Whose Education Matters for Health Trajectories in Later Life? A Three-Generation Comparison in China

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Introduction

Although the protective effects of individual education on health are well documented (Dupre 2007; Kim and Durden 2007; Leopold 2016 2018 2019; Lynch 2003; Mirowsky and Ross 2008; Willson et al. 2007), our knowledge is still limited in some important ways. Firstly, it is unclear whether the health benefits also accrue from other family members' education during later life. Second, we do not yet know how the impact of family members' education on individual health varies depending on the specific health indicators considered. Finally, it is uncertain whether men and women benefit equally from the education of family members.

Using longitudinal data from the China Health and Retirement Longitudinal Study (CHARLS), following 9,800 individuals across 36,743 panel observations (person-years) between 2011 and 2020, we investigate the impact of education across three generations — self, spouse, parents, and children — on individual mental and physical health trajectories. This study aims to (1) assess how family members' educational attainment influences individual health trajectories in later life; (2) to explore how these relationships vary across different health indicators; and (3) to investigate gender differences in these effects.

Data and Method

We used five-wave (2011-2020) data of CHARLS. Our sample was comprised of older adults aged 45 and 85 who had a spouse and at least one child aged 25 or older at the 2011 baseline. After eliminating missing values in variables of interest, our analytical sample includes 9,800 respondents and 36,743 observations.

Mental health was assessed by depressive symptoms using a 10-item short form of the Center for Epidemiologic Studies Depression Scale. CESD score (0-30) was obtained by calculating the total score of ten items, with a higher score indicating poorer mental health. *Physical health* was measured by Instrumental Activities of Daily Living (IADL). IADL score (5-20) was derived by summing five items, with higher scores indicating poorer physical health. Both CESD and IADL were overall z-standardized,

where higher scores reflected worse mental or physical health.

Family members' education was measured by the highest level of education attained. Parental education was determined by the highest education level of either parent, and children's education was measured by the highest education level among all children. We divided individual, spouse, parents, and children into groups according to their birth cohort (five year), and then used tertiles within each group to divide the education level into low, medium, and high groups.

Age was assessed as a time-varying variable ranging from 45 to 85. Due to the small number of samples aged 80 and above, we regard 80 years and above as 80 years old. *Birth cohort* was treated as a time-constant variable that indicated the year of birth. Controlling for cohort effects allowed us to accurately capture the relationship between health and age while accounting for potential shifts in the health returns of education over time, especially given China's significant social changes. *Gender* was coded as 1 for men and 0 for women.

We employed hierarchical linear regression models (HLM) to estimate the impact of family members' education on health trajectories. The analysis began with a description of sample characteristics, followed by an examination of the impact of education on health trajectories. All analyses were conducted separately for women and men.

Results

Table 1 provides the sample characteristics.

Table 1 Sample characteristics

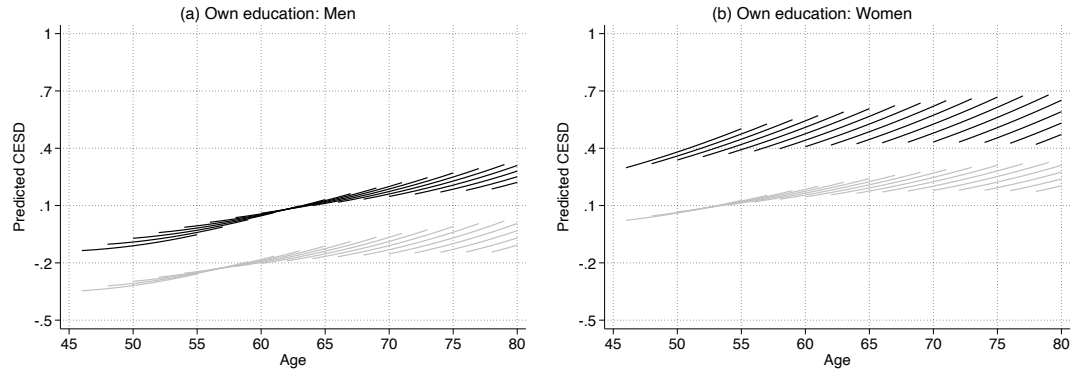
Variables	Men		Women		*p*-value [c]
	Mean / %	SD	Mean / %	SD	
Participant characteristics [a]					
Own education					0.000
Low	28.10%		62.34%		
Medium	41.66%		24.41%		
High	30.25%		13.25%		
Spousal education					0.000
Low	62.35%		28.47%		
Medium	24.09%		41.50%		
High	13.56%		30.03%		
Parental education					0.736
Low	61.59%		61.32%		
Medium	14.54%		15.11%		
High	23.87%		23.57%		
Children's education					0.673
Low	48.50%		49.41%		

