2.03, 2.67)	44.2 (38.5, 49.9)
		Diff.	*0.03 (-0.16, 0.22)*	*0.18 (-0.20, 0.56)*	*3.1 (-3.9, 10.2)*	*-0.15 (-0.54, 0.23)*	*-3.1 (-10.2, 3.9)*
80-85	**Literate**	Earlier	4.81 (4.62, 5.00)	2.74 (2.45, 3.03)	57.0 (51.1, 62.8)	2.07 (1.77, 2.37)	43.0 (37.2, 48.9)
		Later	4.85 (4.65, 5.04)	3.46 (3.14, 3.78)	71.3 (65.8, 76.8)	1.39 (1.13, 1.65)	28.7 (23.2, 34.2)
		Diff.	*0.04 (-0.23, 0.31)*	*0.72 (0.28, 1.15)***	*14.4 (6.3, 22.4)****	*-0.68 (-1.08, -0.28)****	*-14.4 (-22.4, -6.3)****
	Illiterate	Earlier	4.72 (4.58, 4.86)	2.78 (2.56, 3.01)	59.0 (54.8, 63.2)	1.93 (1.73, 2.13)	41.0 (36.8, 45.2)
		Later	4.84 (4.66, 5.03)	3.19 (2.89, 3.48)	65.8 (60.6, 70.9)	1.66 (1.41, 1.90)	34.2 (29.1, 39.4)
		Diff.	*0.12 (-0.11, 0.36)*	*0.40 (0.03, 0.77)**	*6.8 (0.1, 13.4)**	*-0.28 (-0.60, 0.04)*	*-6.8 (-13.4, -0.1)**
86-91	**Literate**	Earlier	4.00 (3.80, 4.20)	2.43 (2.14, 2.72)	60.8 (54.3, 67.4)	1.57 (1.29, 1.84)	39.2 (32.6, 45.7)
		Later	4.50 (4.28, 4.72)	3.14 (2.76, 3.52)	69.9 (62.7, 77.0)	1.35 (1.04, 1.67)	30.1 (23.0, 37.3)
		Diff.	*0.50 (0.20, 0.79)***	*0.71 (0.23, 1.19)***	*9.0 (-0.7, 18.8)*	*-0.21 (-0.63, 0.20)*	*-9.0 (-18.8, 0.7)*
	Illiterate	Earlier	4.08 (3.95, 4.20)	2.41 (2.23, 2.59)	59.2 (55.2, 63.2)	1.66 (1.50, 1.83)	40.8 (36.8, 44.8)
		Later	4.11 (3.95, 4.27)	2.76 (2.55, 2.98)	67.1 (62.7, 71.5)	1.35 (1.17, 1.54)	32.9 (28.5, 37.3)
		Diff.	*0.04 (-0.17, 0.24)*	*0.35 (0.07, 0.63)**	*7.9 (2.0, 13.9)***	*-0.31 (-0.56, -0.06)**	*-7.9 (-13.9, -2.0)***

Notes: PC-LE = Partial cohort life expectancy, PC-HapLE = Partial cohort happy life expectancy, PC-UnHapLE = Partial cohort unhappy life expectancy, HapLE% = Percentage of happy life expectancy in total life expectancy, UnHapLE% = Percentage of unhappy life expectancy in total life expectancy. The *Diff.* row represents the difference calculated as the later cohort's value minus the earlier cohort's value. Values in parentheses are 95% CI. Significance of the difference is denoted by: * p<0.05, ** p<0.01, *** p<0.001.

Source: Authors' calculations based on CLHLS, 2002–2018.

