Social Change and Socioeconomic Disparity in Health over the Life Course: The Case of China

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Extended Abstract

The positive association between socioeconomic status (SES) and health has been consistently documented across different societies around the world. People with higher SES are more likely to report better health, experience greater levels of physical functioning and mobility, better mental health outcomes, and lower rates of disability and mortality. However, the seemingly universal pattern of the relation between SES and health is clouded considerably when put in the context of aging and life course, with one body of the literature reporting a convergence of health inequality by SES while the other demonstrating a persistent or even diverging gap in health differentials between the socioeconomically advantaged and disadvantaged in later life. The inconsistency in the U.S. based studies was often attributed to confounding age and cohort effects. Conceptually, the crux of the problem lies in the difficulty to separate changes in individual lives from changes in the society in general.

The urgency of disentangling the process of *social change* and *life changes* in the study of health disparities is unmistakably evident in societies where extensive social transformation has taken place. In China, a country characterized by large-scale social, economic and political transitions for the most part of the 20th century, it is incomprehensible to answer the question of whether the effect of SES on health grows weaker or stronger as people age without addressing how social change influences health differentials. Unlike the U.S. and other western countries, which enjoyed relative economic prosperity and stability since the World War II, the Chinese society has gone through a series of dramatic political, economic and cultural upheavals in the last sixty years, including the Communist Revolution (late 1940s), the Great Leap Forward and Famine (late 1950s), the Cultural Revolution (mid 1960s-1970s), and the introduction of the post-Mao economic reforms (late 1970s till now). Without properly sorting out the age and cohort effects, it is nearly impossible to see whether socioeconomic differentials in health increase over the life course. For example, the market reform in China led to an astounding growth in income inequality since the 1980s. At the same time, the governmental health insurance/care systems, which were established in the pre-reform era and provided a comprehensive level of basic health care provision in both urban and rural areas, became increasingly dysfunctional under the pressure of privatization and much reduced governmental support. Thus, a cohort effect (an increasing SES effect on health across *birth cohorts* who came of age at different historical time) could seriously confound an age effect (the effect of SES on health over *individual life course*) in a cross-sectional design, where there is only one single indicator for age or cohort in a single calendar year.

With the use of a five-wave longitudinal dataset spanning 13 years (China Health and Nutrition Survey, 1991, 1993, 1997, 2000, 2004), we examine socioeconomic differentials in health over individuals' adult life course. Further, we study how their health trajectories can be shaped by recent socioeconomic transformation and how historical events may leave different imprints on successive cohorts' life experiences and consequently diverging health outcomes. In essence, we investigate whether cohort effect may have influenced health disparity by socioeconomic status over the life course, with the goal of advancing our understanding of the mechanisms generating inequality in health in a society experiencing ongoing and rapid changes in social structure.

Research Hypotheses

This study of social stratification of health in the adult life course in China builds on and extends recently developed methodologies on cohort variations in age trajectories of health in the U.S. (for detailed description of recent development in the Age-Period-Cohort (APC) models, see Yang [2007]; Yang and Land [2006]). We specifically test the following hypotheses.

First, we test the cumulative advantage theory by modeling SES differentials in growth trajectories of health *within cohorts* (i.e. the age by SES interaction effects net of cohort effects).The cumulative advantage theory predicts increasing effects of SES on health with age, with SES influencing resource accumulation (economic, social, and psychological) and in turn resulting in greater health disparities in later life. Recent empirical tests of the theory in the U.S. produced inconsistent findings with regard to whether the effects of SES on health outcomes strengthen or diminish over the life course. The inconsistency was partly due to the use of the cross-sectional design, which ignores differential health change with age by historical time and confounds individual time with birth cohort effects.

