THE ASSOCIATION OF CHILDHOOD SOCIOECONOMIC CONDITIONS WITH HEALTHY LONGEVITY AT THE OLDEST-OLD AGES IN CHINA*

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Based on unique data from the largest-ever sample of the Chinese oldest-old aged 80 and older, our multivariate logistic regression analyses show that either receiving adequate medical service during sickness in childhood or never/rarely suffering from serious illness during childhood significantly reduces the risk of being ADL (activities of daily living) impaired, being cognitively impaired, and self-reporting poor health by 18%–33% at the oldest-old ages. Estimates of effects for five other indicators of childhood conditions are similarly positive but mostly not statistically significant. Multivariate survival analysis shows that better childhood socioeconomic conditions in general tend to reduce the four-year period mortality risk among the oldest-old. But after additional controls for 14 covariates are put into the model, the effects are not statistically significant, thus suggesting that most of the effects of childhood conditions on oldest-old mortality are indirect—at least to the point of affecting current health status at the oldest-old ages, which itself is strongly associated with mortality. While acknowledging limitations of the present analyses due to a lack of information on childhood illness, the oldest-olds' recollection errors, and other data problems, we conclude, based on this and other studies, that policies that enhance childhood health care and children's socioeconomic well-being can have large and long-lasting benefits up to the oldest-old ages.

A number of recent demographic, medical, and epidemiological studies have provided evidence of linkages between childhood socioeconomic conditions and health/survival in later life (e.g., Elo and Preston 1992; Hayward and Gorman 2004; O'Rand and Hamil-Luker 2005). Preston, Hill, and Drevenstedt (1998) found that, for African American cohorts born early in the twentieth century, certain childhood socioeconomic conditions—farm background, having literate parents, and living in a two-parent household—raised the chances of surviving from childhood to age 85. Fogel (1993) reported that, in the nineteenth century, increases in stature, which were determined mostly by childhood socioeconomic conditions, probably accounted for 50%–60% of the decrease in U.S. mortality rates during that century. Fogel and Costa (1997) observed that short men, whether modern Norwegians or nineteenth-century Americans, were more likely to die at younger ages than were tall men. Hayward and Gorman (2004) showed that men's adult mortality is associated with a variety of childhood conditions related to socioeconomic status. Beebe-Dimmer et al. (2004) found that childhood conditions in terms of father's occupation and education are correlated with a 31-year mortality risk in adult women. Other studies found that adult mortality is associated with educational attainment (e.g., Amaducci et al. 1998;

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Feldman et al. 1989; Lauderdale 2001; Martelin, Koskinen, and Valkonen 1998; Preston and Taubman 1994), height (Fogel 1993), fetal and infant nutrition (Barker et al. 1989), loss of a parent (Campbell and Lee 2006), and other indicators of childhood socioeconomic conditions (Kuh et al. 2002). Finch and Crimmins (2004) proposed that the reduction in lifetime exposure to infectious disease and other sources of inflammation in early life—a cohort mechanism—also made an important contribution to the historical decline in old-age mortality. Gluckman and Hanson (2004) argued that experimental and prospective clinical studies added weight to the epidemiological data and suggested that early development does have significant echoes in disease risk throughout life.

To explain the pathway of effects of childhood conditions on later health and survival, researchers have articulated several hypotheses (e.g., Kuh and Ben-Shlomo 2004; Lynch, Kaplan, and Salonen 1997; Preston et al. 1998). For instance, Preston et al. (1998) proposed a conceptual framework of direct and indirect mechanisms for investigating the possible impacts of childhood conditions on health and mortality in later life. *Direct mechanisms* include physiological scarring effects (i.e., certain adverse conditions and infectious diseases suffered in childhood might trigger health problems at later ages) and acquired immunity effects (i.e., more frequent exposure to infectious diseases may increase the autoimmune function and reduce the risk of death). Finch and Crimmins (2004) named such physiological scarring and acquired immunity effects "cohort morbidity phenotypes," which represent inflammatory processes that persist from early age into adult life. *Indirect mechanisms* include correlated environments (i.e., better access to education and health care in childhood usually results in a higher socioeconomic status, better health, and lower mortality in later life) and differential mortality selection (i.e., those who survived unusually poor health conditions in childhood might have genetic traits that help certain robust individuals survive harsh childhood conditions). Some supportive evidence for all of these proposed mechanisms can be found in the literature. For example, some studies have reported that infectious diseases in childhood raise the likelihood of heart diseases by stimulating the development of atherosclerotic lesions that result in the accumulation of plaque in later life (Buck and Simpson 1982; Mathews, Whittingham, and Mackay 1974). Jenkins et al. (1994) found that those who suffered asthma in childhood had a lower prevalence of the same disease at adulthood.

There are, however, other studies that do not support and sometimes even contradict the childhood and fetal growth origin hypothesis about the close correlation between very early life conditions and health/survival in late life (Christensen et al. 1995; Elford, Whincup, and Shaper 1991; Hasle 1990; Kumaran et al. 2000; Lucas and Morley 1994; Lynch et al. 1994; Matthes et al. 1994; Seidman et al. 1991; Whincup, Cook, and Papacosta 1992). For example, Christensen et al. (1995) reported that mortality among surviving twins differed little from that among the general population, despite twins' greatly restricted fetal and early childhood growth. Elford and colleagues (1991) argued that evidence implicating poor childhood circumstance in adult cardiovascular disease was not wholly convincing. Lynch and colleagues (1994) demonstrated that socioeconomic conditions in childhood were not important determinants of all-cause mortality and cardiovascular mortality in the late adulthood but mainly were correlated with adulthood conditions.

Empirical studies further showed that the favorable conditions in adulthood could compensate for the effects of childhood disadvantages (Graham 2002; Hart, Smith, and Blane 1998; Luo and Waite 2005). Luo and Waite (2005) illustrated that those who experienced an upward social mobility from childhood to adulthood had better health conditions than any other group except those who were stably in good conditions in both childhood and adulthood, whereas those who witnessed a downward mobility had worse health than any group except those who stayed in low hierarchical conditions from childhood to adulthood.

In view of these contradictory findings, further research is warranted. The association of childhood conditions with health and mortality at old ages also merits rigorous testing

because of its substantial implications for public policy (Hayward and Gorman 2004). Findings from such research may help explain variations in health and survival and thereby provide clues to policymaking and program intervention (Kramer and Joseph 1996).

