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# Acceptance of advance care planning and influencing factors from the perspective of the life cycle: a cross-sectional study

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## Abstract

**Background** Advance care planning is an important part of palliative care. Public acceptance is a prerequisite for the widespread development and implementation of advance care planning. However, little is known about the level of public's acceptance and influencing factors of advance care planning across different life cycles.

**Methods** A cross-sectional study in mainland China was conducted from June 20 to August 31, 2022. We used multi-stage sampling strategy to recruit participants. A stepwise linear regression analysis was used to examine the influencing factors in different life cycles (nonage, mature age, middle age and old age).

**Results** The final sample size was 18,002. The average acceptance score of advance care planning of the public throughout the entire life cycle was 64.03. The average score in nonage was 67.13, which is the highest. The average score in mature age was 63.87, in middle age was 63.51, and in old age was 63.54. Multiple linear stepwise regression results indicated that death education support level, well-being index, neighbor relations, health literacy, family social status, and siblings were influencing factors in nonage. Medical insurance, injury events, multiple properties, death education support level, health literacy, family social status, neighbor relation, social support, family health, media contact, and well-being index were influencing factors in mature age. In middle age, region, living alone, depression, debt, houses, death education support level, health literacy, social support, and family social status were influencing factors. In old age, injury event, death education support level, neighbor relation, well-being index, siblings and children were influencing factors.

**Conclusions** This study is the first to compare the Chinese people with different life cycles. It found that the public's acceptance and influencing factors of advance care planning varied across different life cycles. Governments and health care personnel should emphasize autonomy and initiate advance care planning based on different life cycles and individual approaches, then introduce appropriate public health policies into newer and broader fields.

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**Keywords** Life cycle, Advance care planning, Acceptance, China, Cross-sectional study

## Introduction

The trend of global population aging is gradually deepening, and with the occurrence of sudden public health emergencies, people have more opportunities to come into contact with hospitals and discuss death [1]. Advance care planning (ACP) is an important component of modern medicine and a core force of palliative care, with respect for individual autonomy as the fundamental principle, allowing adults of any age or health stage to understand and share their values, goals, and future medical care intentions [2].

Due to the influence of traditional Chinese culture, the public lacks opportunities to discuss future end-of-life medical decisions with family members or medical staff, and discussions on end-of-life topics still face difficulties [3]. In China, organizations such as the “Choice and Dignity Website” run by volunteers and the Beijing Association for Living Will have made efforts to encourage the public to discuss death plans in advance and launch the first “advance care planning” folk text “My Five Wishes” [4]. However, due to the late start and slow development of Advance care planning in China, only Taiwan and Hong Kong have implemented ACP and established relevant systems and laws [5]. In 2022, Shenzhen became the first region in mainland China to achieve legislation on the autonomy of end-of-life healthcare. The popularization and implementation of ACP in China is a long and arduous task [6].

Given the lack of theoretical guidance in previous studies, this study introduced the total life cycle theory and dynamic biopsychosocial model. The Healthy China Action (2019–2030) states that health management should cover the total life cycle [7]. The total life cycle is generally regarded as a complete life process from the emergence, development, decline, to extinction of the research object, and explains that the value form of the research object continuously changes throughout the entire life cycle, and different individuals have similar behavior patterns at the same stage of the cycle [8]. The dynamic biopsychosocial (DBPS) model is an extension of the biopsychosocial model. Unlike traditional biopsychosocial model, the DBPS model specifically divides social factors into interpersonal factors and macro system environmental factors. This model interprets human health behavior as the result of the interplay of biological, psychological, interpersonal, and environmental factors [9].

This study was based on the total life cycle theory and dynamic biopsychosocial model. It was the first attempt to study the acceptance level and influencing factors of advance care planning by the public in different life cycles of nonage, mature age, middle age and old age. And We

analyzed the geographical differences in the acceptance of ACP among participants throughout the entire cycle and each cycle. The study is of great significance for seeking targeted popularization strategies, advancing the medical and health system, and improving the level of medical services.