Medium	25.97%		25.65%		
High	25.53%		24.93%		
Birth year	1951.30	7.38	1953.37	7.15	0.000
Observation characteristics [b]					
Age	63.68	7.66	61.56	7.53	0.000
Survey year	2014.98	3.25	2014.92	3.24	0.093
Number of waves	2.82	1.42	2.79	1.41	0.092
CESD	7.22	5.74	9.46	6.65	0.000
IADL	5.70	2.09	5.98	2.27	0.000

Notes: [a] Time-constant variables are summarized at the 2011 baseline. [b] Time-varying variables are summarized over all observations. [c] *Chi-square* test for categorical variables and *t* test for continuous variables were conducted to examine the gender difference in sample characteristics. CESD = Depressive symptoms. SD = Standard Deviation.

Figures 1 and 2 show model-based predictions for change in CESD and IADL by education and gender, respectively. To illustrate cohort effects, we fixed the variable for cohort at 17 values of age at initial observation, counting in two-year intervals from the age of 46 (i.e., birth year of 1965) to the age of 80 (i.e., birth year of 1931) to enhance the visualization of trends in CESD and IADL over time. To evaluate age patterns and effect sizes in more detail, Table 2 shows the corresponding marginal effects for educational differences for CESD at the initial age of 45 and at the age of 60 and 75 as well as change in educational differences in CESD across these age intervals. Three central findings emerged from the analyses.

First, the pattern of CESD inequality unfolding over the later life course looks different for the measures of education. For men, disparities in CESD based on individual, spousal, and children's education levels increase with age, while differences related to parental education remain insignificant across the later life course. For women, CESD disparities linked to their own and their spouse's education remain stable with age, but those related to parental and children's education widen over time.