This paper explores the association between childhood socioeconomic conditions and healthy longevity at the oldest-old ages in China based on a longitudinal survey data set collected from 13,294 Chinese oldest-old (those aged 80–109). Our research is unique in three respects. First, we investigate the oldest-old based on longitudinal survey data with an exceptionally large sample of oldest-old individuals that includes controls for a rich set of confounding factors. Thus far, very few studies have examined the association of childhood socioeconomic conditions and health and survival at the oldest-old ages. Nearly all this literature focuses on ages younger than 80. A notable exception is the study by Preston et al. (1998), a cross-sectional study of African American cohorts born at the beginning of the twentieth century that used very limited covariates. Second, we deal with a developing country, China, whereas almost all previous studies dealt with industrialized countries. Compared with developing countries, in Western countries, where the childhood origins hypothesis originated, children are relatively better off in terms of socioeconomic conditions, but some chronic diseases (e.g., coronary heart disease) in adulthood are more common. Chinese children formerly suffered poor living conditions, but some chronic diseases are relatively rare when they become adults or elderly (Barker et al. 1991). Third, the socioeconomic statuses of these cohorts of the Chinese oldest-old were disrupted and their health trajectories were affected by many historical events, including famines, wars, political upheavals, the Cultural Revolution, and so on. For example, compared with those oldest-old whose childhood conditions were better off, the oldest-old whose childhood conditions were poor might have suffered more in the famines and wars before 1950, when the People's Republic of China was established. But these persons from poor family origins might generally have suffered less after 1950 in the starvation of the three-year disasters (1959–1962) and the political upheaval due to their "red" family background, which usually implied higher social status under the communist regime. The oldest-old who grew up in rich families might have suffered substantially during the Chinese Cultural Revolution in the period 1966–1976 because of their "black" family backgrounds. Some of those oldest-old who were born into poor families (i.e., "red" background) might have likely been party/government leaders at various levels and might have been attacked as "power holders impelling the way of capitalism" ("*zou zi pai*") by the Red Guards during the Cultural Revolution. Thus, the connections between childhood conditions and life course trajectories among the Chinese oldest-old are somewhat complicated and not universally in one direction. Consequently, longitudinal data collected from these particular cohorts with a large sample size may offer more opportunities to study and distinguish the impacts of childhood and adulthood conditions on late health and survival.

DATA SOURCE

Data used in this study are from the Chinese Longitudinal Healthy Longevity Survey (CLHLS), which is the largest longitudinal study of centenarians, nonagenarians, and octogenarians ever conducted. The CLHLS was initiated to meet the needs of scientific research on the oldest-old, a subpopulation about which we know little but that is increasing at an extraordinary rate. The survey, conducted in 1998, 2000, 2002, and 2005, randomly selected half of the counties/cities in 22 Chinese provinces, whose populations together constitute about 85% of the total population in China.[1]

Previous studies (e.g., Coale and Li 1991) and a CLHLS pilot study, which focused on the age validation of Chinese Han centenarians through comparison of demographic

1. A detailed description of the survey design can be found in Zeng et al. (2002) and Zeng and Vaupel (2004). Therefore, it will not be repeated here.

indices with Sweden, Japan, France, and Italy (Wang et al. 1998), supported the conclusion that age reporting in the CLHLS generally is acceptable. This has been confirmed by Gu and Zeng (2004), who showed that the sex-age-specific mortality patterns at ages 80–107 derived from the CLHLS over the periods 1998–2000 and 2000–2002 are quite similar to those of Sweden and Japan, where age reporting at the oldest-old ages is excellent. A careful evaluation (based, for example, on reliability coefficients, factor analysis, proportion of logically inconsistent answers, proxy response rate, and sample attrition) suggests that the data quality of the Chinese survey on healthy longevity is generally acceptable (Gu and Zeng 2004), although some problems do exist.[2]

In the present study, to increase statistical precision and produce more robust results, we pool those first interviewed in 1998 and those first interviewed in 2000.[3] Excluding those who were lost to follow-up, the total pooled sample size in this study is 13,294 oldest-old aged 80 and older, consisting of 5,451 men and 7,843 women. We examine the effects of early childhood socioeconomic conditions on survival at the oldest-old ages over a four-year interval. More specifically, the starting point and ending point of the interval are 1998 and 2002 for those who were first interviewed in 1998, while the starting ending points are 2000 and 2002 for those who were newly recruited in 2000. Those who were first interviewed in 2000 and survived to be interviewed in 2002 are considered as censored at two years in our four-year survival analysis model. The estimates of the effects of early childhood socioeconomic conditions on health status are based on data collected from the first interview for the 13,294 oldest-old subjects included in this study.

MEASURES AND VARIABLES

All indicators of childhood socioeconomic conditions, present health status, and control variables used in this study are measured at the first interview for the oldest-old who were recruited in either the 1998 baseline survey or the 2000 wave. The frequency distributions of all of these variables are given in Table 1. These variables were chosen because of their potential association with survival or health status. Following the approach adopted in similar studies (e.g., Koenig et al. 1999; Smith and Kington 1997), all variables are dichotomized except age, whether the subject received adequate medical service in childhood, parental survivorship when the respondent reached age 10, and primary lifetime occupation of the respondent.

Responses to questions concerning the six childhood indicators in Table 1 were collected mainly based on answers provided by the sampled oldest-old themselves. In cases when they were unable to provide an answer (e.g., when they were too sick or cognitively impaired and could not understand the question), a proxy who was most often a spouse or another close family member was used. The proportion of proxy answers is around 18%–20% for each childhood indicator, and 44% of the respondents had at least one proxy answer among the six childhood indicators. To reduce the influence of missing values on some variables on statistical analysis and inference, we apply the multiple imputation approach described by Allison (2002).[4] Those who were lost to follow-up are excluded from the study.

2. A notable example is that responses concerning self-assessed chronic conditions are not reliable because many Chinese oldest-old, especially those living in rural and poor areas, might never have heard the names of some chronic diseases even if they actually had them. Thus, data on the self-assessed chronic conditions will not be used to measure the health status of the oldest-old in this study.

3. Pooling data to increase statistical precision has been done in some previous studies (e.g., Crimmins, Hayward, and Saito 1994).

4. The proportions of missing values of the variables that were subjected to multiple imputations in this study are the following: place of birth, 0.1%; father's occupation, 0.4%; received adequate medical service during childhood illness, 0.9%; frequently went to bed hungry during childhood, 0.8%; years of schooling, 0.5%; and living alone, 0.4%.