## Methods

### Survey design and participants

This cross-sectional study used data from a survey we conducted in China from June 20th, 2022 to August 31th, 2022 [10]. We adopt a multi-stage, stratified random sampling method and selected a total of 22 provinces, 5 autonomous regions, and 4 municipalities directly under the central government, including 148 cities, 202 districts and counties, 390 townships and streets, and 780 communities and villages. Each provincial-level administrative region was responsible for the recruitment, training, organization, and coordination of investigators or teams in their respective provinces, with a provincial-level investigator in charge. Each city recruited at least one investigator or one investigation team, and all investigators underwent strict and unified training. Based on the results of China’s seventh population census, quota sampling was conducted on gender, age, and urban-rural areas. The study was registered at the China Clinical Trial Registration Center on June 15th, 2022 (ChiCTR2200061046). The investigators distributed electronic questionnaires one-on-one and face-to-face at the scene to the respondents through the online questionnaire star platform (<https://www.wjx.cn>).

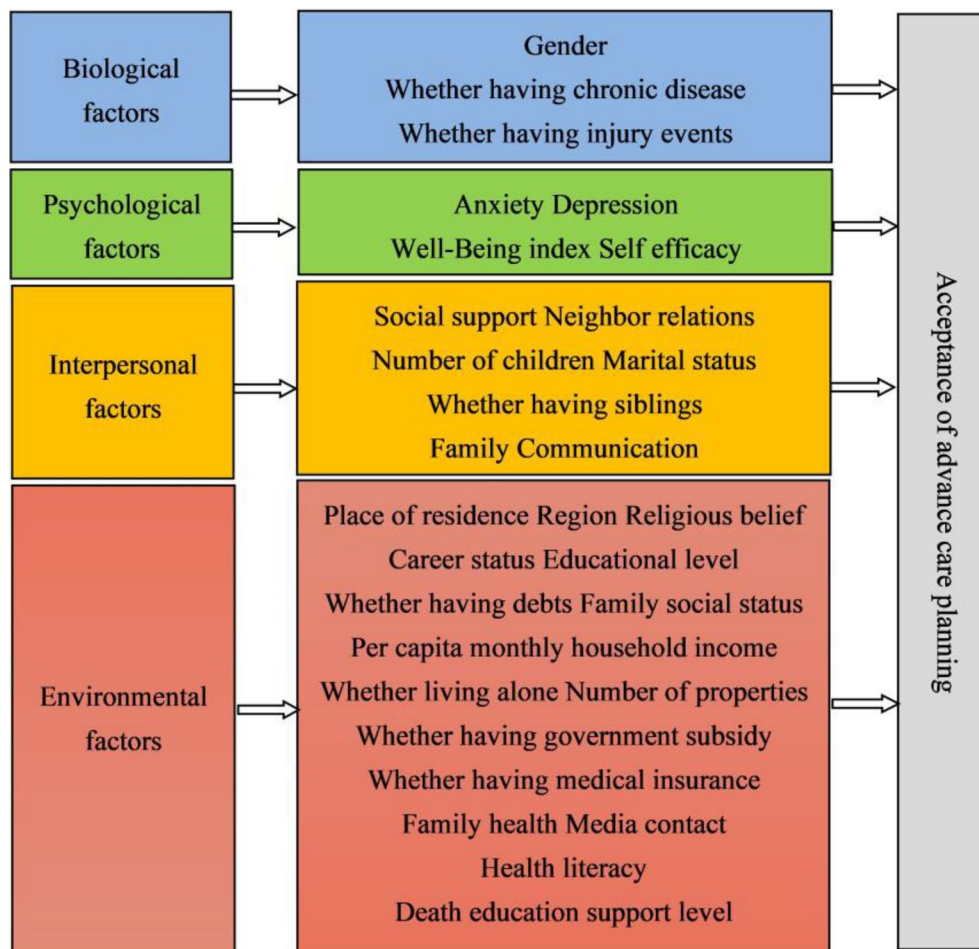
The inclusion criteria included: (1) age  $\geq 12$  years old, (2) Chinese nationality, (3) China’s permanent population (annual outside time  $\leq 1$  month), (4) able to complete the questionnaire survey independently or with investigators’ help, (5) capable of comprehending each item on the questionnaire, (6) voluntarily participated in the study and signed an informed consent form. The exclusion criteria included: (1) with mental disorders or confusion, (2) having cognitive impairment, (3) unwilling to cooperate. It is worth mentioning that in this study, minors aged 12 and above were selected because they already have the basic ability to think independently, and multiple studies have shown that advance care planning should involve adolescents and children [11, 12]. Sample size estimation:  $n = U\alpha^2 \times P(1-P) / \delta^2$ . Acceptance level of ACP for residents in Zhengzhou City (80.1%) was selected as the sample size calculation index  $P$  [13]. The significance level  $\alpha = 0.05$ ,  $U\alpha = 1.96$ . The allowable error  $\delta$  was 0.01, expanded the sample size by 15%, and the minimum sample size of this study was calculated as 7042 cases.

