

# Education as a moderator in the effect of successful aging on mortality risk in elderly Chinese: A national longitudinal study (2011-2016)

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## Research

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# Abstract

## Background

Some literatures have found that successful aging and its components were significantly associated with older adults' health, their achievement has a positive effect on reducing mortality rates. However, there is little evidence to discuss whether education modified the effect of successful aging on mortality risk. A majority of literatures from worldwide were cross-sectional and previous studies on the association between successful aging and mortality in China are quite little. It aims to evaluate the effect of successful aging and each of its components on mortality risk of older in China and further discussed whether education was a moderator in this effect. It also investigated differences in results among males and females.

## Methods

Data was collected from CHARLS (China Health and Retirement Longitudinal Study), which is a nationally representative follow-up survey. Cox proportional hazards model was used to estimate the education's moderate effect on the relationship between successful aging and mortality.

## Results

In total, 4824 residents aged 60 years and above were recorded. 15.18%(n=367) for males and 15.74%(n=379) for females were defined as successful aging and the mortality were 2.61%(n=63) for males and 3.45%(n=83) for females during the survey. It is the first longitudinal study using national cohort data to research the educational effects on the association between mortality and successful aging, the study showed that the effect only existed in females aged 65-74 years old group with lower education.

## Conclusions

Education has the significant effect on the relationship between successful aging and mortality. Physical health is significantly associated with the achieving of successful aging among young older. More measures should be paid on improving mental health among the young female older with lower education to achieve successful aging and to against mortality and live longevity.

# Introduction

Faced with life expectancy increased dramatically, the world's demographic structure has changed significantly[1]. It is predicted that almost 2 billion people will be 60 years or older by the year 2050, accounting for 20% of the global population, aging populations pose economic challenges to society[2]. Social attention about aging has shifted from "how to live longer" to "how to age well", how can people age well? Many people, all around the world, regard good health as an important goal in their lives[3].

The concept of successful aging which was closely connected with good health has evolved for several decades, there is no agreed-upon definition of successful aging. This term was first introduced by Robert J. Havighurst who discussed early the concept of successful aging[4]. Rowe and Kahn discussed the operational concept of successful aging that encompasses three main criteria: low risk of disease and disability, maintenance of high physical and cognitive functioning, and active engagement in social and productive activities[5]. In recent years, the World Health Organization (WHO) reported the concept of active aging, which is "the process of optimizing opportunities for health, participation and security in order to enhance the quality life as people age"[6]. Several empirical studies nowadays have recognized the successful aging as a "calculable gold standard of aging"[7].

Although there are different defined successful aging across countries, cultures and literatures, a majority of researches of successful aging has already paid attention to the factors which is associated with the achievement of successful aging and

the prediction of future health outcomes result from successful aging[8, 9].A considerable number of studies have found that individual components (absence of major disease, freedom from disability, high cognitive function, no depressive symptoms, active social engagement in life) of successful aging were significantly associated with older adults' health[10–13], their achievement has a positive effect on reducing mortality rates.

Education, as the common proxy for socioeconomic status (SES), makes it possible for individuals to have more knowledge about diseases and to understand the health treatments and cope with mechanisms for ill-health[14]. Meanwhile, some literatures indicated that higher socioeconomic status, longer life expectancy and lower morbidity is positively associated with successful aging[15], which indicates that education may promote older to live successfully and reduce the mortality rate significantly. Furthermore, research found that successful aging rate may be differ from different education level. However, there is little evidence to discuss whether education modified the effect of successful aging on morality risk.

A majority of literatures from worldwide were cross-sectional and previous studies on the association between successful aging and mortality in China are quite little.

This prospective study aims to evaluate the effect of successful aging and each of its components on mortality risk of older in China, we further discussed whether education was a moderator in this effect using nationally representative longitudinal data. Gender disparities exist in the health indicators of mortality in aging population, as a result, we investigated differences in results among males and females.