6. Sensitivity Analysis Detailed Results

Table S7. Estimated PC-LE, PC-HapLE, PC-NLE, PC-UnHapLE, HapLE%, NLE%, and UnHapLE% and cohort differences, by age range and gender from the 4-state model

Age Range	Gender	Cohort	PC-LE	PC-HapLE	HapLE%	PC-NLE	NLE%	PC-UnHapLE	UnHapLE%
68-73	**Overall**	Earlier	5.57 (5.49, 5.65)	3.06 (2.90, 3.23)	55.0 (52.2, 57.8)	2.19 (2.03, 2.35)	39.3 (36.5, 42.1)	0.32 (0.25, 0.38)	5.7 (4.6, 6.9)
		Later	5.52 (5.29, 5.74)	3.64 (3.06, 4.22)	66.0 (56.5, 75.4)	1.72 (1.23, 2.22)	31.2 (21.9, 40.6)	0.16 (-0.04, 0.35)	2.8 (-0.7, 6.4)
		Diff.	*-0.05 (-0.29, 0.19)*	*0.58 (-0.03, 1.18)*	*11.0 (1.1, 20.8)**	*-0.47 (-0.98, 0.05)*	*-8.1 (-17.8, 1.7)*	*-0.16 (-0.37, 0.05)*	*-2.9 (-6.6, 0.9)*
	Men	Earlier	5.52 (5.41, 5.63)	3.03 (2.78, 3.27)	54.9 (50.7, 59.0)	2.20 (1.98, 2.42)	39.8 (35.8, 43.8)	0.29 (0.19, 0.39)	5.3 (3.5, 7.1)
		Later	5.39 (5.04, 5.73)	3.38 (2.63, 4.13)	62.7 (50.3, 75.2)	1.82 (1.14, 2.51)	33.8 (20.8, 46.9)	0.18 (-0.14, 0.51)	3.4 (-2.5, 9.3)
		Diff.	*-0.13 (-0.49, 0.23)*	*0.35 (-0.44, 1.14)*	*7.9 (-5.3, 21.0)*	*-0.37 (-1.09, 0.34)*	*-6.0 (-19.6, 7.7)*	*-0.11 (-0.45, 0.23)*	*-1.9 (-8.0, 4.3)*
	Women	Earlier	5.62 (5.52, 5.71)	3.09 (2.87, 3.32)	55.1 (51.1, 59.1)	2.18 (1.95, 2.41)	38.8 (34.9, 42.8)	0.34 (0.25, 0.43)	6.1 (4.4, 7.7)
		Later	5.65 (5.39, 5.91)	3.94 (3.22, 4.66)	69.7 (58.2, 81.1)	1.62 (1.01, 2.23)	28.6 (17.4, 39.8)	0.10 (0.02, 0.18)	1.7 (0.3, 3.1)
		Diff.	*0.04 (-0.24, 0.31)*	*0.85 (0.09, 1.60)**	*14.6 (2.4, 26.7)**	*-0.56 (-1.22, 0.09)*	*-10.2 (-22.1, 1.7)*	*-0.24 (-0.37, -0.12)****	*-4.4 (-6.5, -2.2)****
74-79	**Overall**	Earlier	5.28 (5.20, 5.36)	2.93 (2.77, 3.10)	55.5 (52.5, 58.5)	1.93 (1.78, 2.07)	36.5 (33.8, 39.2)	0.43 (0.34, 0.51)	8.0 (6.5, 9.6)
		Later	5.34 (5.25, 5.43)	3.32 (3.13, 3.51)	62.2 (58.7, 65.7)	1.79 (1.61, 1.98)	33.6 (30.2, 37.0)	0.23 (0.16, 0.29)	4.2 (3.0, 5.5)
