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Socioeconomic Positions and Midlife Health Trajectories in a Changing Social Context: Evidence from China, 1991–2006

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Abstract

Cumulative (dis)advantage theory posits that socioeconomic disparities in health may increase with age. This study examines individuals' midlife health trajectories, taking account of how their life courses are embedded within changing social contexts. Using the China Health and Nutrition Survey (1991–2006), it examines the health gap between Chinese rural peasants and urban nonpeasants in three adjacent time periods, during which a rapid process of social change increased the inequalities between rural and urban areas. Findings show that the health gap increases more rapidly in the more recent time periods, with higher levels of inequality, indicating that health inequalities between the two groups are contingent upon the social contexts in which individuals' lives unfold. To better understand the differences observed over these time periods, further analysis will examine the roles of two structural factors: income inequality and differential access to medical care.

Keywords

cumulative (dis)advantage theory, health inequality, life course, social change, socioeconomic position

It has been acknowledged that socioeconomic positions predict people's health, and according to cumulative (dis)advantage theory, the gap between high and low socioeconomic groups may widen over the life course (Dannefer 2003; Ferraro and Shippee 2009). Previous empirical studies have shown supporting evidence for this trend, and in addition, the incorporation of cohort membership has contributed to a more accurate picture of the cohort-specific health trajectories of different socioeconomic groups (Clarke et al. 2011; Montez and Hayward 2014; Yang et al. 2017; Zheng 2014).

Recent studies have tended to pay greater attention to the social contexts in which individuals' health trajectories unfold. Cross-national comparative analysis has shown that the extent to which health-related advantages and disadvantages cumulate over time varies across different countries, which points to the potential influence of different social contexts in shaping individuals' health trajectories and in moderating health gaps between different socioeconomic groups (Leopold 2018). However, the question of whether the synchronic variations that have been observed across different countries would exhibit similarities with changing social conditions in a particular society over time has not been sufficiently explored. Moreover, the role of specific structural factors in shaping health inequalities over time has yet to be identified.

Filling in these gaps is important for academic research. Discussion of an individual's socioeconomic position should never be separated from a specific social context, within which the resource

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distribution may change over time. For example, when the resource distribution of a society becomes more polarized (changing social contexts), does the health gap between the working class and the middle class (socioeconomic positions) increase more quickly with age? A direct examination of diachronic changes in social conditions and their implications for people's health would facilitate a better understanding of how individuals' lives interact with macro social contexts. In addition, focusing on a given society opens up opportunities for a closer inspection of underlying mechanisms. For instance, what roles do income inequality and unequal access to medical care play in producing health gaps? To devise policy measures that can address health inequality, a crucial first step is to examine the role of specific structural factors and the extent to which they exert an influence on people's health trajectories.

The present study attempts to address these issues. The empirical study is based on China and examines the health trajectories of two socioeconomic groups during periods of social change. China is one of the best cases for this study because its social transition involves the world's largest population and has occurred at a very fast speed and on an unprecedented scale. At the same time, the increasing inequality witnessed in China in recent decades also mirrors the trend experienced by more than 70% of the global population (United Nations 2020), and this study can therefore shed light on how socioeconomic inequalities relate to health issues beyond the Chinese context.

The empirical analysis is based on the China Health and Nutrition Survey (CHNS), the longest series of panel surveys (1989–2015) of people's health and nutritional conditions in China. This study examines the health trajectories of two socioeconomic groups: Chinese rural peasants and urban nonpeasants. Chinese rural peasants have long been the most disadvantaged group in the Chinese social stratification structure, and they have been further left behind in China's urbanization and marketization process. By examining the changing health trajectories of the two groups in China's changing social context and the roles of specific structural factors, this article embeds individuals' life courses within the social transition process. Adopting a context-embedded life course perspective, this article contributes new evidence to debates about whether socioeconomic position has a cumulative effect on health outcomes.

BACKGROUND

Cumulative Advantage/Disadvantage Theory

Cumulative (dis)advantage theory describes a process whereby initial advantages or disadvantages may compound over time. As Robert Merton (1988:606) put it, cumulative advantage refers to "the ways in which initial comparative advantages of trained capacity, structural location, and available resources make for successive increments of advantage such that the gaps between the haves and the have-nots . . . widen." In the field of aging and health, cumulative (dis)advantage theory posits that a structural position tends to be associated with a range of health-related benefits or risks, which may cumulate with the passage of time and may therefore result in systemic divergences in health outcomes (Dannefer 1987, 2003; DiPrete and Eirich 2006; Ferraro and Shippee 2009).

An important implication of cumulative (dis)advantage theory is that people in different socioeconomic positions tend to experience increasing health inequality during the aging process. Empirical evidence has shown that health deteriorates more rapidly with age among people with lower educational levels (Leopold 2016; Mirowsky and Ross 2008), household income (Smith 2007), or occupational status (Chandola et al. 2007) or people who experience some combination of these socioeconomic disadvantages over their lifetime (Luo and Waite 2005; Montez and Hayward 2014; Pais 2014; Yang et al. 2017). The possible implications of a disadvantaged socioeconomic position include precarious income, low-quality food and living conditions, higher risk of unemployment and social isolation, and insufficient health care and medical treatment. The consequences of these risk factors may cumulate over time, which may either directly take a heavy toll on people's health or increase their exposure to chronic stress and unhealthy lifestyles (Ferraro, Schafer, and Wilkinson 2016; Ferraro and Shippee 2009; House, Lantz, and Herd 2005). Recent studies using biomarkers have explored physiological factors to better understand how social inequality gradually "gets under the skin" over the life course (Merkin et al. 2014; Yang et al. 2017).

Although a more nuanced review is beyond the scope of this article, it is worth noting that neither health nor socioeconomic position should be perceived as unitary constructs and that the underlying mechanisms should not be assumed the same for different health outcomes (Clouston et al. 2016; Herd, Goesling, and House 2007; Masters, Hummer, and Powers 2012). For example, education and income have been found to have different explanatory powers for the onset and progression of chronic conditions (Herd et al. 2007). Moreover, the extent of health inequalities and the direction of their changes have been shown to be disease specific (Clouston et al. 2016; Masters et al. 2012). Different studies exhibit some variations in the details of their supporting evidence, and it is also worth noting that some studies have found a persistent or converging health disparity between socioeconomic groups in later life (Herd 2006; Hoffmann 2005; House et al. 1994). The conflicting findings have been attributed partly to the selection effect of mortality, especially when very advanced ages were included, but more importantly, differences between cohorts under examination may also have contributed to the mixed results. To obtain a clearer picture of the cumulative effect of socioeconomic position on health outcomes, cohort-specific analysis has been deemed necessary.

Cohort-Specific Analysis

It is a general trend that health deteriorates after a certain point in the aging process, but the process may vary by cohort. Cohort membership not only marks individuals at birth but also indicates specific social and historical contexts they are embedded in, the main disease patterns they may be exposed to, and the resources and technologies that can be used to prolong their lives. Considering the implications of cohort membership for health trajectories, Riley (1987) proposed the "principle of cohort differences in aging," which advocates cohort-specific analysis in aging and health studies.

Empirical research that adopts the cohort perspective has provided evidence of the importance of cohort membership in analyzing health trajectories. For instance, the "cohort morbidity phenotype" characterizes the phenomenon whereby cohorts with lower infection-caused mortality in early childhood also experience lower mortality at older ages (Crimmins and Finch 2006; Finch and Crimmins 2004). This demonstrates that morbidity and mortality patterns of a cohort are associated with their specific early-life conditions. In other words, cohorts with health advantages in early life are more likely to maintain that advantage in later life, and this may be due to the benefit of reduced lifetime exposure to infectious diseases and other sources of inflammation.

The "technophysio evolution" thesis has also provided evidence of substantial cohort variations in mortality and morbidity. Instead of focusing on infection and inflammation, this thesis emphasizes the role of nutrition as the main mechanism. According to the technophysio evolution theory, humans have achieved great technological innovations and gained an unprecedented degree of control over the environment in the past 300 years, and this has created abundant and stable food supplies and provided a unique opportunity for physiological development. As a result, more recent cohorts tend to have better nutrition in utero and in early childhood, which contributes to the later onset of diseases and greater longevity in these groups (Floud et al. 2011; Fogel and Costa 1997).

Because existing evidence shows the importance of cohort membership in health trajectories, state-of-the-art research on the cumulative (dis)advantage thesis tends to use longitudinal data to examine cohort-specific health status in people's aging processes (Chen, Yang, and Liu 2010; Clarke et al. 2011; Zheng 2014). Studies in this field have made considerable contributions to previous literature by revealing intercohort variations in health trajectories, thereby depicting health disparities between different socioeconomic groups more accurately.