By following multiple birth cohorts over multiple time points, we intend to capture the varying effect of SES on health by age by simultaneous assessment of the effects of the intra-cohort and inter-cohort differentiations. This is crucial for the test of cumulative advantage theory in China, because successive birth cohorts could have markedly different life experiences. Cohort effects on health could be due to differentials in early life conditions, a commonly used explanation for susceptibility to diseases and mortality in the epidemiological research on chronic diseases. Similarly, cohort changes could be reflected by the shifts in individual health capital since the years of birth. It was argued that more recent cohorts tend to have better health capital at birth and have lower depreciation rates in the stock of health capital throughout the 20^{th} century. This theory was supported by the evidence that the successive birth cohorts experience later onset of chronic diseases and disabilities in the U.S. Nonetheless, the effect of rapid cohort changes on health could manifest in a very different way in China, given its unstable political and socioeconomic environment prior to the late 1970s, and its unparalleled power of the state. For example, the birth cohort born in the early 1930s enjoyed a relative peaceful time in early childhood, in contrast to those born in the early 1940s, in the midst of the anti-Japanese and civil war turmoil. For the birth cohort born in the early

1950s, they could be the first cohort to have benefited from the beginning of a massive state sponsored public health campaign against parasitic and infectious diseases, which achieved world spotlight success in its speed of lowering the mortality rate. In contrast, for the birth cohort born in the late 1950s, who experienced the disastrous Great Famine and Great leap forward (1958-1960) in their early life, the early disadvantage in life could translate into a heightened susceptibility to diseases later in life.

Second, we investigate the inter-cohort change hypothesis by modeling variations in SES disparities in trajectories of health *across birth cohorts* (i.e., three-way interaction effects between cohort, age and SES). In Elder's seminal work of the "Children of the Great Depression," he demonstrated convincingly that the economic loss and deprivation early in life for the Oakland cohort (born in 1920-21) did not have the same magnitude of effect on physical and emotional health across different social classes, with the most adverse effect on adult health bearing by those who were most socioeconomically disadvantaged (Elder 1974). Interestingly, when compared with a younger cohort (born in 1928-29), who were more adversely influenced by family hardship than the older youth, the latter actually demonstrated better resilience in later life, possibly explained by military service and war mobilization (Elder 1986, 1987). A recent study by Willson, Shuey and Elder (2007) using data from the Panel Study of Income Dynamics lent further support to cumulative advantage processes as mechanisms of inequality in life course health.

In this study, we are especially interested in how recent socioeconomic transformation in China affects cohort's health change over time. Over the last two decades of economic reforms, China has experienced phenomenal growth in its economy, which has undoubtedly improved the average living standard but also caused increasingly pronounced economic disparities among its population. The rising income inequality, together with the collapse or dysfunction of government health insurance schemes as well as reduced funding in public health programs, led to widely unequal access to health care. Thus, we hypothesize the effect of SES on health not only varies with age, but is also conditioned by cohort, reflecting the life stage principles (Elder 1979). Further, we hypothesize that the effect of SES on health increases in more recent cohorts. For example, the impact of the Cultural Revolution (1966-1976), known for causing major disorder in the Chinese society, was probably felt quite differently by different birth cohorts. Among the older birth cohorts (born in 1920s and 1930s), those who were intellectuals and professionals were often targets of persecution, which could lead to a negative effect of SES on health. The Cultural Revolution also sent millions of youth from the cities to countryside ("sent down" youth) and completely paralyzed the school system. For the birth cohort who reached young adulthood during that time (born in 1940-1945), they faced uncertain options of marriage, parenthood, and early career during the turmoil. However, they were often promoted into leadership positions in the post cultural revolution period. On the other hand, for a younger birth cohort (born 1950-1955), who were stripped of the opportunity of high school or college education during that period time, they faced enormous challenges later in life when education again became a valuable asset in the post-reform era. It is easy to see the overlap between this hypothesis and the cumulative advantage hypothesis in a cross-sectional design. Yet, by using data from a longitudinal design, it is possible to test an interaction between SES and birth cohort, while controlling for individual time.