		Diff.	*0.06 (-0.06, 0.18)*	*0.39 (0.14, 0.64)***	*6.7 (2.1, 11.3)***	*-0.13 (-0.37, 0.10)*	*-2.9 (-7.2, 1.5)*	*-0.20 (-0.31, -0.09)****	*-3.8 (-5.8, -1.8)****
	Men	Earlier	5.22 (5.11, 5.33)	3.03 (2.83, 3.23)	58.0 (54.4, 61.7)	1.89 (1.71, 2.07)	36.2 (32.8, 39.5)	0.30 (0.22, 0.39)	5.8 (4.1, 7.4)
		Later	5.16 (5.01, 5.30)	3.13 (2.90, 3.35)	60.6 (56.2, 65.1)	1.78 (1.56, 2.00)	34.5 (30.6, 38.4)	0.25 (0.16, 0.34)	4.9 (3.1, 6.7)
		Diff.	*-0.07 (-0.25, 0.12)*	*0.10 (-0.21, 0.40)*	*2.6 (-3.2, 8.3)*	*-0.11 (-0.39, 0.17)*	*-1.7 (-6.8, 3.5)*	*-0.05 (-0.18, 0.07)*	*-0.9 (-3.4, 1.5)*
	Women	Earlier	5.36 (5.25, 5.46)	2.84 (2.63, 3.05)	53.0 (49.1, 56.9)	1.97 (1.78, 2.17)	36.8 (33.2, 40.4)	0.54 (0.43, 0.66)	10.2 (8.0, 12.3)
		Later	5.53 (5.44, 5.62)	3.48 (3.21, 3.75)	62.9 (58.2, 67.6)	1.85 (1.59, 2.11)	33.3 (28.6, 38.1)	0.21 (0.11, 0.31)	3.7 (1.9, 5.5)
		Diff.	*0.17 (0.04, 0.31)**	*0.64 (0.30, 0.99)****	*9.9 (3.8, 16.0)***	*-0.13 (-0.46, 0.20)*	*-3.5 (-9.4, 2.5)*	*-0.34 (-0.49, -0.19)****	*-6.4 (-9.2, -3.6)****
80-85	**Overall**	Earlier	4.74 (4.63, 4.85)	2.76 (2.58, 2.93)	58.1 (54.8, 61.5)	1.48 (1.33, 1.63)	31.3 (28.2, 34.3)	0.50 (0.41, 0.59)	10.6 (8.7, 12.5)
		Later	4.84 (4.70, 4.97)	3.30 (3.08, 3.52)	68.3 (64.6, 72.0)	1.40 (1.24, 1.56)	29.0 (25.5, 32.5)	0.13 (0.08, 0.18)	2.7 (1.7, 3.7)
		Diff.	*0.09 (-0.07, 0.26)*	*0.55 (0.27, 0.83)****	*10.2 (5.2, 15.1)****	*-0.08 (-0.30, 0.14)*	*-2.3 (-6.9, 2.4)*	*-0.37 (-0.47, -0.27)****	*-7.9 (-10.1, -5.7)****
	Men	Earlier	4.61 (4.47, 4.74)	2.74 (2.52, 2.96)	59.4 (55.1, 63.7)	1.46 (1.27, 1.64)	31.7 (27.8, 35.5)	0.41 (0.28, 0.54)	8.9 (6.1, 11.8)
		Later	4.71 (4.53, 4.90)	3.13 (2.86, 3.40)	66.4 (61.4, 71.3)	1.46 (1.23, 1.69)	31.0 (26.1, 35.8)	0.12 (0.05, 0.20)	2.6 (1.1, 4.2)