Knowledge Gap: The Role of Social Context

Previous research has examined the cumulative effect of socioeconomic position on health outcomes, and cohort-specific analysis allows researchers to take account of the characteristics associated with specific cohort membership, which may reflect the general situation of infection and nutrition in cohort members' early lives. However, the social context that each cohort lives in is not fixed, and the health trajectory of a certain cohort is not predestined at birth. Changes in the routine social environment in which people live, work, and age may impact the extent to which socioeconomic (dis) advantages compound over time and shape people's health trajectories (Hayward and Sheehan 2016).

A recent study has touched on this topic by conducting comparative analysis using longitudinal data from the United States, the United Kingdom, the Netherlands, and Sweden (Leopold 2018). The four countries exhibit variations across a range of structural factors such as educational opportunity, income inequality, access to health care, employment protection, and so on. The combination of these factors and the interactions between them set up different social contexts in which the association between socioeconomic position and health is revealed. Based on cohort-specific analysis of health trajectories of people ages 50 to 76, results showed that health gaps between socioeconomic groups (measured by educational achievement in this study) were smallest in Sweden, larger in the Netherlands and the United Kingdom, and largest in the United States. Moreover, the extent to which the gaps widened with age followed a similar trajectory across these countries, with Sweden showing the smallest growth and the United States the largest.

These variations between countries provide evidence that health inequalities and their evolution during the aging process are dependent on the social contexts in which people's life courses unfold. However, it is not known whether changes in social contexts that take place in a given society also leave an imprint on people's health trajectories over the life course. Finding answers to this question is key to better understanding trends in population health, and the answers would also provide a response to recent calls for an updated framework that would incorporate micro- and meso-level social determinants within structural forces (Montez, Hayward, and Zajacova 2021). In addition, in previous cross-national comparative studies, the countries being compared often vary in many respects. Apart from the variations between countries in the aforementioned study (Leopold 2018), there can also be differences involving gender and race structures, cultural norms, pension schemes, dietary habits, and so on, all of which can be important confounding factors but can hardly be examined comprehensively. In the jungle of this broad range of differences, it is difficult to identify the roles of specific factors, which would be important to consider in devising public policy to address health inequality. This article therefore focuses on the relationship between socioeconomic position and health trajectory in the changing context of a single society and investigates the roles of two specific structural factors—income inequality and differential access to medical care—in shaping health disparities over time. By incorporating micro-level determinants within structural forces and examining the roles of specific macro-level factors, it aims to add to the evidence on health disparities from a context-embedded life course perspective.

Rural Peasants and Urban Nonpeasants in China's Changing Social Context

To examine the relationship between socioeconomic position and health trajectory in a changing social context, China is one of the best countries to use as a case study. Since the 1980s, China has experienced rapid socioeconomic changes, which have been continuing for four decades and have involved billions of people. By contrast with the relatively stable social structures in the Western world and the dramatic changes experienced in the former socialist countries of Eastern Europe, China has undergone fundamental social changes in a relatively gradual and peaceful manner. It therefore offers observable social changes in a relatively short time period and at the same time avoids dramatic interruptions such as war and revolution. In addition, the socioeconomic transformation in China has involved increasing levels of social inequality, a trend that resembles developments seen in many other countries over the past few decades.

As explained previously, this study focuses on two comparison groups: Chinese rural peasants and urban nonpeasants. Before the 1980s, China was predominantly an agricultural society, and over 70% of its labor force was concentrated in the agricultural sector. As a result of the continuing industrialization process, this figure dropped to 50% in 2000 and further decreased in the new century. Here, I use data collected between 1991 and 2006 and restrict the analysis to people in their midlife years during the survey period. As a result, all respondents in the analysis were born between 1931 and 1961, and rural peasants account for around 70% of the analytical sample. To ensure a sufficient sample size for analysis, I do not make further differentiations among the nonpeasant group, at the cost of not being able to reveal heterogeneity within this group.

As in most countries, employment is the backbone of social stratification in China. Whether measured in socioeconomic index scores (which draw on information about education and incomes associated with specific occupations) or in class schemas (most of which are also based on occupational information but put more emphasis on employment relations), peasants are consistently placed at the bottom of occupational scales in the Chinese context. In addition, the peasant versus nonpeasant division in China has been reinforced by the household registration system (*hukou*), an administrative and redistributive arrangement established in the 1950s, through which differential rights and benefits were allocated to urban and rural residents (Chan and Buckingham 2008; Wu and Treiman 2004). Due to double disadvantages—occupational and institutional—dating back to the era before the economic reform, rural peasants in China have consistently occupied an inferior socioeconomic position compared to urban nonpeasants.

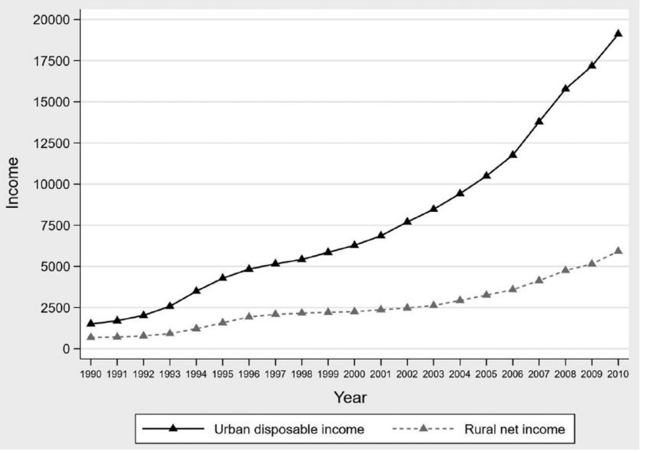

Figure 1. Average Income of Chinese Urban and Rural Residents: 1990–2010 (in Chinese yuan).
Source: Data are from the National Bureau of Statistics of China.

The economic reform started in the 1980s and was initiated in rural areas. The commune system was replaced by the household responsibility system, and this decollectivization process led to an advancement of agricultural production. However, the primary sector was very soon surpassed. From the 1990s, several new policies were launched to stimulate investment in urban areas and to deepen economic reform in the secondary and tertiary sectors. The market became increasingly important in resource allocation in these sectors, and it facilitated rapid economic growth. As a result, the primary sector accounted for a decreasing segment of GDP, from around one third in the early 1980s to one tenth in 2010, while the secondary and tertiary sectors achieved fast and sustained development (National Bureau of Statistics of China 2020).

In addition, China's stepped-up economic reform was accompanied by a series of moves toward marketization in public services. Government funding for education, housing, pension provision, and medical care was reduced, and individuals' welfare became more dependent on the resources and distribution policy of enterprises (Li, Miao, and Wang 2009). The reform had a universal but unequal effect on the population: People were least affected if they enjoyed permanent jobs and generous welfare packages in their employment, while those who lacked proper social insurance and welfare, such as rural peasants, were left in a more vulnerable position, facing increasing costs driven by market prices.

In a nutshell, the reform since the 1980s has driven fast economic growth in China but has also brought about increasing social inequality. From 1979 to 2010, China's average annual GDP growth was 9.91%, making China the world's second largest economy, while the Gini coefficient increased from around .28 in the early days of the reform to a peak of .49 in 2008 (Zhou and Hu 2021), a figure well above the alarm level and that might even have been underestimated due to the inadequacy of the urban high-income group sample (Yue, Li, and Gao 2013). Some scholars have pointed out that the rural–urban income gap has become a key driving force of the increasing income inequality in China (Li 2016). Although rural residents' incomes have increased due to the rapid economic growth, they have increased at a slower pace than those of their urban counterparts, leading to a widening income gap between the two groups. As can be seen in Figure 1, income inequality between urban and rural residents started to increase from the mid-1990s and accelerated in the new century. According to existing evidence, income inequality has important implications for population health, especially for disadvantaged groups (for recent reviews, see Bor, Cohen, and Galea 2017; Pickett and Wilkinson 2015). Given that rising income inequality is one of the distinguishing features of the economic reform in China and that it has been extensively discussed in the theoretical literature, I include it as a key structural factor in this article and examine its role in shaping the health trajectories of rural peasants and urban nonpeasants.

In addition to increasing economic disparity, the reduction in government funding in public services also intensified rural residents' vulnerability. Taking medical care as an example, in the early 1980s, government spending accounted for almost 40% of total health expenditure, but it declined to 15% in 2000, while out-of-pocket payments rose from 20% to around 60% (National Bureau of Statistics of China 2020). During this period of time, the number of medical institutions and the use of medical services increased in urban areas, whereas in rural areas, both underwent a decline (Liu, Hsiao, and Eggleston 1999).[1] Previous studies have shown that accessible and affordable medical care has a significant influence on the life expectancy of a society, and unequal access may act as a contributing factor to health inequality among different socioeconomic groups (Hoebel et al. 2017; McMaughan, Oloruntoba, and Smith 2020; Ranabhat et al. 2018). Because the reform in medical care marked a milestone during the marketization process in public services and had a direct effect on population health, this article includes differential access to medical care as a second structural factor and examines its influence on people's health trajectories in China's transformation process.