## Methods

### Study data

CHARLS (China Health and Retirement Longitudinal Study) is a nationally representative follow-up survey, which is designed to investigate the economic and health of the populations aged 45 years old and above. The baseline survey (W1) of the CHARLS interviewed 17705 respondents and was conducted in 2011–2012. The second survey (W2) was conducted in 2013–2014 and the third (W3) and fourth survey (W4) was conducted in 2014–2015 and 2015–2016 respectively[16]. The detailed description of the design of CHARLS has been previously published. The Biomedical Ethics Review Committee of Peking University (IRB00001052-11015) gave the ethic approval and allowed the CHARLS research group to collect data. Requiring all interviewees to sign informed consent was the first step for study.

This study used the baseline data from W1 and follow-up data from W2, W3 and W4. To research the association between the successful aging and mortality rate, we limited the samples to respondents who had answered the question about the all components of successful aging in W1. A total of 4824 subjects were included.

### Definition of successful aging

Our concept of successful aging took the definition of Rowe and Kahn[5], including the following 5 components: 1) absence of major disease, 2) freedom from disability, 3) high cognitive function, 4) no depressive symptoms, 5) active social engagement in life.

1 Absence of major disease: To judge the status of chronic disease, respondents were asked by using the following series of question: "Have you been diagnosed with conditions listed below by a doctor?" The conditions included cancer, chronic lung disease, diabetes, heart disease, and stroke. The research indicated that those disease mentioned above caused the major disease burden for older[17], the respondents were classified as having no major disease if they reported have no any of the five chronic diseases.

2 Freedom from disability: The ADL scale was used to assess the ADLs[18], according to the followed questions: "Because of a physical, mental, emotional or memory problem, do you have any difficulty with one type of everyday activity, excluding any that you expect to last less than three months?" The everyday activities included dressing, bathing or showering, eating,

getting into or out of bed, using the toilet, and controlling urination and defecation. Respondents were classified as having no disability if they reported that they had no difficulty with the everyday activities of six items mentioned above.

3 High cognitive function[19] : Cognitive function was assessed with the telephone interview for cognitive status (TICS). This includes both immediate and delayed recall of ten words on a list, serial subtraction of seven from 100 (up to five times), and naming the day of the week, month, day, year, and season, and drawing the picture. The score of cognitive function ranged from 0 to 21. Participants were considered to have high cognitive functioning if they achieved a median or above score, and the median score was 11.

4 No depressive symptoms: Depressive symptoms were assessed using the CES-D 10 (Epidemiological Studies Depression Scale). The cut-off value is less than 10 points, which was used to identify no depressive symptoms.

5 Active social engagement in life: Respondents were defined as being actively social engaged if they participate in any of the following types of social groups: voluntary or charity work, provided help to family, friends, or neighbors, gone to a sport, social, or other kind of club in the month preceding the interview. The participant who met all five indicator criteria mentioned above was defined as "successful aging", otherwise as "non-successful aging".

## Other variables

Control variables includes following factors: age (60–74 years/75 years or older), sex (Male/Female), education level (Primary school and below/Junior high school or above), income (low:  $\leq$ 650yuan, medium: 650-100580yuan, high:  $\geq$ 10058yuan) marital status (Married/Cohabiting/Divorced/Separated/Widowed/Never married), community type (Rural/Urban), smoking (Yes/No/Quit), and drinking (Drink more than once a month/Drink but less than once a month/Do not drink).

## Mortality

We collected the all-cause mortality and survival information of the respondents during the four waves surveys (2011–2016). The second wave had the data source of the respondents' status (dead or alive) and death time, the waves 3 and 4 only provided the interview status information (dead or alive). We recorded and calculated the survival time of those who had the accurate all-cause death time by the interval between the interview time of waves 1 and the specific death time. If we cannot get the accurate death time and only can access to the death status, we calculated the specific value by the interval between the interview time of wave 1 and the specific wave with death information and then used the median of the value as the survival time. The survival time of those who were alive during whole follow-up interview was the interval between waves 1 and 4.