		Diff.	*0.10 (-0.12, 0.33)*	*0.39 (0.04, 0.74)**	*7.0 (0.4, 13.5)**	*0.00 (-0.29, 0.30)*	*-0.7 (-6.9, 5.5)*	*-0.29 (-0.43, -0.14)****	*-6.3 (-9.5, -3.1)****
	Women	Earlier	4.85 (4.71, 5.00)	2.76 (2.54, 2.99)	57.0 (52.5, 61.4)	1.53 (1.33, 1.73)	31.5 (27.5, 35.4)	0.56 (0.44, 0.69)	11.6 (9.0, 14.2)
		Later	4.94 (4.78, 5.11)	3.43 (3.15, 3.71)	69.5 (64.8, 74.2)	1.37 (1.16, 1.59)	27.8 (23.3, 32.3)	0.14 (0.07, 0.20)	2.8 (1.4, 4.1)
		Diff.	*0.09 (-0.13, 0.31)*	*0.67 (0.31, 1.03)****	*12.5 (6.1, 19.0)****	*-0.15 (-0.45, 0.14)*	*-3.7 (-9.7, 2.3)*	*-0.43 (-0.57, -0.29)****	*-8.8 (-11.8, -5.9)****
86-91	**Overall**	Earlier	4.03 (3.93, 4.14)	2.42 (2.26, 2.58)	60.0 (56.7, 63.4)	1.28 (1.16, 1.41)	31.8 (28.6, 34.9)	0.33 (0.24, 0.42)	8.2 (6.0, 10.4)
		Later	4.25 (4.12, 4.38)	2.91 (2.71, 3.11)	68.4 (64.5, 72.3)	1.15 (0.99, 1.30)	27.0 (23.3, 30.7)	0.19 (0.13, 0.26)	4.6 (3.0, 6.1)
		Diff.	*0.22 (0.05, 0.38)**	*0.49 (0.23, 0.74)****	*8.4 (3.3, 13.6)***	*-0.13 (-0.33, 0.07)*	*-4.8 (-9.6, 0.1)*	*-0.14 (-0.25, -0.03)**	*-3.7 (-6.4, -1.0)***
	Men	Earlier	3.80 (3.67, 3.92)	2.30 (2.13, 2.46)	60.6 (56.4, 64.7)	1.29 (1.11, 1.46)	34.0 (29.6, 38.4)	0.21 (0.11, 0.30)	5.5 (2.9, 8.0)
		Later	4.00 (3.81, 4.18)	2.74 (2.51, 2.98)	68.6 (63.7, 73.4)	1.12 (0.95, 1.30)	28.1 (23.8, 32.4)	0.13 (0.07, 0.20)	3.3 (1.7, 4.9)
		Diff.	*0.20 (-0.02, 0.43)*	*0.44 (0.16, 0.73)***	*8.0 (1.6, 14.4)**	*-0.16 (-0.41, 0.08)*	*-5.8 (-12.0, 0.3)*	*-0.07 (-0.19, 0.04)*	*-2.1 (-5.1, 0.9)*
	Women	Earlier	4.18 (4.04, 4.31)	2.50 (2.29, 2.71)	59.8 (55.4, 64.2)	1.29 (1.13, 1.44)	30.8 (27.0, 34.6)	0.39 (0.27, 0.51)	9.4 (6.5, 12.3)
		Later	4.39 (4.22, 4.57)	3.01 (2.74, 3.29)	68.6 (63.4, 73.8)	1.15 (0.94, 1.37)	26.2 (21.3, 31.1)	0.23 (0.13, 0.33)	5.2 (2.9, 7.5)
		Diff.	*0.22 (-0.00, 0.44)*	*0.52 (0.17, 0.86)***	*8.8 (2.0, 15.6)**	*-0.13 (-0.40, 0.13)*	*-4.6 (-10.8, 1.6)*	*-0.16 (-0.32, -0.01)**	*-4.2 (-7.9, -0.5)**