Table 1. Distribution of Variables Measuring Childhood and Current Statuses

	Number		%	
Variable	Men	Women	Men	Women
Early Childhood Conditions				
Place of birth				
Urban	870	1,129	16.0	14.4
Rural	4,581	6,714	84.0	85.6
Father's occupation				
Professional/administrative	276	301	5.1	3.8
Other lower-income categories	5,175	7,542	94.9	96.2
Received adequate medical service during childhood illness				
No	1,315	1,965	24.1	25.0
Yes	1,759	2,373	32.3	30.3
Never/rarely suffered from severe sickness during childhood	2,337	3,504	43.6	44.7
Frequently went to bed hungry during childhood				
No	2,334	3,236	42.8	41.3
Yes	3,117	4,607	57.2	58.7
Parental survivorship at age 10				
Both parents alive	3,105	3,570	57.0	45.5
At least one parent died	692	838	12.7	10.7
Did not report	1,654	3,435	30.3	43.8
Years of schooling				
None	2,009	6,847	36.9	87.3
Some	3,442	996	63.1	12.7
Sociodemographic Variables				
Mean age	—	—	89.4	92.9
Birth cohort				
Born in 1900 or earlier	912	2,997	16.7	38.2
Born in 1901–1910	2,126	2,534	39.0	32.3
Born in 1911 or later	2,413	2,312	44.3	29.5
Ethnicity				
Han	5,114	7,318	93.8	93.3
Minority	337	525	6.2	6.7
Current residence				
Urban	2,596	3,487	47.6	44.5
Rural	2,855	4,356	52.4	55.5
Primary occupation before age 60				
Agricultural	4,533	5,019	83.2	64.0
Housewife	NA	2,525	NA	32.2
Nonagricultural	918	299	16.8	3.8

(continued)

(Table 1, continued)

Variable	Number		%	
	Men	Women	Men	Women
Family Support and Social Relationships				
Currently married				
No	3,462	7,322	63.5	93.4
Yes	1,989	521	36.5	6.6
Proximity to children				
Low	1,337	1,555	24.5	19.8
High	4,114	6,288	75.5	80.2
Religious activities				
No	4,861	6,295	89.2	80.3
Yes	590	1,548	10.8	19.7
Health-Related Behaviors				
Currently smokes				
No	3,211	7,181	58.9	91.6
Yes	2,240	662	41.1	8.4
Currently drinks heavily				
No	4,787	7,628	87.8	97.3
Yes	664	215	12.2	2.7
Currently exercises regularly				
No	3,288	6,132	60.3	78.2
Yes	2,163	1,711	39.7	21.8
Health Conditions				
ADL disabled				
No	4,005	4,624	73.5	58.9
Yes	1,446	3,219	26.5	41.1
Cognitive functions impaired				
No	3,837	3,546	70.4	45.2
Yes	1,614	4,297	29.6	54.8
Self-reported poor health				
No	4,787	6,401	87.8	81.6
Yes	664	1,442	12.2	18.4
Total	5,451	7,843	100.0	100.0

Notes: Variables are measured at the first interview. Data in this table are unweighted based on the pooled data set of multiple waves.

Childhood Socioeconomic Conditions

Medical service and hunger at bedtime in childhood. The CLHLS gathered information on whether the subject received adequate medical service when he/she was sick as a child and needed to visit a doctor or go to a clinic/hospital for treatment. This variable captures the accessibility and availability of health care resources in childhood. Possible answers to

this question are yes, no, or was never sick during childhood.[5] About 44% of the oldest-old participants answered "never sick during childhood." This percentage may be an overestimate because some oldest-old might simply forget the occasional and rare cases of sickness. We therefore need to interpret this category as "never or rarely having severe sickness." The CLHLS also collected data on whether the respondent frequently went to bed hungry during childhood. Such information about bedtime hunger reflects both socioeconomic conditions and nutritional status during childhood. Although direct data on diseases suffered in childhood are not available, the CLHLS data on whether adequate medical service was received and if the subject frequently went to bed hungry nevertheless enable us to follow the conceptual framework of Preston et al. (1998) and Hayward and Gorman (2004) for examining the association between childhood socioeconomic conditions and health and mortality at the oldest-old ages.

Father's occupation and parental survival. In the CLHLS, data are obtained on seven categories of father's occupation[6]: professional and technical personnel; governmental, institutional, or managerial personnel; agriculture, forestry, and animal husbandry worker; fishery worker; industrial laborer and commercial or sales worker; military personnel; and other. We combine the first and second categories and combine the remaining five categories to form two groups. The first group represents a higher socioeconomic class, while the second group indicates lower socioeconomic status. Information on the ages at death of both parents and the age of the respondent at the time of parents' death were obtained in the CLHLS. This enables us to measure the survival status of parents when the respondent was 10 years old. Although the survival of parents during childhood might not indicate high socioeconomic status, the early death of parents could very likely cause damage to family-based socioeconomic and emotional resources available to a child.[7] The rate of missing values on survival status of parents when the respondent was age 10 is 30% and 44% among the oldest-old men and women, respectively. Such high rates are mainly due to oldest-old respondents who could not remember their own or their parents' ages when their parents died as well as proxy respondents who were likely not aware of such information. We tested the effect of the death of the mother versus the father and found no significant difference, and thus we use "at least one parent died" to measure the survivorship of parents of the respondents at age 10. We found that those interviewees with a missing value for this variable mostly had poor health. Therefore, we treat the respondents who did not provide information on parental survival when they were aged 10 as a separate category of "missing" and do not do any imputation for this variable in our multivariate analysis; this is similar to the approach used by Hayward and Gorman (2004).

Rural/urban residence at birth. The CLHLS collected information about whether each respondent was born in an urban or rural area. Socioeconomic conditions in rural and urban areas in China were dramatically different in the early twentieth century, with rural disadvantages. Thus, rural/urban residence at birth is an important indicator of general socioeconomic environment during childhood.

Some schooling or no schooling. Unlike Hayward and Gorman (2004), who treated education as an indicator at adulthood for their analysis of the U.S. adult mortality data, we

5. The term "childhood" in the CLHLS is defined as a period from birth to age 14. The interviewers were instructed in the training workshop that "sick during childhood" meant that when the elder was a child, he or she needed to visit a doctor or go to a clinic/hospital for treatment. "Adequate medical service" includes Chinese and Western medicines—whatever were available to them at that time. While such a question allows us to collect only some general medical service information, it would be extremely hard for the oldest-old to remember and provide meaningful answers if we asked for very detailed questions about childhood medical service.

6. Father's education was not collected in the CLHLS. Father's occupation could serve as a proxy for father's education, given that those who were educated most likely engaged in nonagricultural sectors.