To sum up, because rural peasants in China occupied a lower socioeconomic position and were left further behind in the social transformation process than their urban nonpeasant counterparts, they might have been exposed to higher health risks. It is therefore worth asking how the health trajectories of Chinese rural peasants and urban nonpeasants were affected by this changing social context. Furthermore, what roles were played by specific structural factors, such as income inequality and differential access to medical care, in the evolution of these trajectories?

DATA AND METHODS

Data

The empirical analysis was based on the China Health and Nutrition Survey (CHNS), an international collaborative project between the Carolina Population Centre at the University of North Carolina at Chapel Hill and the National Institute for Nutrition and Health at the Chinese Centre for Disease Control and Prevention. The survey covers nine provinces[2] that feature substantial differences in geography and economic development and that accommodate one third of China's total population. During the sampling process, the CHNS used a multistage random cluster design in each province. The primary sampling units were urban neighborhoods, suburban neighborhoods, towns, and villages. Within each primary sampling unit, households were randomly selected, and all individuals in each household were surveyed. More information can be found on the project's website at http://www.cpc.unc.edu/projects/china. Previous research has shown that the household and individual samples from the CHNS have characteristics comparable with the national population (Chen 2005; Entwisle and Chen 2002). However, findings from this survey should be used cautiously in making inferences about the overall population.

The CHNS spans the period from 1989 to 2015 and includes 10 waves in total. It provides opportunities to trace similarities and differences in health and nutritional conditions between the two comparison groups, starting from the late 1980s and the early 1990s (featuring only moderate disparities of income and other resources between rural peasants and urban nonpeasants) up to the new century (featuring a thriving urban economy and widening inequalities between the two groups). In this research, I used data from six waves of the survey (1991, 1993, 1997, 2000, 2004, and 2006). The other waves were excluded because they did not include the measurement for self-rated health, the dependent variable of this study.

Variables

Self-rated health. Self-rated health has been shown to be a valid measure of overall health status. Researchers have found that health is a multidimensional concept that should not be narrowly categorized as a merely physical condition but also needs to encompass facets such as mental status and social functioning. In this sense, self-rated health can be considered a good proxy for overall health. Higher scores for self-rated health have been found to be effective predictors for healthy aging and low mortality even after controlling for objective health measures such as physicians' examination results and medical records (Cosco et al. 2013; Depp, Vahia, and Jeste 2010; Idler and Benyamini 1997). In the waves from 1991 to 2006, CHNS respondents were asked the following question: "How would you describe your health compared to that of other people your age?" The responses were ordered in four categories and were reversely coded as: (1) poor, (2) fair, (3) good, and (4) excellent.

Comparison groups. The main focus of this article is on the comparison between the rural peasant group and the urban nonpeasant group. Based on information collected in the CHNS, the rural peasant group included people who had rural *hukou* status and reported their main occupation as farming, fishing, or hunting, while the urban nonpeasant group included people who had urban *hukou* status and were engaged in nonagricultural occupations.

Other covariates. To depict health trajectories during the aging process, I included age as the main covariate and its quadratic term for possible nonlinear progression. I also included variables to indicate cohort membership so that examination of health trajectories along the age spectrum takes account of cohort variations. Control variables included gender, years of education, and marital status. Gender was a dummy variable, with male coded as 1 and female as 0. Years of education was a continuous variable for the number of school years completed. Marital status had three categories, single, married, and divorced, separated, or widowed.[3] To address potential bias associated with follow-up attritions, I also accounted for different follow-up statuses: staying in the survey, passed away, migration, and other missing. Explanatory variables included individuals' annual net income, GDP per capita, Gini coefficient, and the total number of medical institutions in the province of residence. Gender, cohort membership, and years of education (which seldom change after age 45) were treated as time-invariant variables, and the measures were taken from the first valid observation in the analytical sample. All the other variables were included in model estimation as time-varying and were measured at different waves of the survey. The descriptive statistics for these variables are shown in Table 1.

Method

In this study, the growth curve modeling approach was applied to depict the health trajectories of Chinese rural peasants and urban nonpeasants as they advance through the aging process. As we know, in person-year data, age and period are fundamentally interlocked. For a given individual, any variation in age corresponds to the same variation in time progression. To better present health trajectories as people age in different social contexts, I split the overall sample and conducted longitudinal analysis in three adjacent time periods. The research design is shown in Table 2.

First, instead of including six waves from 1991 to 2006 in a single sample, this study separated the data into three subsamples representing three successive time periods: 1991 to 2000, 1993 to 2004, and 1997 to 2006.[4] Each period consisted of four waves of the survey, covering similar lengths of time. In Table 2, waves covered in each period are marked in black, contrasting with gray for those not included. Because the CHNS is an ongoing longitudinal study, it recruits new respondents in each wave to replace those no longer participating so that the sample remains representative of the target population over time. I assumed that the samples in the starting waves for the three time periods (Wave 1991 in the first period, Wave 1993 in the second, and Wave 1997 in the third) are representative of the target population at different times. For each sample, the cases for analysis were limited to the individuals who were present in the initial wave, and they were tracked another three times in the following waves unless they withdrew from the survey. As mentioned earlier, the disparity in socioeconomic resources between urban and rural residents was constantly increasing in the 1990s and 2000s, and these three periods were examined to reflect this general trend alongside the social transformation process.

Second, within each sample, the age effect was examined within the range of 45 to 60 years, a life stage when health disparities have emerged and mortality rates have not converged. For reasons of comparison, the same age range was examined from wave to wave. As can be seen in Table 2, where the target range is designated by frames, data for respondents below age 45 or above age 60 were not included in the analysis. For example, respondents born in 1950, who participated in the 1991 survey at the age of 41, were counted as valid cases in the 1991 to 2000 subsample, but they were only included in later waves when they reached the 45 to 60 age bracket.

Third, in terms of cohort variations, the analytical sample involved 31 different birth years in total, from the year 1931 to the year 1961. In this study, five-year cohorts were constructed: 1931 to 1935, 1936 to 1940, 1941 to 1945, 1946 to 1950, 1951 to 1955, and 1956 to 1961, with the last cohort including six birth years. As time progresses, the replacement of older cohorts with younger ones is inevitable. In this analysis, within the time span from 1991 to 2006, the 1931 to 1935 cohort was replaced by the 1956 to 1961 cohort, but most of the cohorts (Cohorts 2–5) were observed across the three subsamples, which offers a good basis for comparison over time.

Table 1. Descriptive Statistics for Variables (Mean or Percentage) in the Analytical Sample, Unweighted Data for Subsamples 1991–2000, 1993–2004, and 1997–2006.

	Sample 1 (1991–2000)	Sample 2 (1993–2004)	Sample 3 (1997–2006)
Self-rated health	2.66	2.64	2.64
Comparison groups			
Rural peasant	67.12%	73.61%	73.24%
Urban nonpeasant	32.88%	26.39%	26.76%
Birth cohort			
1931–1935	12.36%	—	—
1936–1940	2.25%	13.70%	5.54%
1941–1945	28.03%	23.10%	15.72%
1946–1950	24.41%	31.78%	32.08%
1951–1955	14.95%	26.16%	35.20%
1956–1961	—	5.26%	11.46%
Age	51.47	51.00	51.43
Gender			
Male	51.56%	51.56%	52.69%
Female	48.44%	48.44%	47.31%
Years of education	4.66	5.15	5.57
Marital status			
Married	92.09%	92.21%	92.34%
Single	2.01%	2.44%	2.17%
Divorced/separated/widowed	5.90%	5.35%	5.49%
Follow-up status			
Staying in the survey	9.74%	89.95%	9.71%
Passed away	1.58%	1.45%	.97%
Migration	2.00%	2.17%	2.73%
Other missing	5.68%	6.43%	5.59%
Annual net income (Chinese yuan)	2,607.69	3,762.88	5,308.97
Provincial GDP per capita	377.98	6,049.86	8,495.99
Provincial Gini coefficient	4.74	4.94	5.04
Provincial number of medical institutions	10,135.19	1,097.87	11,601.42
Number of observations	6,563	5,611	5,994
Number of individuals	3,379	3,004	3,082

Note: Gender, cohort membership, and years of education are treated as time-invariant, and the measures are taken from the first valid observation in the analytical sample. All the other variables are included in model estimation as time-varying and measured at different waves of the survey. The data source for GDP per capita and the number of medical institutions in each province is annual data from the National Bureau of Statistics of China. All the other variables are constructed from the China Health and Nutrition Survey.