Notes: PC-LE = Partial cohort life expectancy, PC-HapLE = Partial cohort happy life expectancy, PC-NLE = Partial cohort neutral life expectancy, PC-UnHapLE = Partial cohort unhappy life expectancy, HapLE% = Percentage of happy life expectancy in total life expectancy, NLE% = Percentage of neutral life expectancy in total life expectancy, UnHapLE% = Percentage of unhappy life expectancy in total life expectancy. The *Diff.* row represents the difference calculated as the later cohort's value minus the earlier cohort's value. Values in parentheses are 95% CI. Significance of the difference is denoted by: * p<0.05, ** p<0.01, *** p<0.001.

Source: Authors' calculations based on CLHLS, 2002–2018.

Table S8. Estimated PC-LE, PC-HapLE, PC-NLE, PC-UnHapLE, HapLE%, NLE%, and UnHapLE% and cohort differences, by age range and urban-rural residence from the 4-state model

Age Range	Residence	Cohort	PC-LE	PC-HapLE	HapLE%	PC-NLE	NLE%	PC-UnHapLE	UnHapLE%
68-73	**Urban**	Earlier	5.61 (5.51, 5.72)	3.19 (2.93, 3.46)	56.9 (52.2, 61.6)	2.21 (1.94, 2.48)	39.3 (34.6, 44.0)	0.21 (0.10, 0.32)	3.7 (1.8, 5.7)
		Later	5.73 (5.55, 5.90)	4.22 (3.69, 4.76)	73.8 (64.5, 83.1)	1.43 (0.90, 1.96)	25.0 (15.8, 34.2)	0.07 (0.01, 0.13)	1.2 (0.1, 2.4)
		Diff.	*0.11 (-0.10, 0.32)*	*1.03 (0.43, 1.63)****	*16.9 (6.4, 27.3)***	*-0.78 (-1.37, -0.18)**	*-14.4 (-24.7, -4.0)***	*-0.14 (-0.27, -0.01)**	*-2.5 (-4.8, -0.3)**
	Rural	Earlier	5.55 (5.45, 5.64)	2.97 (2.76, 3.18)	53.6 (50.0, 57.2)	2.20 (1.99, 2.41)	39.7 (36.0, 43.4)	0.37 (0.28, 0.47)	6.7 (5.0, 8.5)
		Later	5.30 (4.94, 5.67)	3.19 (2.38, 4.01)	60.2 (46.8, 73.7)	1.88 (1.19, 2.57)	35.4 (21.5, 49.4)	0.23 (-0.15, 0.61)	4.3 (-2.7, 11.3)
		Diff.	*-0.24 (-0.62, 0.13)*	*0.22 (-0.62, 1.07)*	*6.7 (-7.3, 20.6)*	*-0.32 (-1.04, 0.40)*	*-4.2 (-18.7, 10.2)*	*-0.15 (-0.54, 0.25)*	*-2.4 (-9.7, 4.8)*
74-79	**Urban**	Earlier	5.22 (5.09, 5.35)	3.11 (2.89, 3.33)	59.5 (55.5, 63.5)	1.79 (1.58, 2.01)	34.4 (30.3, 38.4)	0.32 (0.21, 0.43)	6.1 (4.0, 8.2)
		Later	5.28 (5.17, 5.40)	3.61 (3.38, 3.83)	68.2 (64.3, 72.2)	1.51 (1.29, 1.72)	28.5 (24.4, 32.6)	0.17 (0.11, 0.24)	3.3 (2.0, 4.5)
		Diff.	*0.06 (-0.11, 0.24)*	*0.50 (0.18, 0.81)***	*8.7 (3.1, 14.3)***	*-0.29 (-0.59, 0.02)*	*-5.9 (-11.6, -0.1)**	*-0.15 (-0.28, -0.02)**	*-2.8 (-5.3, -0.4)**