Third, we hypothesize that the cohort effects on health disparities may differ by rural and urban residence. One of the most salient features of Chinese society is its divide between the rural and urban parts of the country. The ***Hukou*** (household registration system) divides the population into "agricultural" and "non-agricultural" sectors, which in turn follow different social and economic system. For example, in the pre-reform era, the urban population enjoyed guaranteed employment, housing, access to health care, and retirement benefits while the rural population were largely on their own under the commune system. The market transition beginning in the 1980s brought major challenges to the health care system in urban China, as state owned enterprises became responsible for their own benefits and losses. The government initiated a new set of health care system reform policies, including limiting public funds available for health care and allowing for private ownership of health facilities and clinical practices (Rosner 2004). The urban reform, however, is modest in comparison with a near collapse of the rural cooperative medical scheme, which helped its rural population to achieve remarkable health improvement from the1950s to 1970s. As a result, inequality in access to health care facilities and the health status of populations among rural communities widened considerably since the 1980s. Given these additional complications, we hypothesize that the interaction effect between SES and cohort on health may be stronger in rural China.

<u>Data</u>

We use data from the China Health and Nutrition Survey (CHNS), an ongoing collaborative project of the Carolina Population Center at the University of North Carolina, Institute of Nutrition and Food Hygiene, and the Chinese Academy of Preventive Medicine in Beijing. The survey was designed to study how social and economic transformations in Chinese society affect the nutritional, demographic, and health status of its population. It has collected panel data on individuals, households, and their communities. The survey covers eight provinces and autonomous regions in China: Liaoning, Jiangsu, Shandong, Henan, Hubei, Hunan, Guangxi, and Guizhou. A third of China's population (approximately 450 million) lives in these provinces, which vary substantially in geography and economic development. While few longitudinal studies involve multiple follow-up surveys of adults of all ages in the U.S., the CHNS have collected five waves of the data so far (1991, 1993, 1997, 2000, and 2004)[1]. This creates a unique opportunity for cohort analysis of age change.

The CHNS collects extensive information on health, including a variety of indicators on health outcomes, measures of health behavior, and access to health care. The following question was asked of each household member regarding one's health: "How would you describe your health compared to that of other people of your age?" The responses range from 1 to 4, indicating excellent to poor health. We will start with

[1] The survey began in 1989, but we are unable to include it in the study because of the lack of a key health measure.

this measure of self-reported health as our main dependent variable, which has been used extensively in U.S. based research.

We select a sample of adults aged 20 and above at the baseline (T1=1991). Based on the age range, we construct seven birth cohorts with a ten-year interval, with the exception of the 1951-1955 and 1956-1960 cohorts, given the historical significance of Great Leap Forward and Three-Year-Famine, which occurred in the late 1950s. We then follow the seven birth cohorts at the baseline to later survey years (T2=1993, T3=1997, T4=2000, T5=2004). The following table sketches out the age-cohort design:

	T1=1991	**T2=1993**	**T3=1997**	**T4=2000**	**T5=2004**
Birth Cohort			**Age**		
0 = -1920	(71-85+)	(73-85+)	(77-85+)	(80-85+)	(84-85+)
1 = 1921-30	(61-70)	(63-72)	(67-76)	(70-79)	(74-83)
2 = 1931-40	(51-60)	(53-62)	(57-66)	(60-69)	(64-73)
3 = 1941-50	(41-50)	(43-52)	(47-56)	(50-59)	(54-63)
4 = 1951-55	(36-40)	(38-42)	(42-46)	(45-49)	(49-53)
5 = 1956-60	(31-35)	(33-37)	(37-41)	(40-44)	(44-48)
6 = 1961-70	(21-30)	(23-32)	(27-36)	(30-39)	(34-43)

Our key independent variables are measures of SES. The CHNS not only includes basic questions on education and occupation, but also covers very detailed information on home assets, employment sector (state, collective, and private), and income from different sources. Based on our previous research, we propose to use four different measures of SES: education, per capita family income, employment sector, as well as an index for the household's aggregate asset ownership. In developing countries, where measuring household income poses methodological difficulties, the indicators of household ownership and amenities have proven to be valid proxies of household living standards (Montgomery et al., 2000).

Another attraction of the CHNS data lies in its rich data on the proximate determinants of health. The CHNS provides rich information on health behavior, including smoking, drinking, dietary knowledge, and data on height and weight, which can be used to construct BMI (Body Mass Index, as a proxy of diet). We will also use variables on health insurance and accessibility to health care facilities as measures for resources. Finally, we include variables of social support, including family size, marital status, and proximity to parents.