7. Father's occupation and parental survivorship when the respondent was a child also have been used in other similar studies (e.g., Hayward and Gorman 2004; Preston et al. 1998).

consider whether a respondent had schooling in general as an indicator of socioeconomic status at both childhood and adulthood of the oldest-old cohorts in the Chinese context. Whether one had schooling is a strong indicator of socioeconomic conditions in childhood among the oldest-old in China.[8] During the period of 1895–1925, when respondents were children, all schools were private (there was no public education system) and resources for most families were sparse in China. Of the respondents, 36.9% of the male sample and 87.3% of the female sample had no schooling at all, and the proportions of male and female oldest-old who had a middle school or higher education were only 17% and 4%, respectively. The high proportion of "no schooling" among the oldest-old Chinese leads us to dichotomize the education variable into "some schooling" and "no schooling." The dichotomization enables us to distinguish whether the subject's childhood family environment was poor or "not so poor," but it does not measure the quantity or quality of educational attainment. Thus, the dichotomized variable of "some schooling" or "no schooling" used in this study may be considered an indicator of childhood socioeconomic conditions, while it may also indicate the socioeconomic status in adulthood.

Correlation and Proxy Answers of the Six Childhood Socioeconomic Variables

We examined the correlation between each pair of the six childhood socioeconomic variables. The largest correlation coefficient was 0.218. Latent class analysis shows that these six variables are loaded on different factors. This suggests that they are not highly correlated, and combining them into one or two latent variables is not preferable to including them separately in the model. To examine the possible effects on inferences, we also estimated additional models by including one childhood condition variable at a time and dropping the other five. We found that the estimated coefficients for each childhood variable in the absence of the other five differed very little from the estimates in the presence of the other five. These results (not presented in this paper due to space limitations) confirm that correlations among the six childhood SES variables do not affect the estimates presented later in Tables 2 and 3.

Moreover, we tested the possible effects of proxy answers on the results of associations of childhood conditions with health as well as survival. The analyses revealed similar results between the model that included proxy answers and the model that excluded them. This is consistent with previous studies that showed that a proxy may be used in elderly surveys to deal with the problems of some respondents' inability to answer some questions (e.g., Magaziner et al. 1996). In sum, the variables measuring childhood medical service, went to bed hungry, father's occupation, parental survivorship at age 10, rural/urban residence at birth, and schooling used in this study can reasonably capture respondents' socioeconomic conditions during childhood. This enables us to examine the association between childhood socioeconomic conditions and healthy longevity at the oldest-old ages based on the available data.

Current health status. Health is a complex and multidimensional concept with intricate interrelationships among its dimensions (e.g., Verbrugge and Jette 1994). Physical capacity, mental health, and social well-being are the three most important dimensions of health as indicated by the World Health Organization (WHO 1958). Data on various

8. One may suspect that some of the oldest-old respondents might have received some schooling in adulthood during the national movement of adult illiteracy eradication in the 1950s and 1960s, and thus reported that they "had schooling," but that they did not have any schooling in childhood, which may affect the estimates. We believe that such effects are minor because a large majority of our oldest-old sample were over age 40 in 1950s, and the movement of adult illiteracy eradication in 1950s and 1960s focused on younger adults aged 15–40. Moreover, for not-so-young adults, the movement might have also especially focused on those who had a little schooling (e.g., one or two years of schooling) in childhood, since it would be much harder to teach those not-so-young adults with no previous schooling in reading and writing.

dimensions and aspects of health were collected in the CLHLS. Based on statistical analysis of the CLHLS data, Ahlburg, Jensen, and Liao (2004) concluded that various health measures in the CLHLS represent different dimensions of health; therefore, it may not be appropriate to integrate them into a single index. Based on the available CLHLS data and previous research, we use activities of daily living (ADL), Mini-Mental State Examination (MMSE), and self-reported health as the main indicators of the physical health, mental health, and subjective well-being in the present analyses.

The ADL functional statuses of eating, dressing, indoor transferring (walking inside the house), using the toilet, bathing, and incontinence are used to measure each respondent's status with respect to physical capacity and independence in daily living.[9] The ADL data collected in the CLHLS are based on Katz's ADL index (Katz et al. 1963), adapted to the Chinese cultural/social context and carefully tested by pilot studies and interviews. In the present analyses, if none of the six ADL activities is impaired, the elder is classified as "ADL active"; if one or more activities are impaired, the elder is classified as "ADL impaired."

The mental state of the Chinese oldest-old was screened by the Chinese version of the MMSE, which was culturally adapted and translated into the Chinese language based on the international standard MMSE questionnaire (Folstein, Folstein, and McHugh 1975) and carefully tested by our pilot survey interviews (see Zeng et al. 2002 for details). A perfect score on the MMSE is 30; the methods for determining the score based on items pertaining to orientation, registration, attention, calculation, recall, and language are the same as the international standard. The same cutoffs as the MMSE international standard also are used to define a score of 24 and above as "normal cognitive function" and lower scores as "impaired cognitive function" (see, e.g., Deb and Braganza 1999).[10]

Each respondent also was asked, "How do you rate your health at present?," with possible answers of excellent, good, fair, poor, and not able to answer; no proxy answers were allowed. Responses were dichotomized into good/fair versus poor. Respondents who were unable to answer the question on self-rated health due to health problems are included in the poor category. Self-reported health reflects not only the respondents' general feelings about physical health but also their subjective evaluation about social status, connection, and integration with society. This argument is perhaps especially true among the oldest-old. Numerous studies that included data from China have shown that self-perceived health is a good predictor of future health care use and mortality and has predictive value for the decline of functional ability both among the elderly and in the general population (e.g., Chen and Wu 2004; Idler and Benyamini 1997; Wannamethee and Shaper 1991; Yu et al. 1998). Furthermore, empirical studies have shown that objective physical and mental health measured by various indicators, including ADL and MMSE, declined dramatically with increasing age, but self-reported health did not change very much (or changed only modestly) across ages (Zeng and Vaupel 2002); other studies have found similar patterns (e.g., Leinonen, Heikkinen, and Jylha 2001). This fact has led us to believe that self-reported health differs substantially from the physical and mental health indicators and is an appropriate indicator of the social dimension of health. This argument also is consistent with prior conclusions that self-reported health represents social, physical, and emotional aspects of health and well-being; it is not a substitute for more-objective indicators, but rather complements these measures (e.g., Federal Interagency Forum on Aging-Related Statistics 2003).

9. Many recent uses of ADL measures have excluded incontinence (e.g., Jagger et al. 2001). We compared the results between excluding and including incontinence in our analysis, but the results are almost identical.

10. Around 30% of the men and 55% of the women were cognitively impaired. We compared the results of associations of childhood conditions with health measured by the two health outcomes other than MMSE, as well as survival between those who were cognitively impaired and those who were unimpaired. The results are very similar to each other.