Table 2. Cases for Analysis in Three Subsamples: 1991–2000, 1993–2004, and 1997–2006, from the China Health and Nutrition Survey.

		Sample 1 (1991–2000)								Sample 2 (1993–2004)								Sample 3 (1997–2006)					
		1991	1993	1997	2000	2004	2006			1991	1993	1997	2000	2004	2006			1991	1993	1997	2000	2004	2006
Cohort 1	1931	60	62	66	69	73	75	Cohort 1	1931	60	62	66	69	73	75	Cohort 1	1931	60	62	66	69	73	75
	1932	59	61	65	68	72	74		1932	59	61	65	68	72	74		1932	59	61	65	68	72	74
	1933	58	60	64	67	71	73		1933	58	60	64	67	71	73		1933	58	60	64	67	71	73
	1934	57	59	63	66	70	72		1934	57	59	63	66	70	72		1934	57	59	63	66	70	72
	1935	56	58	62	65	69	71		1935	56	58	62	65	69	71		1935	56	58	62	65	69	71
Cohort 2	1936	55	57	61	64	68	70	Cohort 2	1936	55	57	61	64	68	70	Cohort 2	1936	55	57	61	64	68	70
	1937	54	56	60	63	67	69		1937	54	56	60	63	67	69		1937	54	56	60	63	67	69
	1938	53	55	59	62	66	68		1938	53	55	59	62	66	68		1938	53	55	59	62	66	68
	1939	52	54	58	61	65	67		1939	52	54	58	61	65	67		1939	52	54	58	61	65	67
	1940	51	53	57	60	64	66		1940	51	53	57	60	64	66		1940	51	53	57	60	64	66
Cohort 3	1941	50	52	56	59	63	65	Cohort 3	1941	50	52	56	59	63	65	Cohort 3	1941	50	52	56	59	63	65
	1942	49	51	55	58	62	64		1942	49	51	55	58	62	64		1942	49	51	55	58	62	64
	1943	48	50	54	57	61	63		1943	48	50	54	57	61	63		1943	48	50	54	57	61	63
	1944	47	49	53	56	60	62		1944	47	49	53	56	60	62		1944	47	49	53	56	60	62
	1945	46	48	52	55	59	61		1945	46	48	52	55	59	61		1945	46	48	52	55	59	61
Cohort 4	1946	45	47	51	54	58	60	Cohort 4	1946	45	47	51	54	58	60	Cohort 4	1946	45	47	51	54	58	60
	1947	44	46	50	53	57	59		1947	44	46	50	53	57	59		1947	44	46	50	53	57	59
	1948	43	45	49	52	56	58		1948	43	45	49	52	56	58		1948	43	45	49	52	56	58
	1949	42	44	48	51	55	57		1949	42	44	48	51	55	57		1949	42	44	48	51	55	57
	1950	41	43	47	50	54	56		1950	41	43	47	50	54	56		1950	41	43	47	50	54	56
Cohort 5	1951	40	42	46	49	53	55	Cohort 5	1951	40	42	46	49	53	55	Cohort 5	1951	40	42	46	49	53	55
	1952	39	41	45	48	52	54		1952	39	41	45	48	52	54		1952	39	41	45	48	52	54
	1953	38	40	44	47	51	53		1953	38	40	44	47	51	53		1953	38	40	44	47	51	53
	1954	37	39	43	46	50	52		1954	37	39	43	46	50	52		1954	37	39	43	46	50	52
	1955	36	38	42	45	49	51		1955	36	38	42	45	49	51		1955	36	38	42	45	49	51
Cohort 6	1956	35	37	41	44	48	50	Cohort 6	1956	35	37	41	44	48	50	Cohort 6	1956	35	37	41	44	48	50
	1957	34	36	40	43	47	49		1957	34	36	40	43	47	49		1957	34	36	40	43	47	49
	1958	33	35	39	42	46	48		1958	33	35	39	42	46	48		1958	33	35	39	42	46	48
	1959	32	34	38	41	45	47		1959	32	34	38	41	45	47		1959	32	34	38	41	45	47
	1960	31	33	37	40	44	46		1960	31	33	37	40	44	46		1960	31	33	37	40	44	46
	1961	30	32	36	39	43	45		1961	30	32	36	39	43	45		1961	30	32	36	39	43	45

Note: This study separated the data into three subsamples representing three successive time periods: 1991 -2000, 1993 -2004, and 1997 -2006. Each sample consisted of four waves of the survey, which are marked in black, contrasting with gray for those not included. For each sample, the cases for analysis were limited to the individuals who were present in the initial wave (Wave 1991 in the first period, Wave 1993 in the second, and Wave 1997 in the third), and they were tracked another three times in the following waves unless they withdrew from the survey. For reasons of comparison, the same age range (45 to 60 years) was examined from wave to wave, which is designated by frames. In this study, six cohorts were constructed. As time progresses, the 1931 to 1935 cohort (Cohort 1) was replaced by the 1956 to 1961 cohort (Cohort 6), but most of the cohorts (Cohorts 2 -5) were observed across the three subsamples, which offers a good basis for comparison over time.

The model specification for each subsample is as follows:

$$Health_{ti} = \beta_{0i} + \beta_{1i}\left(Age_{ti}\right) + \beta_{2i}(Age_{ti})^2 + \sum_{j=1}^{n}\delta_j X_i + \sum_{k=1}^{m}\varphi_k Z_{ti} + \varepsilon_{ti}$$

$$\beta_{0i} = \gamma_{00} + \gamma_{01}Peasant_i + \sum_{l=2}^{6}\gamma_{0l}Cohort_{il} + \mu_{0i}$$

$$\beta_{1i} = \gamma_{10} + \gamma_{11}Peasant_i + \sum_{l=2}^{6}\gamma_{1l}Cohort_{il} + \mu_{1i}$$

$$\beta_{2i} = \gamma_{20} + \mu_{2i}$$

where the outcome variable $Health_{ti}$ was modeled as a function of age and age-squared for individual *i* at time *t*, controlling for time-invariant covariates X_i and time-varying covariates Z_{ti}. In the model estimation process, age was centered at 52 and rescaled as $(Age_{ti} - 52) / 10$. In this study, the main focus was on the health disparities between the two comparison groups (i.e., rural peasants and urban nonpeasants), thus the dummy variable $Peasant_i$ was included as a key predictive variable on both the random intercept (β_{0i}) and random slopes (β_{1i}).[5] Given that the health trajectories of the two groups might be cohort-specific, a series of dummy variables $Cohort_{il}$ (l = 2,3,4,5,6) was included to estimate specific health trajectories for each birth cohort. The interaction terms between the predictive variables $Peasant_i$ and $Cohort_{il}$ were initially included and then removed because no significant effect was found and there was no improvement in the model fit. In addition to the main analysis, an additional analysis was performed using an ordinal growth curve modeling framework. The main conclusions remain unchanged, and the results are shown in Appendix A in the online version of the article.

In this study, the missing cases accounted for 8.67% of the overall analytic sample. Around 2.53% cases were missing for the dependent variable and the rest for other variables. The main source of missing values was the variable *annual net income*—5.99% in the overall sample.[6] For the main analysis, the multiple imputation method was used to deal with missing values for variables included in the analysis. Specifically, I employed the multivariate imputation using chained equations so that imputations were based on univariate conditional distributions of each variable (Van Buuren, Boshuizen, and Knook 1999). The final working sample consisted of 3,379, 3,004, and 3,082 valid cases for the three subsamples, respectively. In addition, two alternative approaches to dealing with missing values—direct maximum likelihood estimation using nonimputed data and multiple imputation with auxiliary variables[7] in the imputation phase—were employed as sensitivity analyses and showed similar findings. The results are shown in Appendices B and C in the online version of the article.

RESULTS

Health Trajectories in a Changing Social Context

Results are shown in Tables 3 and 4. In each table, Models 1, 2, and 3 show results from subsamples 1991 to 2000, 1993 to 2004, and 1997 to 2006, respectively. From model estimation, three conclusions can be generated. First, in terms of health trajectories in the aging process, if we plot on a graph the estimated health status (not shown in the text) based on model estimates in Table 3, we will see that the combined effect of age and age-squared illustrates a declining trend in health status across the age range 45 to 60 years, which applies to all three subsamples. In addition, there are significant disparities between the two socioeconomic groups, with rural peasants showing a disadvantage in health compared to urban nonpeasants. This will be discussed in the following.