Analytical Strategy

We employ hierarchical linear models (HLM) for longitudinal data, or growth curve models, to simultaneously estimate intra-individual age trajectories of health and inter-cohort differences in age trajectories of health (Miyazaki and Raudenbush 2000;

Yang 2007). The panel data have two levels, with repeated measurement at level one being nested within individuals at level two. Accordingly, the model can be specified as the following:

Level-1 Model: $y_{ti} = b_{0i} + b_{1i} Age_{ti} + b_{2i} Age_{ti}^{2} + e_{ti}$

Level-2 Model:

Model for the intercept:

$$b_{0i} = g_{00} + g_{01} SES_i + g_{02} Cohort_i + g_{03} SES_i \cdot Cohort_i + g_{04} Rural_i + g_{05} Rural_i \cdot SES_i \cdot Cohort_i + u_{0i}$$

Model for the rate of change (age):

$$b_{1i} = g_{10} + g_{11} SES_i + g_{12} Cohort_i + g_{13} SES_i \cdot Cohort_i + g_{14} Rural_i + g_{15} Rural_i \cdot SES_i \cdot Cohort_i + u_{1i}$$

At level 1, the response variable y_{ti} for person i at time t is modeled as a function of linear (A) and quadratic terms (A^2) of age measured in single years. The coefficients β_{0i}, β_{1i}, and β_{2i} represent the intercept or mean level, the linear rate of change, and the quadratic rate of change with age, respectively. The random within-person error term, e_{ti}, is assumed to be normally distributed with means of 0 and variance of s^{2}. At level 2, each of the three parameters of age trajectories, β_{0i}, β_{1i}, and β_{2i}, are further modeled as functions of person-level attributes. The associated coefficients of these covariates are denoted as γ, where $\gamma_{00} - \gamma_{05}$ are coefficients for the intercept model that includes main effects of SES, cohort, SES by cohort interaction effect, rural/urban residence, and rural by SES and cohort interaction effect; $\gamma_{10} - \gamma_{15}$ are coefficients for the linear rate of change model that includes interaction effects of age with SES, cohort, SES and cohort interaction, rural/urban residence, and rural by SES and cohort interaction. Similar model for the quadratic rate of change is omitted but will be tested. The level-two residual random effects, u_{0i} and u_{1i} have a multivariate normal distribution with zero means and variances r_{u0} and r_{u1}. Control variables can be entered at level one for time varying covariates and level two for time constant covariates. All continuous variables are centered for the intercept to be substantively meaningful (see, e.g., Yang 2007). Because time period and age are essentially the same variable in the growth curve model specified above, we do not separately estimate period effect and focus instead on the age by cohort interaction effect. The simultaneous estimation of period effects creates the model identification problem that requires different data designs and mixed model specifications to resolve (Yang and Land 2006, 2007) and is a topic for future research

Preliminary Results

We present some basic yet very informative descriptive statistics in this section. To simplify the presentation of results, we operationalize SES by education level only and categorize the sample into those with low education (primary school education or less) and those with high education (lower middle school or more).

Figure 1 shows the mean self-reported health by birth cohort and education from 1991-2004 (see page 8). The education effect seems consistent across cohorts, with those with higher education reporting better health. The SES gap in health seems to be the smallest for an older cohort (1921-1930). Interestingly, among the more educated, the oldest cohort (1920-) reports better health than the cohort of 1921-1930.

Next, we introduce age into the picture by presenting a graph of health trajectories for three selected cohorts (1921-30, 1941-50, 1956-60) by education level over a thirteen year span (see Figure 2 on page 9). As expected, health deteriorates over the life course for all cohorts. This very rough first look of the data also seems to lend support to the cumulative advantage theory. For all three cohorts, the gap between those with low and high education increases from T1 to T5. In addition, it seems a stronger cumulative advantage process is at work for the earlier cohorts because the magnitude of the SES gap in health is the largest for the 1921–30 cohort.

We will further test the statistical significance of the above age and cohort variations and SES differences in subsequent regression analysis. The results are expected to shed some light on the three research hypotheses.