## Statistics analysis

All descriptive statistical analyses were performed by sex. We use chi-square test to compare individual characteristics (including dichotomous or categorical variables) with and without successful aging. The survival analysis was used to examine the association between successful aging and all-cause mortality. The Cox proportional hazards regression models were used to estimate the unadjusted and adjusted hazard ratios (HRs) and 95% confidence intervals (CIs) of successful aging.

In addition, whether the education could modify the effect of successful aging on the all-cause mortality was assessed. We still used the Cox proportional hazards regression models to examine the educational mediating effect. All statistical analyses were performed by SAS 9.3. The significance level was set at 0.05.

## Results

Table 1 shows the participants' baseline characteristics according to successful aging. In the group aged 60–74 years old, 15.20% (n = 297) for males and 15.95% (n = 305) for females were defined as successful aging according to our criteria. Among males and females, people with high education level were likely to achieve successful aging compared with lower education

( $P < 0.001$ ). Higher income makes it possible for people to achieve successful aging ( $P < 0.01$ ). People keeping the drinking habits (Drink but less than once a month and Drink more than once a month,  $P < 0.001$ ) were more likely to achieve aging successfully, compared with the people (Do not drink). In addition, a smoker were more likely to be successful aging in men group ( $P = 0.001$ ). For the group of 75 years old and above, the successful aging rate was 15.12% ( $n = 70$ ) for males and 14.95% ( $n = 74$ ) for females respectively. The connection between successful aging and education was similar with the group aged 60–74 years old. More details of characteristics of this group of participants were shown in Table 1.

As Table 2 shows, among population aged 60–74 years old group, the mortality rate of females (3.50%) was higher than males (2.46%), although the difference was not significant ( $P = 0.055$ ). Moreover, the distribution of the association between successful aging and its components and mortality differed by gender, the association between successful aging and mortality was significant in females ( $P = 0.033$ ), but not in males ( $P = 0.200$ ). Specifically speaking, individual components comprising successful aging except "Active social engagement in life ( $P = 0.642$ )" in females were associated with mortality significantly, and those significant correlation in males only existed in "Absence of major disease ( $P < 0.001$ )" and "Freedom from disability ( $P < 0.001$ )". Among group aged 75 years old and above, the mortality rate of males and females were similar (males = 3.24% female = 3.23%  $P = 0.995$ ). Moreover, both males and females had same correlation trend between successful aging and its components and mortality except "Absence of major disease ( $P = 0.004$ )" was associated with mortality in males and "High cognitive function ( $P = 0.021$ )" was associated with mortality in females.

In order to assess the risk of mortality onset, the Cox proportional hazards models were used to show relevant result during the follow-up survey according to the successful aging at baseline participants (Table 3). In total, after adjusting education, health behavioral and relevant influencing factors, the association between successful aging and mortality only was observed in the group aged 60–74 years old in females (HR = 3.105 95%CI = 1.128–8.543). However, there was no association between successful aging and mortality significantly in males. In addition, owing to the restriction of data, the females aged 75 years old and above cannot observe similar correlation (females defined as aging successfully had no death data at that age stage).

The study further explore if the education was a moderator in this effect of successful aging on mortality risk (Table 4). Owing to there was no significant association between successful aging and mortality in the group of 75 years old and above, relevant analysis mainly on the group aged 60–74 years old. Table 4 shows the significant correlation between successful aging and mortality only exist in females group with the education level of primary school and below (HR = 3.272 95%CI = 1.019–10.507).

## Discussion

The study investigated the association between successful aging and mortality and education's role of moderating the effect of successful aging on mortality, we found the significant correlation between successful aging and its 5 components with mortality, meanwhile, those correlation existed gender differences. In addition, those significant association only existed in the group of female (60–74 years old) with education level of primary school and below.