Control Variables

Demographic and basic socioeconomic variables. Age, birth cohort, ethnicity (Han or minority), current residence (urban or rural), and primary lifetime occupation (administrative and professional personnel or others) are used as sociodemographic controls.[11] Birth cohort is classified into three groups: born in 1900 or earlier, born in 1901–1910, and born in 1911 or later.[12]

Family and social support/connection. These variables are current marital status, proximity to children (high or low), and religious attendance (yes or no).[13] Elders who reside with children, who have children living close by (on the same street or in the same village), or who have children not living in the same street or village but in the same district/town/township and receive frequent visits from children, are coded as high proximity to children. Otherwise, the elders are coded as low proximity.

Health-related behaviors. Health-related behaviors include currently smokes (yes or no), currently drinks heavily (defined as drinking 100 grams of liquor, 200 grams of wine, or 400 grams of beer/rice wine per day; yes or no), and currently exercises regularly (yes or no).

METHODS: STATISTICAL MODELS

We performed two kinds of multivariate statistical analyses for men and for women separately. First, we applied logistic regression models to analyze whether childhood socioeconomic condition is associated with health status at the oldest-old ages. In these models, the outcome variables are ADL impairment (yes or no), MMSE impairment (yes or no), and self-rated health (good/fair or poor). The explanatory variables include all the measures of childhood socioeconomic conditions discussed earlier plus other covariates for current sociodemographic characteristics, family and social support/connections, and health-related behaviors (see Table 1).

Second, to examine the association between childhood socioeconomic conditions and mortality at the oldest-old ages, we estimated a Cox proportional hazards regression model, controlling for the covariates listed in Table 1. The proportionality hypothesis was tested graphically and with the normal score test (Grambsch and Therneau 1994) and was confirmed. Survival time from the first interview to death or to the last (second or third) interview was measured in days.

We estimated six Cox survival models to examine how the estimated association of childhood socioeconomic conditions with survival is affected when other confounding factors are introduced into the analysis. In addition to the childhood socioeconomic conditions, Model 1 adjusts for age, birth cohort, and ethnicity; Model 2 adjusts for urban/rural residence and primary lifetime occupation plus the Model 1 variables; Model 3 controls for family and social support/connection variables pertaining to marital status, proximity to children, and religious attendance in addition to the Model 1 variables; Model 4 controls for health practice variables pertaining to smoking, alcohol drinking, and exercise, plus the Model 1 variables; Model 5 adjusts current health status plus the Model 1 variables; and Model 6 controls for all covariates included in Models 1–5. Such

11. We do not include the variable of economic independence in terms of main financial sources (retirement wage, own work, or depending on other family members) that was collected in the CLHLS survey because it has strong correlations with occupation and urban/rural residence, given that pension status is largely dependent on occupation and rural/urban residence.

12. We also tried other classifications of cohorts; the coefficients for each indicator of childhood conditions in different models of different cohort classifications are identical, although the coefficients for birth cohort are slightly different.

13. We did not include the available covariate of "living alone" in our models because those with ADL impairment are unlikely to be able to live alone and because it overlaps with marital status.

a design enables us to examine how each set of covariates modifies the estimates of the effects of childhood conditions on health and survival at late ages and thus enables us to identify or isolate possible indirect effects of the early life condition on mortality. Similar designs were used in previous studies for examining the effects of religious attendance on mortality (Hill et al. 2005) and the association between unwanted sexual activity and risky behaviors among black and Hispanic men in the United States (Dilorio, Hartwell, and Hansen 2002).[14]

RESULTS

Tables 2 and 3 contain estimates of the odds ratios of (at the time of the survey) being ADL disabled, being cognitively impaired, and having self-reported poor health, which are used to measure the three main dimensions (physical, mental, and subjective well-being) of health in the CLHLS data. These estimates enable health status comparisons in the initial interview between the oldest-old whose childhood socioeconomic conditions were better with those whose childhood socioeconomic conditions were poor. The comparisons focus on the following six aspects of childhood socioeconomic conditions: receiving versus not receiving adequate medical service when sick as a child; infrequently versus frequently going to bed hungry as a child; father's occupation as professional/administrative versus lower-income occupation categories; both parents were alive when the interviewee had reached age 10 versus at least one parent died before the interviewee had reached age 10; born in urban areas versus in rural areas; having at least one year of formal schooling versus no schooling. Estimates of the odds ratios are adjusted for 11 confounding factors indicative of current demographic and socioeconomic characteristics, family support, social relationships, and health-related behaviors, as listed in Table 1.

In the remainder of this section, we discuss the estimates of odds ratios and hazard ratios of the effects of the six childhood socioeconomic condition variables on health status and mortality at the oldest-old ages, which are the focus of this article. We do not discuss the effects of other (control) variables (although they are also presented in Tables 2–5), because of space limitations.[15]

Medical Service and Hunger in Childhood

Those oldest-old men and women who received adequate medical service or who were never or rarely sick during childhood have a 16.9%–33.2% lower risk of currently being ADL impaired, cognitively impaired, or in self-reported poor health compared with those who did not receive adequate medical service during sickness in childhood. All 12 estimates are statistically significant (see Tables 2 and 3).[16]

14. We also tried another alternative design of sequential modeling: Model 3′ controls for family and social support/connection variables plus all variables included in Model 2; Model 4′ further controls for health practice variables plus the Model 3′ variables; Model 5′ adjusts for current health status plus Model 4′ variables, including all covariates considered (i.e., Model 5′ is identical to Model 6). The estimates of the association of the childhood conditions on survival at oldest-old ages resulting from the alternative sequential models are similar to those from the models we adopted. Although the alternative design allows one to examine how the effects of early childhood conditions on mortality were modified step by step in the presence of an additional set of covariates, it is not intuitive to look at the potential pathway of the indirect effects of early life conditions on mortality through each set of covariates given that the covariates might interact with one another.

15. Those oldest-old men who currently smoke or who are heavy drinkers are less likely to be ADL disabled, cognitively impaired, or in self-rated poor health. This is probably due to selection effects with respect to those oldest-old males who survived and who are smokers or heavy drinkers—they are stronger biologically, higher in socioeconomic status, and may be selected on aging-related genetic characteristics, whereas those smokers and heavy drinkers who are weak in the aforementioned characteristics died before reaching the oldest-old ages. Thus, the cross-sectional data at oldest-old ages cannot be used to detect the effects of smoking and alcohol drinking on health status.

16. Similar results were obtained using the same data sets but following different modeling approaches with different focuses and purposes of analysis (Ahlburg et al. 2004; Zhao 2004).