Figure 1. Mean Self-Rated Health (1991-2004) by Birth Cohort and Education in China

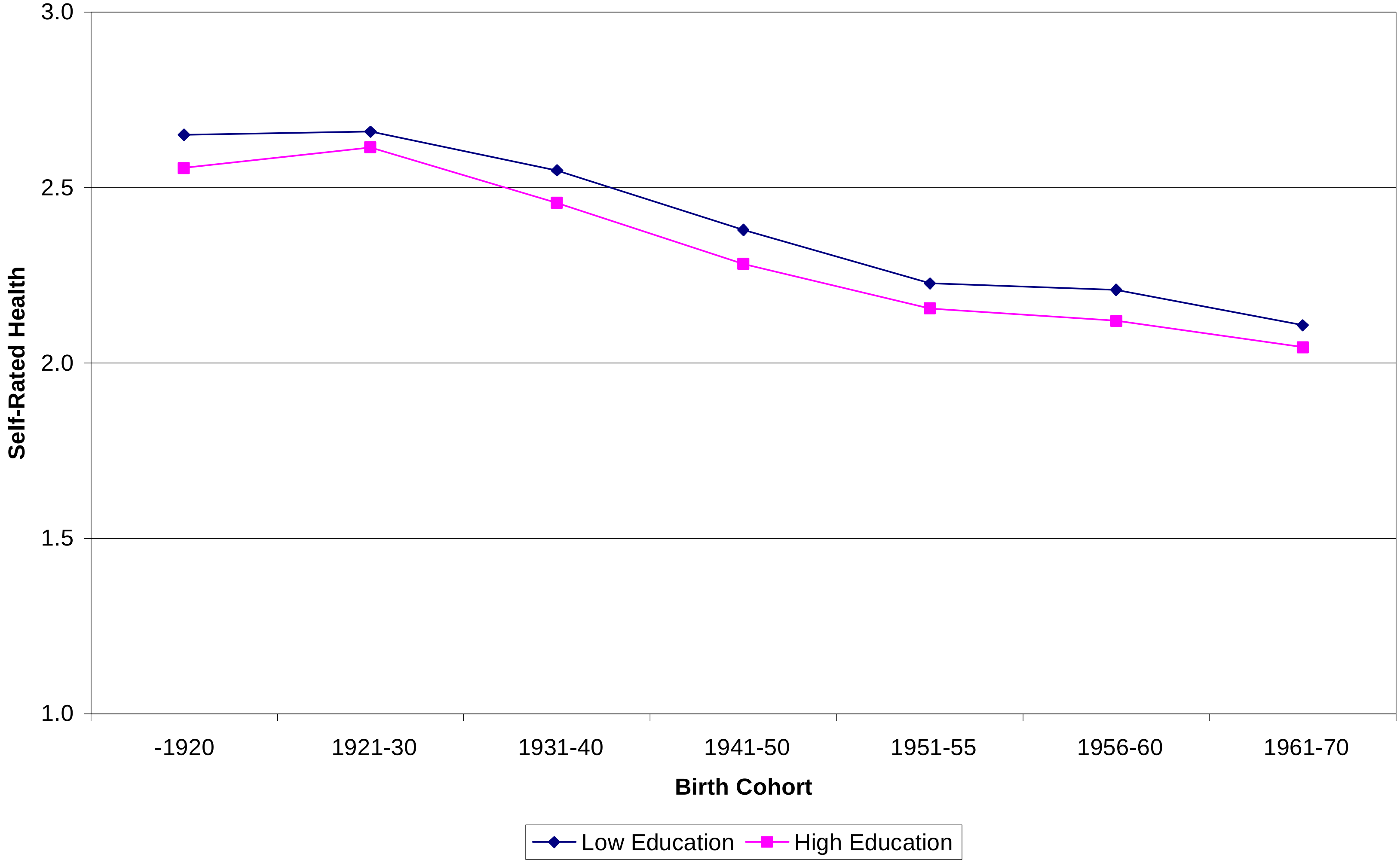

Figure 2. Health Trajectories by Cohort and Education