For 60–74 years old group, we found that the association between successful aging and mortality in females (HR = 3.105 95%CI = 1.128–8.543), not in males. Gender differences in mortality risk were found across 5 components of successful aging; the association was strongest for presence of major disease, disability, low cognitive function and depressive symptoms in females, but for presence of major disease and disability in males. For 75 years old and above group, both males and females had not found the association between successful aging and mortality; the association was strongest for presence of major disease in males, but for presence of low cognitive function in females.

Our finding is accordance with previous studies which found successful aging was significantly associated with lower mortality. In a Korean longitudinal study of aging (2006–2014) which included 3848 participants aged 65 and above, non-successful aging older had a higher risk of mortality than successful agers (men: HR = 1.69, 95%CI = 1.18–2.43; and women: HR = 2.37, 95% CI = 1.21–4.63). Meanwhile, this study found gender differences in mortality risks across all components of

successful aging (absence of major illness, freedom from disability, no depressive symptoms, active social engagement, satisfaction with life, high cognitive function, high physical function)[4]. A study(2 year followed survey)from longevity areas of China focusing on the relationship between successful aging index (assessed by self-rated health, depressive symptoms, cognitive function, disability, and physical activities)and the survival status included 2296 old people (65 years old and above). According to this research, the mortality rate in the successful aging group was lower than non-successful aging group, the death rate in successful aging group reduced by 38%(HR = 0.62, 95% CI = 0.49–0.79)[20]. Considering the definitions of successful aging varied from researches, we cannot directly compare those previous available studies with ours. However, from another perspectives, it is proved that achieving successful aging is crucial for lowering mortality and improving life-expectancy, which could support our study.

We can conclude that aging successfully may be beneficial for lower the risk of mortality, but components of successful aging had different contribution to mortality varying from genders. Some studies indicated this gender difference may result from biological, genetic, and social variations [21–24]. Our study showed that the significant association between successful aging and mortality only existed in females (60–74 years old). On the one hand, possible explanations for the phenomenon is that the association between all components of successful aging (except "Active social engagement in life") and mortality was significant in females (60–74 years old), however, there only found significant association between partly components of successful aging ("Major disease" and "Disability") and mortality in males, as a result, the overall effect of successful aging on mortality in males was diminished. On the other hand, possible explanations for the association between the specific components of successful aging ("Depressive symptoms" and "Cognitive function") and mortality may be weaker in males than females might be that females may have greater and more prolonged hypothalamic-pituitary-adrenal (HPA) response to challenge at older ages than males. That is to say, post-menopausal women are at increased risk of exhibiting greater and more prolonged HPA activation, which may contribute significantly to the increased risks among such post-menopausal women for chronic disease, depression, disability and so on[25], previous researches had proved those diseases are associated with higher mortality.

Meanwhile, the association mentioned above diminished with increasing age, that is to say, we cannot observe similar correlation at the 75 years old and above group among males and females. Potential explanation for the declines in the effects of successful aging on mortality with age is that physiological factors gradually become the prominent contribution factors more than others such as diseases, behaviors and so on for the death of people aged 75 years old and above group.

It is the first longitudinal study using national cohort data to research the educational effects on the association between mortality and successful aging, the study showed that the effect only existed in females aged 65–74 years old group with lower education. On the one hand, focusing on the role of education rather than SES which usually was a comprehensive concept (including education, occupation, income, social class, physical health and so on) provides us a precisely perspective to understand the connection between successful aging and mortality. On the other hand, some studies had found that the effect of education on mortality is stronger in young old than in oldest old[26], lower education population had less possibility to access to more health resources which are related with good health and survival[27, 28].