	Rural	Earlier	5.32 (5.23, 5.42)	2.83 (2.63, 3.03)	53.2 (49.7, 56.8)	2.00 (1.84, 2.17)	37.6 (34.5, 40.7)	0.49 (0.38, 0.60)	9.2 (7.1, 11.2)
		Later	5.38 (5.25, 5.51)	3.08 (2.82, 3.33)	57.2 (52.6, 61.7)	2.04 (1.79, 2.29)	37.9 (33.4, 42.4)	0.27 (0.17, 0.37)	5.0 (3.1, 6.8)
		Diff.	*0.06 (-0.10, 0.22)*	*0.24 (-0.08, 0.57)*	*3.9 (-1.8, 9.7)*	*0.04 (-0.26, 0.33)*	*0.3 (-5.2, 5.7)*	*-0.22 (-0.37, -0.07)***	*-4.2 (-7.0, -1.4)***
80-85	**Urban**	Earlier	4.86 (4.73, 5.00)	2.86 (2.63, 3.10)	58.9 (54.3, 63.5)	1.53 (1.29, 1.78)	31.5 (26.5, 36.6)	0.47 (0.31, 0.62)	9.6 (6.5, 12.7)
		Later	4.91 (4.75, 5.07)	3.49 (3.27, 3.71)	71.1 (67.0, 75.1)	1.30 (1.11, 1.49)	26.5 (22.7, 30.3)	0.12 (0.06, 0.18)	2.5 (1.3, 3.6)
		Diff.	*0.05 (-0.16, 0.25)*	*0.62 (0.30, 0.95)****	*12.2 (6.0, 18.3)****	*-0.23 (-0.55, 0.08)*	*-5.0 (-11.4, 1.3)*	*-0.35 (-0.51, -0.18)****	*-7.1 (-10.5, -3.8)****
	Rural	Earlier	4.69 (4.56, 4.82)	2.72 (2.51, 2.92)	57.9 (54.0, 61.8)	1.46 (1.30, 1.63)	31.2 (27.9, 34.6)	0.51 (0.39, 0.63)	10.9 (8.4, 13.4)
		Later	4.77 (4.59, 4.95)	3.15 (2.85, 3.44)	66.0 (60.8, 71.2)	1.49 (1.26, 1.72)	31.3 (26.3, 36.2)	0.13 (0.05, 0.21)	2.7 (1.1, 4.3)
		Diff.	*0.08 (-0.15, 0.30)*	*0.43 (0.07, 0.79)**	*8.1 (1.6, 14.6)**	*0.03 (-0.26, 0.31)*	*0.0 (-6.0, 6.0)*	*-0.38 (-0.52, -0.24)****	*-8.2 (-11.1, -5.2)****
86-91	**Urban**	Earlier	4.05 (3.92, 4.18)	2.58 (2.40, 2.77)	63.8 (59.8, 67.8)	1.26 (1.09, 1.43)	31.2 (27.1, 35.2)	0.20 (0.13, 0.28)	5.0 (3.2, 6.8)
		Later	4.30 (4.10, 4.50)	3.04 (2.78, 3.30)	70.7 (66.1, 75.3)	1.04 (0.85, 1.22)	24.1 (20.0, 28.2)	0.22 (0.13, 0.32)	5.2 (2.9, 7.4)
		Diff.	*0.25 (0.01, 0.49)**	*0.46 (0.14, 0.77)***	*6.9 (0.8, 13.0)**	*-0.23 (-0.48, 0.02)*	*-7.1 (-12.9, -1.3)**	*0.02 (-0.10, 0.14)*	*0.2 (-2.7, 3.1)*
	Rural	Earlier	4.03 (3.89, 4.16)	2.34 (2.14, 2.54)	58.1 (53.9, 62.3)	1.29 (1.14, 1.45)	32.2 (28.3, 36.1)	0.39 (0.26, 0.52)	9.7 (6.5, 12.9)
		Later	4.21 (4.05, 4.38)	2.82 (2.55, 3.09)	66.9 (61.3, 72.4)	1.22 (0.99, 1.44)	28.8 (23.4, 34.3)	0.18 (0.10, 0.26)	4.3 (2.4, 6.2)
		Diff.	*0.19 (-0.02, 0.40)*	*0.48 (0.14, 0.81)***	*8.7 (1.8, 15.7)**	*-0.08 (-0.36, 0.20)*	*-3.3 (-10.0, 3.4)*	*-0.21 (-0.36, -0.06)***	*-5.4 (-9.2, -1.7)***