Considering that confounding factors in baseline features might give rise to potential confounding bias, we adjusted important variables through quotas, to help make more reasonable comparisons among groups. In this study, the outcome variable was self-reported acceptance of ACP and the determining factor was the respondent's life cycle. According to the Chinese Medical Association and Geriatrics Association age classification criteria, the life cycle was divided into four subgroups: 12 to 17 years was nonage, 18 to 44 years was mature age, 45 to 59 years was middle age, and 60 years or older was old age [14]. Further we explored the public's acceptance of ACP and the differences among different life cycles. Through literature review, we found that differences in genetics, hormones, and environment between men and women could affect their acceptance of ACP [15]. People in urban areas had a higher awareness of ACP related knowledge and were more inclined to make decisions through ACP [16]. Low income group typically had lower understanding of ACP and was less willing to accept it [17]. Therefore, the variables considered

to be confounding factors were gender, urban-rural, and monthly income.

### Instruments

This questionnaire consisted of two parts, acceptance of ACP and influencing factors. This study incorporates relevant biological, psychological, interpersonal, and environmental factors evaluated by experts based on the DBPS model to investigate the multidimensional characteristics of public acceptance of ACP (Fig. 1). The public reported their acceptance of ACP on their own. After consulting with professionals, we used the Visual Analog Scale (VAS) with a score of 0-100 [18, 19]. Residents chose to score according to their own preferences, and the higher score signified the stronger willingness. Before the questionnaires were distributed, the investigators would systematically educate the respondents to explain the relevant background, concepts, functions, etc. of ACP, so as to ensure that the respondents had a certain understanding of ACP. If the respondents had any questions, the investigators would answer them. At



**Fig. 1** Factors related to ACP acceptance based on dynamic biopsychosocial model

the same time, we used the visual analogue scale (VAS) with a score of 0–100 to evaluate participants' support for death education.

The Generalized Anxiety Disorder-7 (GAD-7) was used to measure anxiety level. The score for each item ranges from 0 to 3, from 'never' to 'almost every day'. The total score of the scale goes from 0 to 21. According to the norm results, a score of 0–4 on the scale indicates no anxiety, 5–9 indicates mild anxiety, 10–14 indicates moderate anxiety, 15–21 indicates severe anxiety [20]. The Cronbach  $\alpha$  coefficient for the GAD-7 was 0.942 in the study.

The Patient Health Questionnaire-9 (PHQ-9) was used to assess respondents' level of depression. The PHQ-9 scale has a total of 9 items, with each item scoring 0 (never) to 3 (almost every day). The overall score range of the scale is 0–27. Based on scoring criteria, a score of 0–4 on the scale indicates no depression, 5–9 indicates mild depression, 10–14 indicates moderate depression, 15–19 indicates moderate to severe depression, 20–27 indicates severe depression [21]. The Cronbach  $\alpha$  coefficient of the scale was 0.920 in the study.

The World Health Organization Five-item Well-Being Index (WHO-5) was used to evaluate subjective well-being. This scale consists of 5 items and adopts a 6-point scoring system, ranging from "0=never before" to "5=all times". The initial score is the sum of the 5 answer indices, with a range of 0–25. A higher total score represents a better quality of life or emotions [22]. The Cronbach  $\alpha$  coefficient of the WHO-5 was 0.946 in the study.