Second, the inclusion of cohort membership significantly improves the fit of the model (see F-tests reported in Table 4). Figure 2 depicts the health trajectories of Cohorts 2 through 5, which can be examined in all three time periods. It shows that at a given age, the younger cohorts (especially cohorts 1946–1950 and 1951–1955) reported worse health conditions, and the differences become statistically significant in subsequent models. A possible reason is that in their early years, younger cohorts in the present study experienced the Chinese Great Famine from 1959 to 1961. Several studies in China have found that people who experienced the Great Famine at a young age had lower average height, higher risk of obesity and cardiovascular diseases, and worse mental health status, providing evidence of the long-term adverse impacts of the three-year famine on people's health in later life (Chen and Zhou 2007; Fan and Qian 2015; Meng and Qian 2009).

Third, Tables 3 and 4 both show that the coefficient for rural peasants is negative in all three subsamples, which indicates rural peasants' health disadvantages compared with urban nonpeasants.

Table 3. Model Estimates for Subsamples 1991–2000, 1993–2004, and 1997–2006.

	Model 1	Model 2	Model 3
	(1991–2000)	(1993–2004)	(1997–2006)
Fixed effects			
Intercept	2.693***	2.717***	2.717***
Age[a]	−.154***	−.116*	−.091*
Age-squared	−.014	−.040	−.018
Rural peasant	−.071**	−.125***	−.116***
Rural peasant × Age[b]	−.072†	−.115*	−.156**
Random-effects parameters			
Level-1: Within-individual			
Var(residual)	.402	.413	.399
Level-2: Between-individual			
Var(intercept)	.106	.108	.131
Var(age)	.105	.150	.050
Var(age-squared)	.099	.202	.138
Cov(intercept, age)	−.023	−.016	.014
Cov(intercept, age-squared)	−.067	−.114	−.068
Cov(age, age-squared)	.090	.073	−.009
Number of observations	6,563	5,611	5,994
Number of individuals	3,379	3,004	3,082

Source: Data are from the China Health and Nutrition Survey.
[a]In the model estimation process, age is centered at 52 and rescaled as (Age – 52) / 10.
[b]In additional analysis, rural peasant was included as a predictive variable on both linear and nonlinear random slopes (age and age-squared). Results showed that the effect of rural peasant on age-squared was not significantly different from zero, and the inclusion of Rural peasant × Age-squared did not improve model fit. Given that the coefficient for this term approached zero both statistically and substantively, the term was omitted from model estimation to avoid introducing further complexity to the model.
†$p < .10$, *$p < .05$, **$p < .01$, ***$p < .001$ (for two-tailed tests).

In addition, the interaction term between rural peasant and age is also negative: This relationship tends to become more marked across the three time periods, and it reaches statistical significance in the more recent periods. As shown in Figure 2, in the second and especially the third periods, for each year of aging, rural peasants suffer a greater decline in health compared with urban nonpeasants. As a result, the health gap between the two groups widens more quickly in later time periods.[8] In other words, rural peasants' health disadvantage cumulates at a higher rate in the more recent social context.

Adjusting for Individual Characteristics and Attrition Bias

To explain the increasing health gap between rural peasants and urban nonpeasants across the three subsamples, I first include individual characteristics such as gender, education, and marital status. In addition, as shown in the descriptive statistics in Table 1, because rural peasants have a lower attrition rate than urban nonpeasants in this survey, the rural peasant group accounts for an increasing proportion across the three subsamples. To factor in the possibility that the revealed disparities in health trajectories across the three time periods might be confounded by different attrition patterns in different subsamples, three approaches are employed to counteract a potential selection effect. First, dummy variables are included in each wave to indicate different types of information missing in the following wave. Second, an inverse probability weight is generated and included to adjust for the attrition bias by reweighting observations with different attrition rates. Third, following Warner and Brown (2011), two variables are incorporated in the model to indicate mortal and nonmortal panel attritions, respectively.

In the first approach, three dummy variables are included in each wave to indicate missing cases in the following wave due to death, migration, or other unspecified reasons. The first dummy variable indicates nonmissing as 0 and death as 1. The second

Table 4. Model Estimates for Subsamples 1991–2000, 1993–2004, and 1997–2006, with Cohort Variations.

	Model 1	Model 2	Model 3
	(1991–2000)	(1993–2004)	(1997–2006)
Fixed effects			
Intercept	2.632***	2.718***	2.779***
Age[a]	.056	−.011	−.018
Age-squared	−.199†	−.111	−.141
Rural peasant	−.067**	−.117***	−.112***
Rural peasant × Age	−.066	−.099†	−.137**
Cohort			
1931–1935	—	—	—
1936–1940	.057	—	—
1941–1945	.086	.031	−.011
1946–1950	.020	−.026	−.057
1951–1955	−.132	−.047	−.115
1956–1961	—	.082	.071
Cohort × Age[b]			
1931–1935	—	—	—
1936–1940	−.056	—	—
1941–1945	−.240	−.160	−.081
1946–1950	−.392	−.218	−.107
1951–1955	−.642†	−.261	−.269
1956–1961	—	.253	.178
Random-effects parameters			
Level-1: Within-individual			
Var(residual)	.402	.414	.399
Level-2: Between-individual			
Var(intercept)	.103	.107	.128
Var(age)	.094	.133	.042
Var(age-squared)	.095	.187	.108
Cov(intercept, age)	−.021	−.017	.015
Cov(intercept, age-squared)	−.058	−.106	−.057
Cov(age, age-squared)	.087	.076	.008
Number of observations	6,563	5,611	5,994
Number of individuals	3,379	3,004	3,082
F test ($df = 8$, Prob $> F$)[c]	.391	.006**	.014*

Source: Data are from the China Health and Nutrition Survey.
[a]In the model estimation process, age is centered at 52 and rescaled as (Age – 52) / 10.
[b]In additional analysis, cohort membership was included as a predictive variable on both linear and nonlinear random slopes (age and age-squared). Results showed that the effects of cohorts on age-squared were not significant, and the inclusion of Cohort × Age-Squared did not improve model fit.
[c]F test is a joint test for cohort effects in each subsample. It shows whether the model fit is significantly improved when compared with results in Table 3.
†$p < .10$, *$p < .05$, **$p < .01$, ***$p < .001$ (for two-tailed tests).

dummy variable flags missing cases due to migration, which includes those who relocated permanently outside the original community in the following waves and those who left home temporarily for work or military service.[9] The third dummy variable indicates the category of other missing and includes all the other cases that are missing for unspecified reasons. Given that most cases in this category were missing on the household level and seldom showed up in subsequent

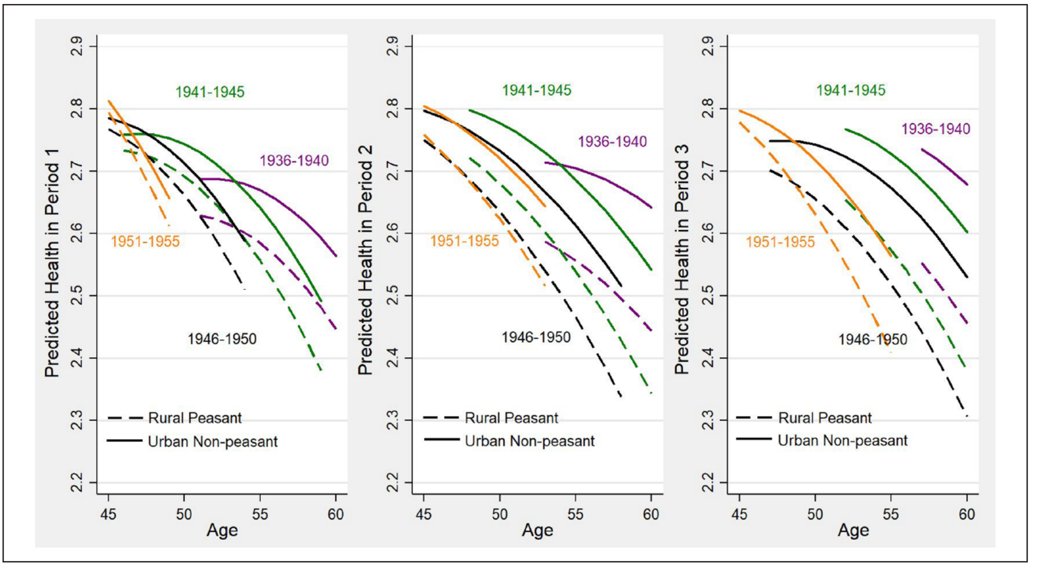

Figure 2. Predicted Health Trajectories of Rural Peasants and Urban Nonpeasants by Cohort in Three Subsamples: 1991–2000, 1993–2004, and 1997–2006, Estimated from Models 1 through 3 in Table 4.
Source: Data are from the China Health and Nutrition Survey.

waves, this group may consist mainly of families that no longer lived in the original community. The attrition rates of the three types across different subsamples are shown in Appendix D in the online version of the article.