## Conclusion

In conclusion, we only found the association between successful aging and mortality in female older aged 60–74 years old, not in males. That is to say, the successful aging female older aged 60–74 years old were more likely to live longevity than those who did not. Moreover, the association between successful aging and its components and mortality existed gender differences, that is to say, physical health is significantly associated with the achieving of successful aging among young older and this study suggested that more measures should be paid on improving mental health among the young female older with lower education to achieve successful aging and to against mortality and live longevity.

## Limitations of study

This study had some limitations. First, we cannot collect the data of exact causes of death because of the restriction of original data. Second, all analyses were operated basing on the 5 years follow-up data, further study is needed to explore the stronger association between the baseline successful aging status and mortality in a long time follow-up period. Lastly, the results cannot be generalized to whole older population.

## Declarations

**Acknowledgements:** We are grateful to the China Center for Economic Research at Beijing University for providing us with the data, and we thank the CHARLS research and field team for collecting the data.

### Ethics approval and consent to participate

The experiments complied with the current laws of the country in which we were performed.

### Consent for publication

Not applicable

### Availability of data and materials

The datasets generated and analysed during the current study are available in the CHARLS project Online System, <http://charls.pku.edu.cn/>.

### Competing interests

The authors declare that they have no competing interests

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### Authors' contributions

HL designed the study, performed the experiments, analyzed the data, and wrote the manuscript; P C prepared the manuscript; JL analyzed the data; XR helped perform the analyses, participated in constructive discussions and contributed to the conception of the study; YW analyzed the data; QC analyzed the data; NL helped perform the analyses, participated in constructive discussions and contributed to the conception of the study; NL and XR were co-corresponding author.

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## Tables

Table1 Characteristics of Study Population According to Baseline Successful Aging by Sex						
Characteristics	Male (N(%))		P	Female (N(%))		P
	successful aging	Non-successful aging		successful aging	Non-successful aging	
<b>60-74 years old</b>	297(15.20)	1657(84.80)		305(15.95)	1607(84.05)	
<b>Education level</b>						
Primary school and below	133(10.33)	1154(89.67)	<0.001	126(9.91)	1146(90.09)	<0.001
Junior high school or above	164(24.59)	503(75.41)		179(27.97)	461(72.03)	
<b>Marital status</b>						
Married/Cohabiting	260(14.91)	1484(85.09)	0.301	241(16.07)	1259(83.93)	0.794
Divorced/Separated/Widowed/Never married	37(17.62)	173(82.38)		64(15.53)	348(84.47)	
<b>Community type</b>						
Rural	232(15.95)	1223(84.05)	0.117	245(16.04)	1282(83.96)	0.826
Urban	65(13.03)	434(86.97)		60(15.58)	325(84.42)	
<b>Income<sup>a</sup></b>						
<650	57(11.75)	428(88.25)	<0.001	64(13.22)	420(86.78)	0.002
650-10058	137(13.39)	886(86.61)		132(14.63)	770(85.37)	
>10058	103(23.09)	343(76.91)		109(20.72)	417(79.28)	
<b>Smoking</b>						
Yes	121(18.67)	527(81.33)	0.001	106(18.50)	467(81.50)	0.111
No	142(12.61)	984(87.39)		170(14.60)	994(85.40)	
Quit	34(18.89)	146(81.11)		29(16.57)	146(83.43)	
<b>Drinking</b>						
Drink more than once a month	29(19.46)	120(80.54)	<0.001	28(18.92)	120(81.08)	<0.001
Drink but less than once a month	105(21.60)	381(78.40)		98(21.35)	361(78.65)	
Do not drink	163(12.36)	1156(87.64)		179(13.72)	1126(86.28)	
<b>75 years old and above</b>	70(15.12)	393(84.88)		74(14.95)	421(85.05)	
<b>Education level</b>						
Primary school and below	30(10.00)	270(90.00)	<0.001	34(10.30)	296(89.70)	<0.001
Junior high school or above	40(24.54)	123(75.46)		40(24.24)	125(75.76)	
<b>Marital status</b>						
Married/Cohabiting	50(14.88)	286(85.12)	0.816	25(13.97)	154(86.03)	0.644
Divorced/Separated/Widowed/Never married	20(15.75)	107(84.25)		49(15.51)	267(84.49)	
<b>Community type</b>						