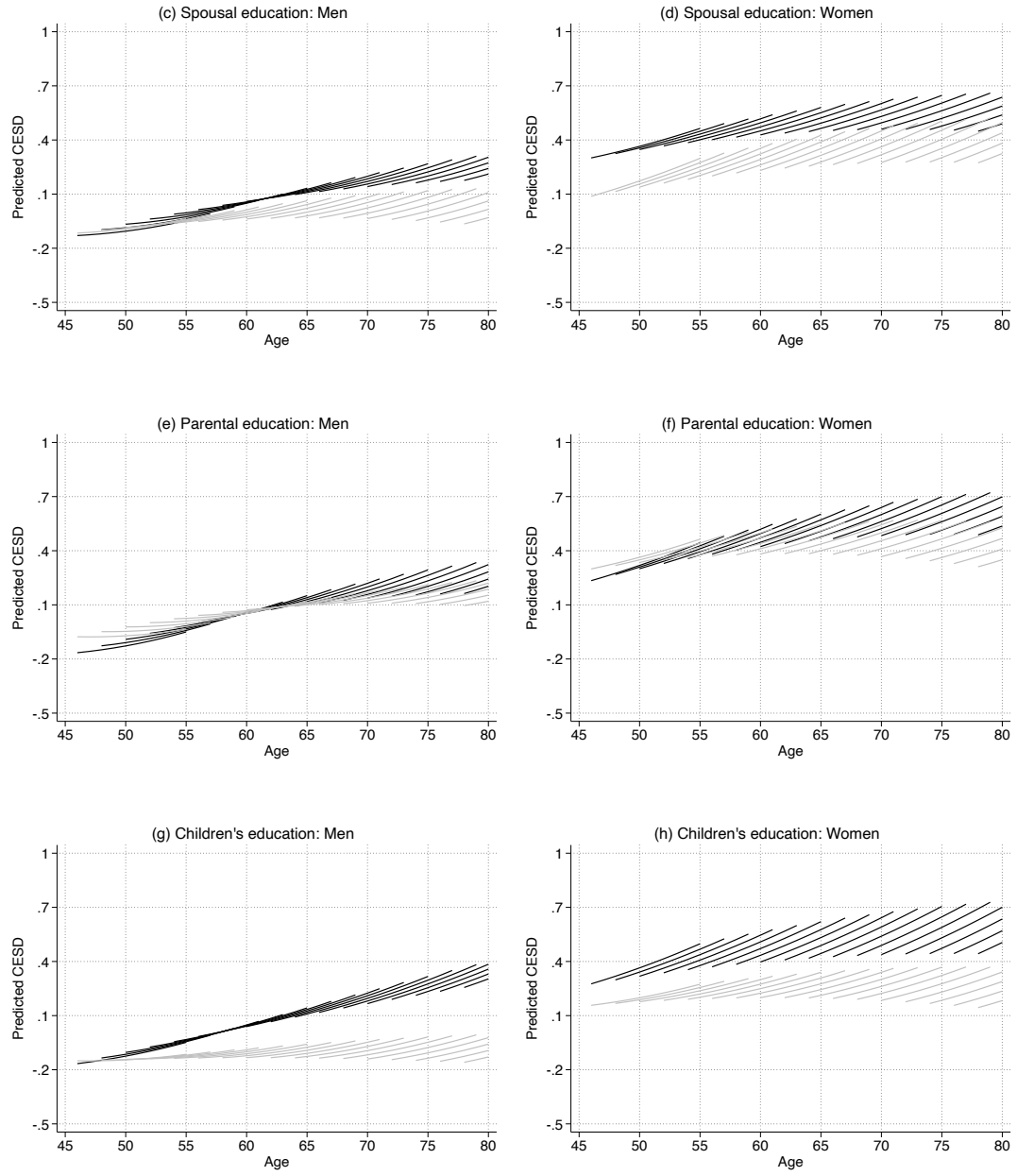


Fig. 1 Predicted age trajectories of CESD-by-education

Notes: In each panel, black lines show trajectories of people with lower levels of education, while the gray lines show trajectories of people with higher levels of education.

Second, the age trajectories of IADL based on family members' education differ from those observed with CESD. For men, IADL differences by their own, parental, and children's education increase with age, while IADL differences by spousal education are not significant in later life. For women, IADL differences by their own, spousal, and children's education increase with age, while IADL differences by parental education are not significant in later life.