Table 2. Effects (Odds Ratios) of Childhood Socioeconomic Conditions on ADL Disability, MMSE Impairment, and Self-Reported Poor Health Among the Chinese Oldest-Old, Adjusted for the Other Childhood Condition Variables and 11 Confounding Covariates, Men

Variable	ADL Disabled	MMSE Impaired	Self-reported Poor Health
Childhood Socioeconomic Conditions			
Received adequate medical service for childhood illness			
Yes (no)	0.818*	0.668***	0.749*
Never/rarely suffered from severe sickness (no adequate medical service when sick)	0.702***	0.737***	0.756**
Infrequently went to bed hungry during childhood (frequently)	0.931	0.888†	0.901
Father's occupation was professional/administrative (other lower-income occupation)	0.895	0.889	0.963
Survival status of parents at age 10			
Both parents alive (at least one parent died)	1.060	1.027	1.233
Missing (at least one parent died)	1.507***	2.277***	2.159***
Born in urban area (rural area)	1.007	0.661***	1.053
Some schooling (no schooling)	0.963	0.642***	0.866
Control Variables			
Age	1.096***	1.124***	1.035*
Born in 1901–1910 (born in 1900 or earlier)	0.808	1.076	0.889
Born in 1911 or later (born in 1900 or earlier)	0.824	1.319	1.048
Minority ethnicity (Han)	0.516***	1.004	0.529**
Current residence urban (rural)	1.401***	1.222*	1.118
Primary lifetime occupation nonagricultural (agricultural)	1.524***	0.692**	1.2001
Currently married (no)	1.129†	0.827*	1.187†
High proximity to children (low)	1.234†	0.869†	0.956
Participates in religious activities (no)	0.552***	0.649***	0.534***
Currently smokes (no)	0.724***	0.785**	0.789**
Currently drinks heavily (no)	0.665***	0.842	0.777†
Currently exercises regularly	0.648***	0.541***	0.457***
Log-Likelihood	–2,802***	–2,744***	–1,903***

Notes: Reference groups are shown in parentheses.

†$p < .01$; *$p < .05$; **$p < .01$; ***$p < .001$

In the Cox proportional hazard model, which controls for age, birth cohort, and ethnicity (Model 1 in Tables 4 and 5), receiving adequate medical service during sickness or having never or rarely been sick during childhood reduces the mortality risk at advanced ages by 5%–7.8% in oldest-old men, but the estimates are not statistically significant. There is almost no effect of childhood medical service on the four-year mortality risk in the oldest-old women. Adding current rural/urban residence, occupation before age 60 (Model 2), family

Table 3. Effects (Odds Ratios) of Childhood Socioeconomic Conditions on ADL Disability, MMSE Impairment, and Self-Reported Poor Health Among the Chinese Oldest-Old, Adjusted for the Other Childhood Condition Variables and 11 Confounding Covariates, Women

Variable	ADL Disabled	MMSE Impaired	Self-reported Poor Health
Childhood Socioeconomic Conditions			
Received adequate medical service for childhood illness			
Yes (no)	0.776***	0.769***	0.818*
Never/rarely suffered from severe sickness (no adequate medical service when was sick)	0.739***	0.752***	0.831*
Infrequently went to bed hungry during childhood (frequently)	0.952	0.891*	0.883†
Father's occupation was professional/administrative (other lower-income occupations)	1.166	1.012	0.900
Survival status of parents at age 10			
Both parents alive (at least one parent died)	1.013	0.884	0.918
Missing (at least one parent died)	1.290**	1.835***	1.786***
Born in urban area (rural area)	1.015	0.748***	0.927
Some schooling (no schooling)	1.029	0.632***	0.941
Control Variables			
Age	1.094***	1.104***	1.069***
Born in 1901–1910 (born in 1900 or earlier)	0.780*	0.852	1.118
Born in 1911 or later (born in 1900 or earlier)	0.739	0.912	1.702*
Minority ethnicity (Han)	0.716**	0.885	0.682**
Current residence urban (rural)	1.379***	0.935†	1.016
Primary lifetime occupation			
Nonagricultural (agricultural)	1.627**	0.990	1.099
Housewife (agricultural)	1.676	1.277†	1.195
Currently married (no)	0.745*	0.735**	1.077
High proximity to children (low)	1.371***	1.046	1.053
Participates in religious activities (no)	0.547***	0.593***	0.704***
Currently smokes (no)	1.012	0.996	0.889
Currently drinks heavily (no)	1.054	1.12†	1.289
Currently exercises regularly	0.729***	0.584***	0.604***
Log-Likelihood	–4,590***	–4,457***	–3,538***

Notes: Reference groups are shown in parentheses.

†$p < .01$; *$p < .05$; **$p < .01$; ***$p < .001$

support and social relationships (Model 3), health-related behaviors (Model 4), physical and mental health (Model 5), and all covariates (Model 6) into the model does not change the estimates substantially.

The estimates listed in Tables 2 and 3 show that infrequently having gone to bed hungry during childhood reduced the risk of current ADL impairment, cognitive impairment, and self-reported poor health by 6.9%–11.2% and 4.8%–11.7% among oldest-old men and

Table 4. Effects (Hazard Ratios) of Childhood Socioeconomic Conditions on Mortality (Within a Four-Year Interval) at Oldest-Old Ages, Adjusted for the Other Childhood Condition Variables and 14 Confounding Covariates, Men

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Childhood Socioeconomic Variables						
Received adequate medical service for childhood illness						
Yes (no)	0.922	0.926	0.922	0.935	0.994	0.998
Never/rarely suffered from severe sickness (no adequate medical service when sick)	0.950	0.952	0.951	0.948	1.028	1.029
Infrequently went to bed hungry during childhood (frequently)	0.990	0.999	0.986	0.996	1.015	1.024
Father's occupation was professional/administrative (other lower-income occupations)	0.777*	0.852	0.782*	0.795*	0.780*	0.858
Survival status of parents at age 10						
Both parents alive (at least one parent died)	0.985	0.988	0.977	0.972	0.980	0.960
Missing (at least one parent died)	1.298***	1.306***	1.291***	1.257**	1.136†	1.113
Born in urban area (rural area)	0.874*	0.886*	0.898†	0.903†	0.889†	0.946
Some schooling (no schooling)	0.895**	0.917*	0.902*	0.941	0.958	1.017
Control Variables						
Age	1.071***	1.069***	1.063***	1.072***	1.051***	1.044***
Born in 1901–1910 (born in 1900 or earlier)	1.054	1.041	1.039	1.060	1.083	1.064
Born in 1911 or later (born in 1900 or earlier)	1.051	1.034	1.033	1.082***	1.048	1.042
Minority ethnicity (Han)	0.920	0.911	0.907	0.873	0.995	0.955
Current residence urban (rural)		1.030				0.999
Primary lifetime occupation nonagricultural (agricultural)		0.784***				0.831**
Currently married (no)			0.722***			0.717***
High proximity to children (low)			1.076			1.038
Participates in religious activities (no)			0.898†			1.021
Currently smokes (no)				1.026		1.085†
Currently drinks heavily (no)				0.919		0.956
Currently exercises regularly (no)				0.701***		0.796***
ADL disabled (active)					1.635***	1.666***
MMSE impaired (unimpaired)					1.541***	1.482***
Self-reported bad health (good)					1.455***	1.436***
Log-Likelihood	–20,388***	–20,381***	–20,360***	–20,353***	–20,201***	–20,150***

Note: Reference groups are shown in parentheses.