Notes: PC-LE = Partial cohort life expectancy, PC-HapLE = Partial cohort happy life expectancy, PC-NLE = Partial cohort neutral life expectancy, PC-UnHapLE = Partial cohort unhappy life expectancy, HapLE% = Percentage of happy life expectancy in total life expectancy, NLE% = Percentage of neutral life expectancy in total life expectancy, UnHapLE% = Percentage of unhappy life expectancy in total life expectancy. The *Diff.* row represents the difference calculated as the later cohort's value minus the earlier cohort's value. Values in parentheses are 95% CI. Significance of the difference is denoted by: * $p<0.05$, ** $p<0.01$, *** $p<0.001$.

Source: Authors' calculations based on CLHLS, 2002–2018.

Table S9. Estimated PC-LE, PC-HapLE, PC-NLE, PC-UnHapLE, HapLE%, NLE%, and UnHapLE% and cohort differences, by age range and education level from the 4-state model

Age Range	Education	Cohort	PC-LE	PC-HapLE	HapLE%	PC-NLE	NLE%	PC-UnHapLE	UnHapLE%
68-73	Literate	Earlier	5.60 (5.51, 5.69)	3.22 (3.00, 3.44)	57.4 (53.6, 61.2)	2.13 (1.92, 2.33)	38.0 (34.4, 41.6)	0.26 (0.18, 0.34)	4.6 (3.2, 6.0)
		Later	5.52 (5.25, 5.78)	3.75 (3.14, 4.36)	67.9 (58.0, 77.8)	1.63 (1.11, 2.15)	29.5 (19.8, 39.2)	0.14 (-0.06, 0.34)	2.6 (-1.0, 6.2)
		Diff.	-0.08 (-0.36, 0.20)	0.53 (-0.12, 1.18)	10.5 (-0.2, 21.1)	-0.50 (-1.06, 0.06)	-8.5 (-18.8, 1.9)	-0.11 (-0.33, 0.10)	-2.0 (-5.8, 1.8)
	Illiterate	Earlier	5.48 (5.32, 5.64)	2.88 (2.58, 3.17)	52.5 (47.2, 57.7)	2.24 (1.95, 2.53)	40.9 (35.8, 46.0)	0.37 (0.25, 0.49)	6.7 (4.5, 8.9)
		Later	5.36 (4.99, 5.72)	3.27 (2.31, 4.22)	61.0 (46.0, 75.9)	1.97 (1.25, 2.69)	36.8 (22.0, 51.5)	0.12 (-0.02, 0.27)	2.3 (-0.4, 5.0)
		Diff.	-0.12 (-0.52, 0.28)	0.39 (-0.61, 1.39)	8.5 (-7.3, 24.4)	-0.27 (-1.04, 0.50)	-4.1 (-19.7, 11.5)	-0.24 (-0.43, -0.06)*	-4.4 (-7.9, -1.0)*
74-79	Literate	Earlier	5.33 (5.22, 5.44)	3.00 (2.81, 3.20)	56.4 (52.7, 60.0)	1.93 (1.70, 2.16)	36.2 (32.2, 40.3)	0.40 (0.29, 0.50)	7.4 (5.4, 9.4)
		Later	5.37 (5.25, 5.48)	3.48 (3.23, 3.74)	64.9 (60.3, 69.5)	1.65 (1.42, 1.89)	30.8 (26.5, 35.1)	0.23 (0.14, 0.31)	4.2 (2.7, 5.8)
		Diff.	0.04 (-0.13, 0.20)	0.48 (0.16, 0.80)**	8.6 (2.7, 14.4)**	-0.28 (-0.60, 0.05)	-5.4 (-11.3, 0.5)	-0.17 (-0.30, -0.03)*	-3.2 (-5.7, -0.7)*
	Illiterate	Earlier	5.27 (5.15, 5.40)	2.78 (2.53, 3.03)	52.7 (48.3, 57.1)	2.02 (1.82, 2.21)	38.2 (34.5, 42.0)	0.48 (0.35, 0.60)	9.1 (6.7, 11.4)
		Later	5.32 (5.17, 5.46)	2.98 (2.66, 3.30)	56.0 (50.3, 61.7)	2.13 (1.82, 2.44)	40.0 (34.4, 45.7)	0.21 (0.10, 0.32)	4.0 (1.9, 6.0)