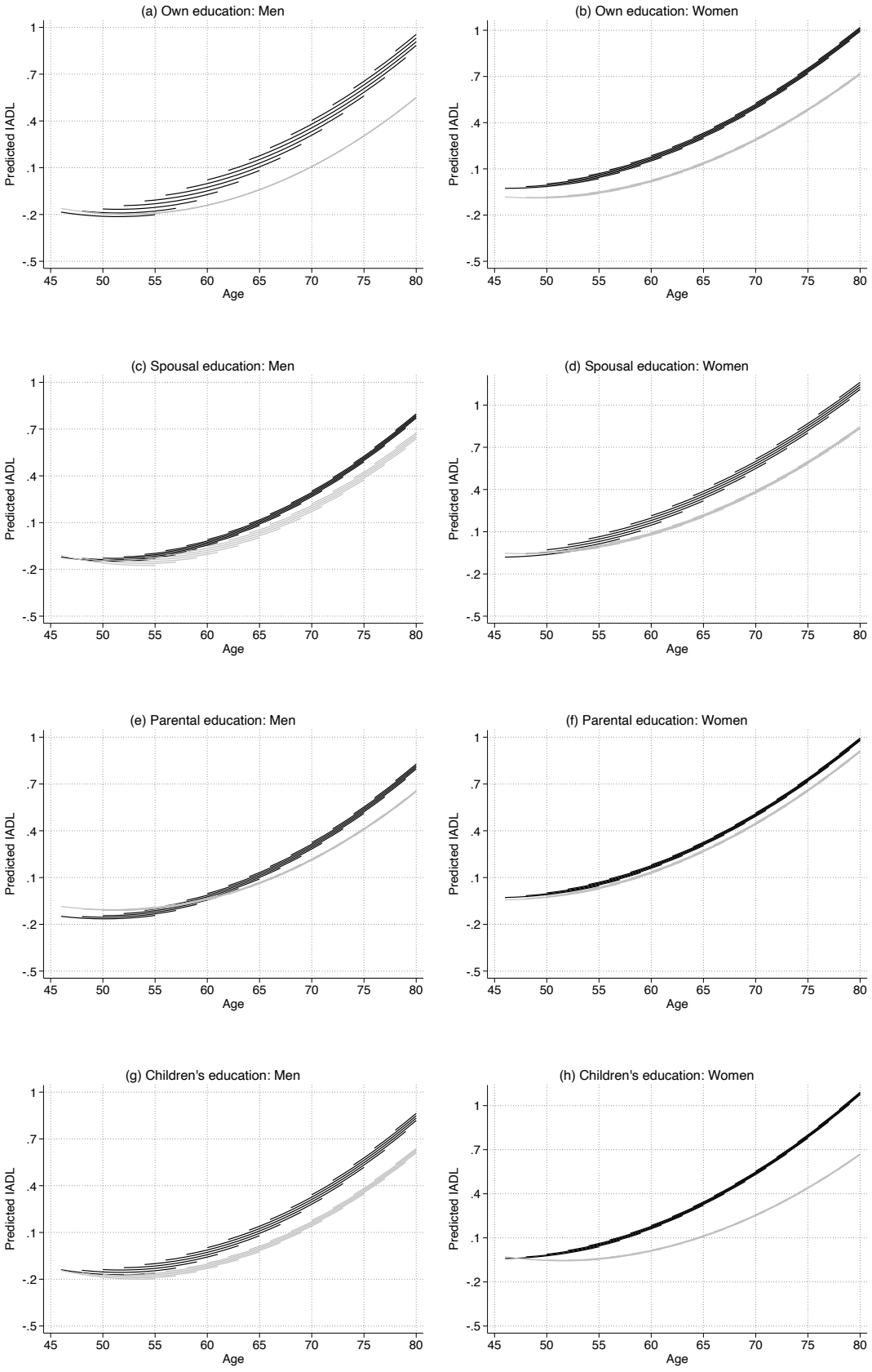


Fig. 2 Predicted age trajectories of IADL-by-education

Notes: In each panel, black lines show trajectories of people with lower levels of education,

while the gray lines show trajectories of people with higher levels of education.

Third, the health benefits of family members' education in later life differ between men and women. For men, changes in mental health are more influenced by the education levels of other family members, particularly children's education, whereas physical health is more strongly linked to their own education. In contrast, for women, changes in both mental and physical health are more strongly influenced by the education levels of other family members than by their own education. Specifically, mental health is more affected by parental education, while physical health is more impacted by children's education.

Table 2. Marginal education differences in health outcomes from 45 to 75 by gender

Age	Own education		Spousal education		Parental education		Children's education	
	Men	Women	Men	Women	Men	Women	Men	Women
Panel A: CESD differences								
45	0.207***	0.276***	-0.022	0.214**	-0.093	-0.073	-0.029	0.113
60	0.263***	0.263***	0.098**	0.196***	-0.020	0.041	0.173***	0.198***
75	0.319***	0.249**	0.217**	0.179*	0.052	0.154*	0.374***	0.282***
Change from age 45 to 75	0.112*	-0.027	0.239*	-0.035*	0.145*	0.227*	0.404*	0.169*
Panel B: IADL differences								
45	-0.037	0.049	-0.013	-0.038	-0.071	0.013	-0.002	-0.025
60	0.162***	0.157***	0.043	0.118**	0.040	0.043	0.098***	0.167***
75	0.362***	0.266*	0.100	0.274**	0.152*	0.073	0.198**	0.360***
Change from age 45 to 75	0.399*	0.217*	0.113*	0.312*	0.223*	0.060*	0.201*	0.385*

Notes: CESD = Depressive symptoms. IADL = Instrumental Activities of Daily Living. Average marginal differences are shown. CESD or IADL differences at ages 45, 60, and 75 are predicted mean differences in CESD or IADL between participants with lower and higher family members' education. Positive values indicate higher CESD or IADL levels among participants with lower and higher family members' education. Change with age is calculated as a difference between the predicted mean differences at age 45 and the predicted mean differences at age 75. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Conclusion

Using five waves of CHARLS data from 2011 to 2020, we examine the impact of family members' education on individual health trajectories in later life. We find that family members' education plays an important role in shaping individual health trajectories in later life, but the effects vary depending on the measurement of education, the choice of health indicators, and the gender of the individual.