†$p < .01$; *$p < .05$; **$p < .01$; ***$p < .001$

Table 5. Effects (Hazard Ratios) of Childhood Socioeconomic Conditions on Mortality (Within a Four-Year Interval) at Oldest-Old Ages, Adjusted for the Other Childhood Condition Variables and 14 Confounding Covariates, Women

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Childhood Socioeconomic Variables						
Received adequate medical service for childhood illness						
Yes (no)	1.018	1.010	1.021	1.013	1.069	1.062
Never/rarely suffered from severe sickness (no adequate medical service when sick)	0.973	0.972	0.971	0.958	1.022	1.008
Infrequently went to bed hungry during childhood (frequently)	1.037	1.030	1.041	1.039	1.069	1.064
Father's occupation was professional/administrative (other lower-income occupations)	0.987	0.979	0.992	0.991	0.969	0.967
Survival status of parents at age 10						
Both parents alive (at least one parent died)	0.947	0.946	0.938	0.941	0.946	0.938
Missing (at least one parent died)	1.089	1.082	1.075	1.071	0.977	0.962
Born in urban area (rural area)	0.932	0.926	0.931	0.950	0.926	0.936
Some schooling (no schooling)	0.896†	0.902†	0.902†	0.926	0.930	0.956
Control Variables						
Age	1.070***	1.070***	1.067***	1.069***	1.049***	1.049***
Born in 1901–1910 (born in 1900 or earlier)	0.987	0.986	0.978	0.992	1.008	1.007
Born in 1911 or later (born in 1900 or earlier)	0.869	0.874	0.860	0.886	0.877	0.888
Minority ethnicity (Han)	0.826***	0.849*	0.812***	0.797***	0.881*	0.868*
Current residence urban (rural)		0.988				0.976
Primary lifetime occupation nonagricultural (agricultural)		0.911				0.890
Housewife (agricultural)		1.150*				1.076†
Currently married (no)			0.867			0.933
High proximity to children (low)			0.961			0.916
Participates in religious activities (no)			0.851***			0.959
Currently smokes (no)				1.072		1.083
Currently drinks heavily (no)				1.178†		1.189*
Currently exercises regularly (no)				0.723***		0.812*
ADL disabled (active)					1.638***	1.621***
MMSE impaired (unimpaired)					1.446***	1.415***
Self-reported bad health (good)					1.344***	1.326***
Log-Likelihood	–32,792***	–32,783***	–32,783***	–32,761***	–32,541***	–32,520***

Note: Reference groups are shown in parentheses.

$^{\dagger}p < .01$; $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$

women, respectively, but only three among the six estimates reach at least marginal levels of statistical significance. By comparison, in the survival analysis, none of the estimates concerning frequency of bedtime hunger are statistically significant.

Father's Occupation and Parental Survival

Oldest-old men whose fathers' occupation was professional/administrative had a 3.7%–10.5% lower risk of current ADL impairment, cognitive impairment, and poor self-reported health compared with oldest-old men whose fathers' occupation was of lower-income categories, but the estimates are not statistically significant. The corresponding odds ratios among women are 0.90–1.17, and they are also not statistically significant. The Cox hazards Model 1 estimates (controlling for age, birth cohort, and ethnicity) show that father's professional/administrative occupation significantly reduces mortality risk at oldest-old ages by 22.3% for men, but there is almost no effect for the oldest-old women. After the other covariates are added to the model (see Models 2–6), father's professional/administrative occupation reduces mortality risk at the oldest-old ages by 14.2%–22.0% for men and 0.8%–3.1% for women. Although the estimates are mostly not statistically significant, the direction of the effects is clear: father's better occupational status, which is a strong indicator of childhood socioeconomic status, is associated with reduced risk of poor health and mortality for men at the oldest-old ages.

Compared with the childhood experience of having at least one parent die, having both parents alive upon reaching age 10 reduces the risk of current cognitive impairment and self-reported poor health among oldest-old women by 8.2%–11.6% but slightly increases the risk of poor health among oldest-old men, but none of these estimates attains statistical significance (see Tables 2 and 3). Compared with those who lost at least one parent by age 10, the estimates based on all six Cox survival models show that having both parents alive at age 10 decreases the four-year risk of mortality by 1.2%–6.2%. Again, however, none of these estimates reach statistical significance (see Tables 4 and 5).

Rural/Urban Residence at Birth

Both male and female oldest-old who were born in urban areas have a significantly lower risk of currently being cognitively (MMSE) impaired compared with those who were born in rural areas. But urban/rural birthplace has no significant effects on ADL disability and self-reported poor health (see Tables 2 and 3). The results of the survival analysis presented in Tables 4 and 5 show that, controlling for various confounding factors, the Chinese oldest-old men and women who were born in urban areas had about 5.4%–12.6% and 5.0%–7.4% lower mortality risk, respectively, within the four-year follow-up interval compared with those born in rural areas. In general, the estimates are statistically significant for the oldest-old men, but not for women.

Schooling

Estimates in Tables 2 and 3 demonstrate that having schooling reduces the current risk of poor health in most cases (except in ADL impairment for women). For example, compared with a lack of schooling, having schooling significantly reduces the risk of cognitive impairment by about 36% for oldest-old men and women, and it reduces the risk of self-reported poor health by 13.4% for the men and 5.9% for the women, although these estimates are not statistically significant.

After we control for the demographic factors of age, birth cohort, and ethnicity, having schooling significantly reduces the four-year mortality risk by 10% for the oldest-old. After the other confounding factors of current residence, primary occupation before age 60, and family support and social relationships are added to the model, the effects of having schooling on the four-year mortality risk are still statistically significant for both oldest-old men and oldest-old women (see Model 2 and Model 3 in Tables 4 and 5). When health-related

behaviors and physical and mental health are added as covariates in Models 4 and 5, the effects of having schooling on the four-year mortality rates are no longer significant.