Table 5 shows the model estimates after allowing for individual characteristics and the three missing types. As expected, cases that were missing due to death already exhibited a significantly worse health status in the preceding wave than those who remained in the survey. Individuals missing due to migration showed a better health status than those who remained in the survey, but the positive coefficient is only found in the first time period and converts to nonsignificant and negative in recent periods.[10] Cases that were missing due to unknown reasons reported worse health than those who remained in the survey in the first two periods, and the difference becomes nonsignificant in the third period. Adjusting for these factors, the interaction term in the second period becomes nonsignificant, but it remains significant in the third period. In other words, after factoring in individual characteristics and different types of follow-up attritions, rural peasants' health disadvantage still cumulates at a higher rate in the more recent social context.

The second approach employed to adjust for attrition bias is the inverse probability weighting approach (Fitzgerald, Gottschalk, and Moffitt 1998). Here, respondents with similar characteristics to those missing from the following waves are given higher weighting to make the sample more like the original one. In this study, a set of auxiliary variables are included to predict the likelihood of attrition in the following waves. The variables include age, gender, education, marital status, occupation, residential province, residential area, and length of stay in the previous surveys, all of which prove to have significant predictive power. Based on the predicted probability of attrition, the inverse probability weight is calculated. Models in the previous analysis are then reestimated by applying the inverse probability weight to adjust for follow-up attritions, and similar results are shown in Appendix E in the online version of the article. The third approach, in which two variables are included in the model estimation process (one indicating whether a respondent was observed to have passed away during the survey period and the other counting the number of waves a respondent participated in during the survey period), also shows similar findings. Results are shown in Appendix F in the online version of the article.

Exploration of Underlying Mechanisms

After allowing for cohort variations, individual characteristics, and potential attrition bias, the differences across the three time periods still remain. There are various mechanisms that might underly changes in population health (Curran and Mahutga 2018; Zheng and George 2018), and here I examine

Table 5. Model Estimates for Subsamples 1991–2000, 1993–2004, and 1997–2006, with Cohort Variations, Individual Characteristics, and Attrition Types.

	Model 1 (1991–2000)	Model 2 (1993–2004)	Model 3 (1997–2006)
Fixed effects			
Intercept	2.546***	2.639***	2.570***
Age[a]	.117	−.014	.083
Age-squared	−.223*	−.130	−.176†
Rural peasant	−.020	−.072*	−.038
Rural peasant × Age	−.066	−.084	−.113*
Cohort			
1931–1935	—	—	—
1936–1940	.054	—	—
1941–1945	.074	.012	.029
1946–1950	−.002	−.056	−.009
1951–1955	−.165	−.091	−.075
1956–1961	—	.042	.078
Cohort × Age			
1931–1935	—	—	—
1936–1940	−.083	—	—
1941–1945	−.296	−.173	−.160
1946–1950	−.470†	−.251	−.225
1951–1955	−.719*	−.304	−.417
1956–1961	—	.254	.006
Gender (female = reference)	.070**	.102***	.118***
Years of education	.009**	.007*	.011**
Marital status (married = reference)			
Single	.090	.044	.024
Divorced/separated/widowed	−.015	−.022	−.020
Attrition types (staying in the survey = reference)			
Passed away	−.512***	−.506***	−.404***
Migration	.107†	−.012	−.070
Other missing	−.088*	−.099*	−.065
Random-effects parameters			
Level-1: Within-individual			
Var(residual)	.401	.413	.397
Level-2: Between-individual			
Var(intercept)	.100	.100	.122
Var(age)	.090	.130	.052
Var(age-squared)	.100	.163	.113
Cov(intercept, age)	−.022	−.018	.015
Cov(intercept, age-squared)	−.061	−.104	−.063
Cov(age, age-squared)	.087	.074	−.005
Number of observations	6,563	5,611	5,994
Number of individuals	3,379	3,004	3,082
F test (*df* = 7, Prob > *F*)[b]	.000***	.000***	.000***

Source: Data are from the China Health and Nutrition Survey.
[a]In the model estimation process, age is centered at 52 and rescaled as (Age - 52) / 10.
[b]*F* test shows whether the model fit is significantly improved when compared with results in Table 4.
†$p < .10$, *$p < .05$, **$p < .01$, ***$p < .001$ (for two-tailed tests).

the roles of two structural factors during the social transformation process: income inequality and differential access to medical care. Regarding the first factor, income disparity and its effect on the two comparison groups are indicated by the Gini coefficient in each province and its interaction term with the rural peasant group. Given that the increase of Gini coefficient is associated with economic growth in the data set, I control for individuals' annual net income and GDP per capita in the province of residence in different waves of the survey to allow for potential confounding effects of economic resources at both individual and regional levels. Regarding the second factor—differential access to medical care and its effects on the two groups—I include the total number of medical institutions (including hospitals, clinics, and various types of medical centers) in each province for each wave and its interaction term with the rural peasant group.

As shown in Table 6, in all three time periods, both individual annual income and provincial GDP per capita have a significant positive effect on health. After allowing for economic resources at both individual and regional levels, the effect of Gini coefficient is examined. The estimated coefficient for Gini is not statistically different from zero, but the interaction term has a significant negative effect, showing that a higher level of income inequality has an exclusively negative impact on the health of rural peasants. With regards to differential access to medical care, increasing the number of medical institutions in the province of residence has a significant positive effect on the health of urban nonpeasants. However, the benefit may not apply equally to rural peasants. The interaction effect has a negative sign throughout and reaches statistical significance in the third subsample, showing a weaker health benefit for rural peasants than for their urban nonpeasant counterparts in the most recent time period.

After factoring in these two aspects (income inequality and differential access to medical care), the interaction term between rural peasant and age drops to a nonsignificant level in all three periods, and the size of the interaction coefficient drops by 31% and 38% in the second and third subsamples, respectively, leading to a similar pattern in all three time periods. The findings suggest that these two structural factors have a strong explanatory power for the widening health gap between the two comparison groups in recent time periods. Further analysis shows that income inequality makes a repeated contribution to the explanatory power of the model across all three periods, while differential access to medical care only exhibits an independent effect in the most recent period.[11]

To show the substantive effects of the structural factors and other covariates in the model, Figure 3 takes the third period as an example and visualizes how health disparities between rural peasants and urban nonpeasants reduce after these variables are accounted for. As can be seen from the figure, once the structural factors are included, there is barely any difference in the health trajectories of the two groups. This suggests that the health gap between these two socioeconomic groups does not automatically accumulate merely as a reflection of aging over time but is conditional on and moderated by the social context in which the aging process takes place.

Additional Analyses

Different cohort groupings. In the main part of this study, five-year cohorts were constructed and included in model estimation. A supplementary analysis was conducted by using a more historically grounded definition of cohorts. The cohort groupings were redefined as 1931 to 1936, 1937 to 1940, 1941 to 1945, 1946 to 1949, 1950 to 1957, and 1958 to 1961, for which the rationale is as follows. The years 1931 to 1936 marked the first phase of Japanese invasion, which escalated into a full-scale war from 1937, followed by an eight-year Sino-Japanese War until 1945. The 1937 to 1940 cohort and the 1941 to 1945 cohort were differentiated because members of the latter were born into a different phase, when the Japanese encountered tremendous difficulties in seizing more territories but the prolonged war wreaked havoc on China's economy and caused hyperinflation. Then the civil war lasted from 1946 to 1949, when the People's Republic of China was founded. Members of the 1950 to 1957 cohort were born into a relatively peaceful time, featuring postwar reconstruction and the start of industrialization. In 1958, the Great Leap Forward movement started and was followed by the Three-Year Famine until 1961. Based on the new definition of cohorts, the analysis was repeated, and the results were very similar. The findings are shown in Appendix G in the online version of the article.

Heterogeneity of newly recruited respondents. In the main part of this study, respondents newly recruited in the 1993 and 1997 waves were included to replace missing cases in the second and third subsamples. Subsequently, to examine the extent to which the difference revealed across time was associated with the heterogeneity of new participants, a supplementary analysis was conducted by tracking only respondents who were already survey participants in the 1991 wave without including those who

Table 6. Model Estimates for Subsamples 1991–2000, 1993–2004, and 1997–2006, with Cohort Variations, Individual Characteristics, Attrition Types, and Explanatory Variables.