		Diff.	0.05 (-0.15, 0.24)	0.20 (-0.20, 0.60)	3.3 (-3.9, 10.5)	0.11 (-0.25, 0.48)	1.8 (-4.9, 8.5)	-0.27 (-0.43, -0.10)**	-5.1 (-8.2, -2.0)**
80-85	Literate	Earlier	4.81 (4.64, 4.99)	2.73 (2.45, 3.02)	56.8 (50.8, 62.8)	1.71 (1.43, 2.00)	35.6 (30.1, 41.1)	0.37 (0.21, 0.53)	7.6 (4.3, 10.9)
		Later	4.85 (4.64, 5.05)	3.47 (3.12, 3.82)	71.6 (65.9, 77.2)	1.30 (1.05, 1.55)	26.8 (21.4, 32.2)	0.08 (0.01, 0.14)	1.6 (0.3, 3.0)
		Diff.	0.03 (-0.24, 0.30)	0.74 (0.29, 1.19)**	14.8 (6.6, 23.0)***	-0.41 (-0.79, -0.04)*	-8.8 (-16.5, -1.1)*	-0.29 (-0.46, -0.11)**	-6.0 (-9.6, -2.4)***
	Illiterate	Earlier	4.73 (4.58, 4.88)	2.78 (2.55, 3.00)	58.8 (54.5, 63.0)	1.35 (1.18, 1.52)	28.6 (25.1, 32.1)	0.60 (0.47, 0.72)	12.7 (10.0, 15.3)
		Later	4.85 (4.67, 5.03)	3.20 (2.93, 3.47)	66.0 (61.3, 70.7)	1.47 (1.25, 1.70)	30.4 (25.7, 35.1)	0.17 (0.09, 0.26)	3.6 (1.8, 5.4)
		Diff.	0.12 (-0.11, 0.36)	0.42 (0.07, 0.77)*	7.2 (0.9, 13.5)*	0.12 (-0.16, 0.41)	1.9 (-4.0, 7.7)	-0.43 (-0.58, -0.27)***	-9.1 (-12.3, -5.9)***
86-91	Literate	Earlier	4.00 (3.79, 4.22)	2.44 (2.13, 2.76)	61.1 (54.2, 67.9)	1.37 (1.10, 1.63)	34.1 (27.7, 40.5)	0.19 (0.04, 0.34)	4.8 (1.0, 8.6)
		Later	4.49 (4.29, 4.70)	3.13 (2.76, 3.50)	69.7 (62.3, 77.1)	1.26 (0.92, 1.61)	28.1 (20.5, 35.7)	0.10 (0.01, 0.19)	2.2 (0.3, 4.1)
		Diff.	0.49 (0.19, 0.79)**	0.69 (0.20, 1.17)**	8.6 (-1.5, 18.7)	-0.10 (-0.53, 0.33)	-6.0 (-15.9, 3.9)	-0.09 (-0.27, 0.08)	-2.6 (-6.9, 1.6)
	Illiterate	Earlier	4.07 (3.94, 4.20)	2.41 (2.22, 2.60)	59.2 (55.1, 63.2)	1.29 (1.13, 1.45)	31.7 (27.9, 35.5)	0.37 (0.26, 0.48)	9.2 (6.4, 11.9)
		Later	4.12 (3.96, 4.28)	2.78 (2.56, 2.99)	67.4 (62.9, 71.9)	1.11 (0.93, 1.29)	27.0 (22.9, 31.1)	0.23 (0.13, 0.33)	5.6 (3.3, 8.0)
		Diff.	0.05 (-0.16, 0.25)	0.37 (0.08, 0.65)*	8.3 (2.2, 14.3)**	-0.18 (-0.42, 0.06)	-4.7 (-10.3, 0.9)	-0.14 (-0.29, 0.01)	-3.5 (-7.2, 0.1)

Notes: PC-LE = Partial cohort life expectancy, PC-HapLE = Partial cohort happy life expectancy, PC-NLE = Partial cohort neutral life expectancy, PC-UnHapLE = Partial cohort unhappy life expectancy, HapLE% = Percentage of happy life expectancy in total life expectancy, NLE% = Percentage of neutral life expectancy in total life expectancy, UnHapLE% = Percentage of unhappy life expectancy in total life expectancy. The *Diff.* row represents the difference calculated as the later cohort's value minus the earlier cohort's value. Values in parentheses are 95% CI. Significance of the difference is denoted by: * p<0.05, ** p<0.01, *** p<0.001.

Source: Authors' calculations based on CLHLS, 2002–2018.