DISCUSSION AND CONCLUSIONS

The present study is unique because it investigates the association between childhood conditions and healthy longevity at the oldest-old ages with a large longitudinal panel from a developing country in which the elderly suffered extremely poor conditions in childhood. The following discussion of the findings takes these unique features into account.

One interesting finding is that oldest-old men and women who received adequate medical service during sickness or who didn't suffer from serious sickness during childhood have an 17%–33% lower risk of being ADL impaired, being cognitively impaired, or self-reporting poor health, compared with those who did not receive adequate medical service during sickness in childhood. These estimates are all highly statistically significant, even after we control for a rich set of confounding factors pertaining to current demographic-socioeconomic status, family support, social relationships, and health-related behaviors. It is interesting to note that having no serious illnesses in childhood is as significantly protective as getting adequate medical service during a sickness period, suggesting that good childhood health is an advantage for better health at advanced ages. This is consistent with Luo and Waite's (2005) finding that childhood health is strongly associated with all adult health outcomes, including self-rated health, functional limitations, chronic conditions, depressive symptoms, and cognitive functioning.

The majority of the net effect estimates of the other five available indicators of childhood socioeconomic conditions also have positive net associations with health status at the oldest-old ages in China. This is consistent with findings from other previous studies (e.g., Everson-Rose et al. 2003; Kohler and Soldo 2004; Luo and Waite 2005).

Because the multivariate logistic regression analyses reported herein adjust for various confounding factors of present demographic-socioeconomic characteristics, family support, social relationships, and health-related behaviors, it may be inferred from our findings that socioeconomic conditions and health status in childhood have long-term, direct effects on health status at the oldest-old ages in China. The possibility of indirect effects cannot be overlooked, however, because (1) the data set does not allow us control for all possible confounding factors; (2) only the childhood medical service variable has persistently and statistically significant effects on health in three main dimensions at the oldest-old ages, while the net effect estimates of the other five childhood socioeconomic variables generally point in the right direction but are mostly statistically insignificant; and (3) the statistical modeling approach used in this study does not adjust for selection and unobserved heterogeneity.

The Cox proportional hazards model estimates, controlling for the basic demographic covariates of age, birth cohort, and ethnicity, showed that better childhood socioeconomic conditions (as measured by six indicators) tend to reduce the four-year period mortality risk among oldest-old men, and the estimates of four out of the six childhood variables are statistically significant. After we separately control for socioeconomic conditions, family support and social relationships, health-related behaviors, and health status at the baseline survey, the effects of childhood socioeconomic conditions on the four-year mortality risk are weakened and not statistically significant. These results are in general consistent with what was reported by Hayward and Gorman (2004) and by Campbell and Lee (2006). The study by Hayward and Gorman (2004) was based on data from 4,562 men aged 45–59 in 1966 and followed for 24 years since 1966 in the National Longitudinal Survey of Older Men. Campbell and Lee (2006) used data from a historical population of men aged 57–75 from 1749 to 1909 in Liaoning Province of China. Both studies found that the significant associations between childhood conditions and mortality risk at late ages had disappeared or were weakened when adulthood factors were incorporated into the model. Hayward and

Gorman (2004) concluded that socioeconomic conditions at childhood shape adulthood socioeconomic conditions and lifestyles that affect health, and the effects of childhood conditions on adult mortality are mostly indirect through conditions during adulthood. In the present study, most of the effects of childhood conditions on oldest-old mortality in China are also indirect—at least to the point of affecting current health status at the oldest-old ages, which itself is strongly associated with mortality.

This study has several limitations that should be noted. First, data on the oldest-old respondents' childhood socioeconomic conditions are collected retrospectively and may involve recollection errors. Second, the available indicators of childhood socioeconomic conditions are limited and may not fully and accurately measure the childhood socioeconomic status. Third, given the fact that data are not available on the impact of historical events such as famines, wars, and the Cultural Revolution on the respondents' life course, we are unable to include the life-course experiences of these events as covariates. Some previous studies have shown that such events could have some influence on trajectories of health and mortality in later life (e.g., Elder, Shanahan, and Clipp 1994; Kannisto, Christensen, and Vaupel 1997). Future research that collects new data on the impacts of the historical events on Chinese people's lives could improve our understanding of the association between life-course experiences (childhood and adulthood conditions) and health and mortality at old ages. Fourth, due to data limitations, the statistical analyses reported herein do not adjust for the possible effects of selection and unobserved heterogeneity. In general, the oldest-old observed in the 1998–2002 longitudinal surveys are a selected group who survived the possible hardships of childhood and middle age and are generally robust in health; some of them may be genetically strong. Many of the weaker persons who suffered poor childhood conditions died before age 80. The selected, more robust oldest-old with poor childhood conditions thus may have advantages in healthy survival. The selection may lead to underestimation of the total effects of childhood conditions on healthy longevity, since we do not have information concerning those who died before age 80. Research on the extraordinarily selected (and large) population of the Chinese oldest-old (including those who suffered a lot in childhood and are likely to be more robust) may provide important insights into why some people survive to advanced old age in good health (Zeng et al. 2001). However, because this study concerns only the oldest-old, it is inappropriate to draw conclusions, based only on this study, about the association of childhood conditions with healthy survival at middle age and the early stage of elderly life in China. Still, studies of other populations have indicated that such an association exists (e.g., Hayward and Gorman 2004).

In conclusion, although the mechanisms remain unclear and the quantitative estimates based on limited data from particular oldest-old cohorts cannot be applied to the elderly population in general, the present study provides evidence to support the qualitative conclusion that childhood socioeconomic conditions have important long-term effects on healthy longevity at advanced ages. Based on the present and other relevant studies, we expect that policies that promote childhood health care and education can have large and long-lasting benefits up to the oldest-old ages. Policies and programs that initially benefit children will eventually benefit the oldest-old, who are most likely to need considerable health care and assistance with living. Such policy implications are particularly relevant in developing countries. At present, the living conditions of about 650 million children are below the poverty line; among them, more than 90% are in developing countries (UNICEF 2002). Our study suggests that investments in improving children's health services and schooling will not only enhance the life quality of children and their families today but will also have large and long-lasting effects on the health, survival, and life quality for the future oldest-old, their families, and society in general. Because the oldest-old consume the most public and private resources of health care and social and family support, such long-lasting effects will certainly be beneficial for all members of society and the nation.

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