	Model 1	Model 2	Model 3
	(1991–2000)	(1993–2004)	(1997–2006)
Fixed effects			
Intercept	−.599	.564	.753
Age[a]	.121	−.259†	.059
Age-squared	−.238*	−.033	−.220*
Rural peasant	.633**	.782*	.824**
Rural peasant × Age	−.069	−.058	−.070
Cohort			
1931–1935	—	—	—
1936–1940	.068	—	—
1941–1945	.015	−.091	.009
1946–1950	−.149	−.205**	−.033
1951–1955	−.392*	−.252**	−.126
1956–1961	—	−.084	−.012
Cohort × Age			
1931–1935	—	—	—
1936–1940	−.200	—	—
1941–1945	−.434†	−.076	−.145
1946–1950	−.664*	−.082	−.252
1951–1955	−.863*	−.030	−.495
1956–1961	—	.629	−.085
Gender (female = reference)	.066**	.100***	.116***
Years of education	.007*	.005	.010**
Marital status (married = reference)			
Single	.085	.042	.028
Divorced/separated/widowed	−.003	−.018	−.021
Attrition types (staying in the survey = reference)			
Passed away	−.501***	−.511***	−.413***
Migration	.121†	.005	−.056
Other missing	−.076*	−.091*	−.056
Annual Net income (in log form)	.263**	.182*	.159*
Provincial GDP per capita/1,000	.017**	.010*	.010**
Provincial Gini Coefficient × 10	.075†	.033	−.002
Peasant × Gini Coefficient × 10	−.123*	−.153**	−.128*
Provincial number of medical institutions/1,000	.012**	.010†	.011*
Peasant × Provincial Number of Medical Institutions/1,000	−.005	−.006	−.015**
Random-effects parameters			
Level-1: Within-individual			
Var(residual)	.399	.410	.396
Level-2: Between-individual			
Var(intercept)	.096	.095	.114
Var(age)	.078	.122	.041
Var(age-squared)	.100	.172	.129
Cov(intercept, age)	−.023	−.018	.014
Cov(intercept, age-squared)	−.056	−.097	−.057
Cov(age, age-squared)	.084	.071	−.004
Number of observations	6,563	5,611	5,994
Number of individuals	3,379	3,004	3,082
F test ($df = 6$, Prob > *F*)[b]	.000***	.000***	.000***

Sources: The data source for GDP per capita and the number of medical institutions in each province is annual data from the National Bureau of Statistics of China. All the other variables are constructed from the China Health and Nutrition Survey.

[a]In the model estimation process, age is centered at 52 and rescaled as (Age - 52) / 10.

[b]*F* test shows whether the model fit is significantly improved when compared with results in Table 5.

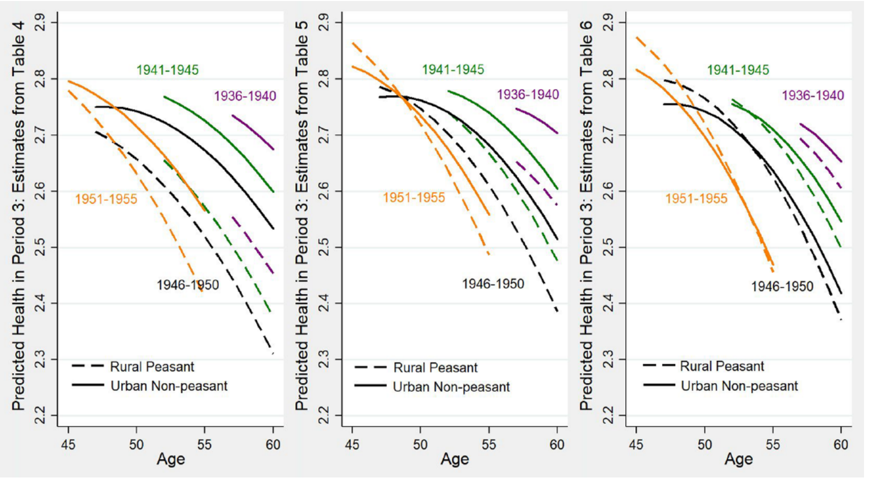

Figure 3. Predicted Health Trajectories of Rural Peasants and Urban Nonpeasants by Cohort in the Third Subsample, 1997–2006.

Source: Annual data from the National Bureau of Statistics of China and the China Health and Nutrition Survey.

Note: Prediction based on Model 3 in Tables 4 through 6, holding constant all other variables as follows when they are included: gender (male), marital status (married), attrition types (staying in the survey), and other covariates (at their average values).

joined in later waves. In this approach, to be included, respondents observed in the 1993 to 2004 subsample must have stayed in the survey for at least two waves from 1991 and respondents in the 1997 to 2006 subsample must not be missing in the third wave in 1997. These restrictions led to smaller sample sizes. The analysis was repeated in the same vein for the three subsamples. It turned out that results were similar to those shown in the main study (for details, see Appendix H in the online version of the article). Therefore, it is safe to conclude that the divergence across the three time periods was not derived from unobserved heterogeneity of the respondents who were newly incorporated in the 1993 and 1997 surveys.

Rural and urban comparison. The main part of this study focuses on two socioeconomic groups—rural peasants and urban nonpeasants. To a large extent, the disparity between these two groups reflects the difference between rural and urban areas during the industrialization and marketization process in China. To check how far the findings could apply to a broader rural–urban comparison, further analysis was conducted for rural and urban residents without reference to the information about their occupation. This showed that the findings in the main study were mostly robust and could be regarded as epitomizing the rural–urban comparison in more general terms. Results are shown in Appendix I in the online version of the article.

Limitations

To answer the research questions, the growth curve modeling approach is employed in this study. Instead of using all data and running a single model on the overall sample, this article splits the data into three subsamples. This analytic approach, which combines several survey years into one time period and then compares health trajectories in the three adjacent periods, is suited to answering the research questions and to presenting evidence of changes occurring over time.

Despite its advantages, the research design also has its weaknesses and limitations. First, coefficient comparisons across models have less power than those within the same model, especially when the observations in the three subsamples are not independent. Second, more waves would be required to avoid overlaps across different subsamples. In this study, because only six survey waves were available, overlaps were inevitable. With only one wave gap between the starting points of the three adjacent periods, differences may only be detected in societies with rapid social changes. Should there be more waves, the differences over time might be better examined.

Third, although the current research design allows a better way of presenting changes over time, it does not solve the age-period-cohort confounding issue, and alternative possibilities and different interpretations cannot be ruled out. Regarding the age-period-cohort conundrum, different approaches have been proposed to deal with the identification problem of the three interrelated factors, ranging from earlier solutions such as the coefficients-constraints approach (Fienberg and Mason 1985) and the proxy variables approach (Blossfeld 1986; O'Brien, Stockard, and Isaacson 1999) to later developments such as the intrinsic estimator method (Fu 2000; Yang et al. 2008), the hierarchical age-period-cohort method (Yang and Land 2006; Zheng, Yang, and Land 2011), and so on. However, no technical solution would work without strong assumptions being imposed because the confounding is mathematical or logical (Bell and Jones 2014).

In the research design of this study, the assumption is that health variations within each subsample can mainly be ascribed to age and cohort, while changes across the subsamples can be attributed to period effect. However, due to the interlocking nature of the age-period-cohort effects, it is possible that the increasing health gap over time may not be a pure reflection of period effect, but rather a combination of more than one contributor among the three. This should be kept in mind when interpreting the model results. Nevertheless, this article does not aim to disentangle the conundrum or to pursue a clear distinction between the three effects. Instead, it shows evidence of an increasing health gap over time, for which the aging process and cohort variations may not have enough explanatory power, and it indicates that structural factors might have played an important role in producing this gap.

DISCUSSION AND CONCLUSION

Research in the field of aging and health has achieved considerable progress by depicting socioeconomic disparities in health over the life course. Recent cross-national research has suggested that the extent to which health gaps between different socioeconomic groups widen with age varies in different countries. In this study, I have examined the health gap between two socioeconomic groups in the changing social context of a given country and have explored the underlying mechanisms. The empirical analysis is based on the longest series of panel surveys in China, which covers a period when China was experiencing a rapid and continuous social transition process.

There are three principal findings. (1) In the age range of 45 to 60 years, rural peasants reported worse health conditions than their urban nonpeasant counterparts and experienced significant decline in health. The incorporation of cohort-specific analysis has contributed to a more precise estimation of health trajectories and has shown intercohort variations. (2) When compared over time, the health gap between the two socioeconomic groups shows only a slight increase at an earlier period but increases more rapidly in the more recent time periods, showing evidence that the extent to which health (dis) advantages cumulate with age is contingent on specific social contexts. (3) The differences across the three subsamples cannot be fully explained by respondents' demographic characteristics or the selection effect of sample attritions. Further analysis shows that the structural factors of increasing income disparities and differential access to medical care between the two groups have contributed to the widening health gap in recent time periods.