Rural	46(13.90)	285(86.10)	0.245	54(14.29)	324(85.71)	0.457
Urban	24(18.18)	108(81.82)		20(17.09)	97(82.91)	
<b>Income<sup>a</sup></b>						
<650	12 (10.91)	98(89.09)	0.051	16(12.90)	108(87.10)	0.458
650-10058	33(13.81)	206(86.19)		36(14.34)	215(85.66)	
>10058	25(21.93)	89(78.07)		22(18.33)	98(81.67)	
<b>Smoking</b>						
Yes	22(15.07)	124(84.93)	0.579	26(16.35)	133(83.65)	0.694
No	38(14.23)	229(85.77)		41(13.85)	255(86.15)	
Quit	10(20.00)	40(80.00)		7(17.50)	33(82.50)	
<b>Drinking</b>						
Drink more than once a month	8(22.86)	27(77.14)	0.325	9(18.00)	41(82.00)	0.141
Drink but less than once a month	20(16.39)	102(83.61)		27(19.29)	113(80.71)	
Do not drink	42(13.73)	264(86.27)		38(12.46)	267(87.54)	

Note

a: The household income per capita with the order from high to low, using inter-quartile range divide household income per capita into three groups low < 650 yuan medium 650-10058 yuan high > 10058 yuan

Table 2 Association between Successful Aging and Mortality by Sex Based on Baseline Successful Aging						
	Male (N(%))		<i>P</i>	Female (N(%))		<i>P</i>
	Mortality incidence cases	Follow-up cases		Mortality incidence cases	Follow-up cases	
<b>60-74 years old</b>	48(2.46)	1954		67(3.50)	1912	
<b>Successful aging</b>						
Yes	4(1.35)	297	0.200	4(1.31)	305	0.033
No	44(2.66)	1657		63(3.92)	1607	
<b>Absence of major disease</b>						
Yes	24(1.62)	1480	<0.001	39(2.76)	1411	0.003
No	24(5.06)	474		28(5.59)	501	
<b>Freedom from disability</b>						
Yes	31(1.83)	1693	<0.001	50(3.05)	1642	0.009
No	17(6.51)	261		17(6.30)	270	
<b>High cognitive function</b>						
Yes	23(2.15)	1069	0.356	23(2.17)	1058	0.001
No	25(2.82)	885		44(5.15)	854	
<b>No depressive symptoms</b>						
Yes	29(2.35)	1236	0.676	34(2.77)	1227	0.023
No	19(2.65)	718		33(4.82)	685	
<b>Active social engagement in life</b>						
Yes	19(1.90)	1001	0.112	32(3.30)	969	0.642
No	29(3.04)	953		35(3.71)	943	
<b>75 years old and above</b>	15(3.24)	463		16(3.23)	495	
<b>Successful aging</b>						
Yes	1(1.43)	70	0.359	0(0.00)	74	0.287
No	14(3.56)	393		16(3.80)	421	
<b>Absence of major disease</b>						
Yes	7(1.93)	363	0.004	11(2.98)	369	0.554
No	8(8.00)	100		5(3.97)	126	
<b>Freedom from disability</b>						
Yes	11(2.84)	387	0.297	14(3.33)	421	0.791

No	4(5.26)	76		2(2.70)	74	
<b>High cognitive function</b>						
Yes	5(2.00)	250	0.120	4(1.44)	278	0.021
No	10(4.69)	213		12(5.53)	217	
<b>No depressive symptoms</b>						
Yes	9(3.10)	290	0.865	11(3.68)	299	0.503
No	6(3.47)	173		5(2.55)	196	
<b>Active social engagement in life</b>						
Yes	7(3.04)	230	0.815	4(1.44)	278	0.362
No	8(3.43)	233		12(5.53)	217	

Table 3 HR (95% CI) of All-Cause Mortality of Successful Aging and Its Component				
	Male (HR 95%CI)		Female (HR 95%CI)	
	Unadjusted	Adjusted	Unadjusted	Adjusted
<b>60-74 years old</b>				
Successful aging	Ref.		Ref.	
Non-successful aging	1.953(0.702-5.436)	2.068(0.739-5.784)	2.994(1.090-8.226)*	3.105(1.128-8.543)*
Absence of major disease	Ref.		Ref.	
Major disease	3.195(1.815-5.626)***	3.299(1.865-5.835)***	2.063(1.269-3.352)**	2.080(1.276-3.380)**
Freedom from disability	Ref.		Ref.	
Disability	3.670(2.031-6.631)***	3.868(2.132-7.018)***	2.085(1.202-3.614)**	2.169(1.246-3.777)**
High cognitive function	Ref.		Ref.	
Not high cognitive function	1.306(0.741-2.300)	1.374(0.775-2.437)	2.378(1.436-3.938)**	2.532(1.520-4.217)***
No depressive symptoms	Ref.		Ref.	
Depressive symptoms	1.131(0.634-2.017)	1.164(0.651-2.081)	1.743(1.080-2.814)*	1.785(1.102-2.890)*
Active social engagement in life	Ref.		Ref.	
Not active social engagement in life	1.598(0.896-2.850)	1.633(0.914-2.918)	1.121(0.694-1.810)	1.140(0.705-1.841)
<b>75 years old and above</b>				
Successful aging	Ref.		Ref.	
Non-successful aging	2.583(0.340-19.642)	2.677(0.346-20.702)	NA	
Absence of major disease	Ref.		Ref.	
Major disease	4.367(1.583-12.044)**	4.027(1.435-11.297)**	1.375(0.478-3.959)	1.236(0.425-3.598)
Freedom from disability	Ref.		Ref.	
Disability	1.839(0.586-5.776)	1.984(0.620-6.352)	0.819(0.186-3.601)	0.690(0.155-3.081)
High cognitive function	Ref.		Ref.	
Not high cognitive function	2.341(0.800-6.849)	2.359(0.783-7.110)	3.802(1.226-11.787)*	3.008(0.958-9.447)
No depressive symptoms	Ref.		Ref.	
Depressive symptoms	1.093(0.389-3.072)	1.293(0.441-3.789)	0.697(0.242-2.006)	0.661(0.229-1.911)
Active social engagement in life	Ref.		Ref.	

Not active social engagement in life	1.128(0.409-3.112)	1.107(0.393-3.115)	0.625(0.227-1.719)	0.580(0.209-1.680)
<i>Note</i>				
* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$ .				
<sup>a</sup> Unadjusted model.				
<sup>b</sup> Adjusted for model 1 criteria and Marital status, Community type, Education, Income, Smoking, Drinking.				

Table 4 HRs of successful aging in 60-74 years old groups with different education level			
	successful aging	Non-Successful aging	
		Male	Female
<b>Primary school and below (60-74 years old)</b>			
Unadjusted <sup>a</sup>	Ref.	1.632(0.496-5.367)	3.141(1.009-10.068)*
Adjusted <sup>b</sup>	Ref.	1.727(0.522-5.716)	3.272(1.019-10.507)*
<b>Junior high school or above (60-74 years old)</b>			
Unadjusted <sup>a</sup>	Ref.	2.925(0.388-22.053)	2.623(0.343-20.056)
Adjusted <sup>b</sup>	Ref.	3.422(0.448-26.114)	2.884(0.367-22.665)
<i>Note</i>			
* $p < 0.05$			
<sup>a</sup> Unadjusted model.			
<sup>b</sup> Adjusted for model 1 criteria and Marital status, Community type, Income, Smoking, Drinking.			