This study makes three key contributions to the existing literature. First, empirically, by adopting a context-embedded life course perspective, it shows evidence that health gaps between different socioeconomic groups are shaped by specific social contexts, which largely define what resources are available to people in different socioeconomic positions and therefore influence their life chances. During the industrialization and marketization processes that brought about increasing inequality in economic and medical resources, Chinese rural peasants have been left further behind compared with urban nonpeasants, and their health disadvantage has become more significant in recent time periods. These findings are consistent with international comparative research, which shows that people in lower socioeconomic positions are more likely to cumulate health disadvantages in social contexts with greater economic inequalities and less supportive social policies (Leopold 2018). The current study provides evidence that the moderating effect of social conditions also applies to diachronic social contexts in a specific society. Adding to the existing knowledge that people in lower socioeconomic positions are likely to have worse health, the study shows that a more polarized stratification structure with higher levels of resource disparity may exacerbate the cumulative effects of health (dis)advantage and lead to a wider health gap over time.

Second, the article calls for a rethink of the implications of cumulative (dis)advantage theory. This theory has been framed and perceived as a variant of "the Matthew Effect," which has its origin in biblical text and has been applied to analysis of widening inequality over time. This study provides partial support for the theory. On the one hand, rural peasants showed a lasting disadvantage in health compared to urban nonpeasants, and education (which might be used as an early-life indicator) has shown some explanatory powers for the phenomenon. On the other hand, however, as this study has shown, rural peasants do not automatically accumulate the same degree of health disadvantage by remaining in their initial socioeconomic position: Instead, macro social contexts have a moderating effect on the accumulation process. In a more equalized social context, the cumulative effect is almost negligible, and it is only in a more polarized context that a widening gap emerges.

This does not undermine the importance of socioeconomic position as implied by cumulative (dis)advantage theory, nor does it contradict previous studies that emphasize individual-level resources as determinants or as moderators in shaping individuals' health trajectories; instead, this study complements existing knowledge by flagging up the significance of structural factors at the macro level for understanding cumulative (dis)advantage theory. It provides a reminder that the social context in which the socioeconomic position or the individual-level resources are embedded needs to be taken more seriously than in previous studies. Of particular note is that most previous studies that examined cumulative (dis)advantage theory have used data collected in recent decades, especially from the 1990s onward, when the world has witnessed increasing social and economic inequalities. Further studies need to examine to what extent cumulative (dis)advantage theory is contingent on this particular background. Future research can also explore in what social conditions a substantial cumulative effect can be detected or conversely, ruled out.

Finally, this research makes a distinctive contribution to existing literature by exploring possible mechanisms underlying the increasing health gap in recent periods, which may have important implications for public policy. To address health inequality through policy measures, we need to understand the role of specific structural factors. This study has examined the effects of two of these factors, income inequality and differential access to medical care. It transpires that income inequality has a strong explanatory power for the observed differences across the three subsamples, and differential access to medical care also shows an independent effect in the most recent time period. For a long time, the processes of industrialization and marketization have been crucial engines of rapid economic growth in China and are expected to drive further development in the future, yet the widening rural–urban disparity and its health consequences for rural peasants must not be overlooked in the policy-making process. Although great caution and careful scrutiny and examination are required, the findings in this study may have wider implications beyond the Chinese context. In an era in which many countries have seen increasing inequalities, more research is needed to examine the role of other structural factors if we are to achieve a better understanding of the causes of health inequality and how they might be addressed.

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SUPPLEMENTAL MATERIAL

Appendices A through K are available in the online version of the article.

NOTES

1. Government spending on the health care system has recently increased to around 30%, including expenditure on rebuilding basic health care in rural areas. In 2009, a new rural cooperative medical system was officially established as the basic health insurance system in rural areas (Peng 2011; Tang et al. 2008). Due to data limitation, the new period is not covered in this study, and future research may identify whether the new measure has narrowed the disparities in medical care and resources between urban and rural residents.
2. The CHNS was initially conducted in eight provinces: Liaoning, Jiangsu, Shandong, Henan, Hubei, Hunan, Guangxi, and Guizhou. The province of Liaoning was not included in the survey in the year 1997, and a new province, Heilongjiang, similar to Liaoning in geographic and other characteristics, was added in to replace it. Liaoning returned to the survey in 2000, and both Liaoning and Heilongjiang have remained in the study since then.
3. Due to the age range examined in this article, the widowed accounted for only .1% in the overall sample. In the three subsamples, there were merely nine, six, and five widowed respondents, respectively. Given the small cell sizes, they were combined with

the divorced/separated respondents instead of being listed as a separate category.

4. Because only six waves of the survey were available for this study, the first three waves of 1991, 1993, and 1997 were used as starting points to guarantee sufficient ensuing waves in each subsample, which inevitably led to overlaps between the three observed periods. This may lead to an underestimation of real differences over time. With only one wave gap between the starting points of the three periods, the current design may only be effective in societies where rapid and continuous social changes enable differences to be detected.
5. The effect of $Peasant_i$ on β_{2i} (the coefficient for age-squared) was not significant, and the same result was found in the case of $Cohort_i$. In addition to tests of individual coefficients, the joint test of including these terms was not significant either. Therefore, in the interests of concision, the effects of $Peasant_i$ and $Cohort_i$ on β_{2i} were deleted from the model. Additional analysis was conducted by using a new model developed by Fannon, Monden, and Nielson (2021), which allowed a more flexible approach to nonlinearities than using a quadratic and generated similar results.
6. There are 5.26%, 5.63%, and 6.44% cases missing for income in the three subsamples, respectively.
7. The second alternative approach was multiple imputation with auxiliary variables (i.e., the imputation phase included additional variables that were not part of the subsequent analysis). Because individuals' annual net income was the main source of missing data, I incorporated four auxiliary variables that might be correlates of individual income or its missingness: total annual income of the household, whether the respondent was working at the time of the survey, the place of residence (city, suburban, town, or village), and the province of residence. Model estimation results were similar to those in the main text.
8. Coefficient comparisons across models have less power than those within the same model, especially when the observations in the three subsamples are not independent. An indirect approach was employed to test the coefficients across the three time periods. Based on a multigroup structural equation model, latent growth trajectories were estimated for the three time periods, which were treated as three groups. Given the overlapping cases in the three subsamples, the error terms of all latent parameters were set to be correlated. An unconstrained model was estimated, and then the target coefficients were set to be equal across different time periods, which led to a significant decline in model fit and thus provided circumstantial evidence that the hypothesis of equal coefficients should be rejected. Nevertheless, there are limitations in coefficient comparisons in the current research design, and this has been reflected in the Limitations section.
9. Since the 1980s, millions of peasants have left their farmland and found job opportunities in nonagricultural sectors, and the number of migrants has increased over time. The increasing rate of migration can also be seen from the data set (for details, see Appendix D in the online version of the article). Considering that the experience of migration might moderate the cumulative effect of belonging to a certain socioeconomic group and because there is no information on individuals' occupations or life situation during the missing waves, once the respondent migrated, they would be treated as missing and the observations from subsequent waves would not be included for model estimation even though sometimes they did come back to the original household and rejoined the survey.
10. Regarding the weak selection effect of migration, there might be two possible explanations. First, as shown in previous research (Tong and Piotrowski 2012), the health selection effect of migration has diminished over time as rural-to-urban migration has become more prevalent due to the relaxation of administrative controls. Second, the cohorts exposed to observation in this study were all born before 1961, and most of them had reached middle age by the time the tide of migration started to grow, whereas the peak age for migration is usually much younger and therefore has little effect on the analytical sample.
11. When examined independently, income inequality and differential access to medical care contributed to 31% and 5%, respectively, of the reduction in the second subsample, and the latter factor became insignificant and did not add to explanatory power when the former was already incorporated. In the third subsample, the corresponding figures were 35% and 4%, respectively. Although income inequality still played a predominant role in the most recent period, differential access to medical care made independent contributions to the explanatory power of the model (for details, see Appendix J in the online version of the article). It is also worth noting that this study uses contemporaneous measurement of income inequality, while previous research has shown that it may have lagged effects on health outcomes (Lillard et al. 2015; Zheng 2012). An additional analysis was conducted by constructing structural factors from the previous wave and incorporating them as explanatory variables in the current modelling framework. As shown in Appendix K in the online version of the article, the lagged measures of the two factors have a smaller explanatory power than the contemporary ones in China, where social change took place at a very fast pace.

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