The New General Self-Efficacy Scale–Short Form (NGSES-SF) was used to evaluate one's attitude towards behavioral cognition, developed by Chen et al., translated and revised by Feng Xiao et al., and simplified by Wang Fei and other scholars. The scale consists of three items, with a Likert 5-point score ranging from "1=strongly disagree" to "5=strongly agree". The total score of the scale ranges from 3 to 15, with higher scores representing higher self-efficacy [23]. The Cronbach  $\alpha$  coefficient of the NGSES-SF was 0.924 in the study.

The Perceived Social Support Scale (PSSS) was used to assess the individual's level of perception of social support. The PSSS includes three concise items for self-reporting in the study, measuring perceived emotional support from family, friends, and important others. Each item is scored on a scale of 1–7 from 'strongly disagree' to 'strongly agree'. The total score of PSSS is between 3 and 21, with higher scores representing greater social support [24]. The Cronbach  $\alpha$  coefficient of the PSSS was 0.888 in the study.

The Family Communication Scale-10 (FCS-10) was used to assess family communication situation. Each item use the Likert 5-level scoring method from 'strongly disagree' to 'strongly agree'. The total scores of the scale

range from 10 to 50, with higher scores meaning better communication between family members [25]. The Cronbach  $\alpha$  coefficient of the FCS-10 was 0.966 in the study.

The Family Health Scale–Short Form (FHS-SF) was used to estimate participants' health literacy and family environment. The scale consists of 10 items, with each item using the Likert 5-level scoring method from 'strongly disagree' to 'strongly agree'. Questions 6, 9, and 10 are scored in reverse. The summed score of FHS-SF is between 3 and 21 with higher scores indicating higher levels of family health [26]. The Cronbach  $\alpha$  coefficient of the FHS-SF was 0.825 in the study.

The Health Literacy Scale Short Form-9 (HLS-SF9) was used to assess health literacy. It adopts a 4-level rating (1=very difficult, 2=difficult, 3=easy, 4=very easy). Use a formula to calculate the standardized HL index, which ranges from 0 to 50. A higher index represents a higher level of health literacy. The calculation formula is,  $\text{index} = (\text{mean} - 1) * (50/3)$  [27]. The Cronbach  $\alpha$  coefficient of the HLS-SF9 was 0.937.

A 6-item self-made scale was used to measure the frequency of media usage behavior. The scale includes 6 dimensions: social activities, self presentation, social actions, leisure and entertainment, information acquisition, and business transactions. For each item, respondents entered a number from 1 to 5, indicating their frequency of media exposure. The total score of the comprehensive scale is between 6 and 30 points, with higher scores indicating higher frequency of media exposure [28]. The Cronbach  $\alpha$  coefficient of the scale was 0.872 in the study.

## Statistical methods

We analyzed data using SPSS for Windows, Version 26.0 (SPSS, Inc). To test the representativeness of the research sample, we used chi square tests to compare the demographic characteristics of four life cycles participants (i.e. gender, urban-rural distribution, and per capita monthly income of households). Descriptive analysis included the mean and standard deviation of continuous variables, as well as the number and percentage of categorical variables. Compare the differences in acceptance of ACP using t-tests and analysis of variance. No clustering was observed among the respondents (correlation=0.03,  $P < 0.001$ ), so multivariate linear stepwise regression analysis was used to analyze the relevant factors for the public's acceptance score of ACP (inclusion criteria and exclusion criteria respectively were  $P = 0.05$  and  $P = 0.1$ ).

## Results

### Quota results

We collected a total of 31,449 questionnaires, 30,505 met the qualification criteria after performing logical

checks, 21,916 remained after quotas based on Chinese demographic characteristics, and 21,891 remained after excluding 25 residents who had not been in Mainland China in the past three months. After matching baseline data through random sampling, the final sample size was 18,002 (Fig. 2). In our research, we matched gender, urban and rural areas, and per capita monthly household income through random sampling. In our research, we matched gender, urban and rural areas, and per capita monthly household income through random sampling. The reference population for matching criteria was not fixed, and we followed the principle of matching with the least loss of samples. We attempted multiple matches based on different reference population until we obtained balanced baseline data with minimal sample loss. The demographic characteristics of respondents with different life cycles before and after the quota are shown in Table 1. We can distinguish from the  $P$  value that the matching method achieves equilibrium among the selected covariates among the four groups (Table 1).

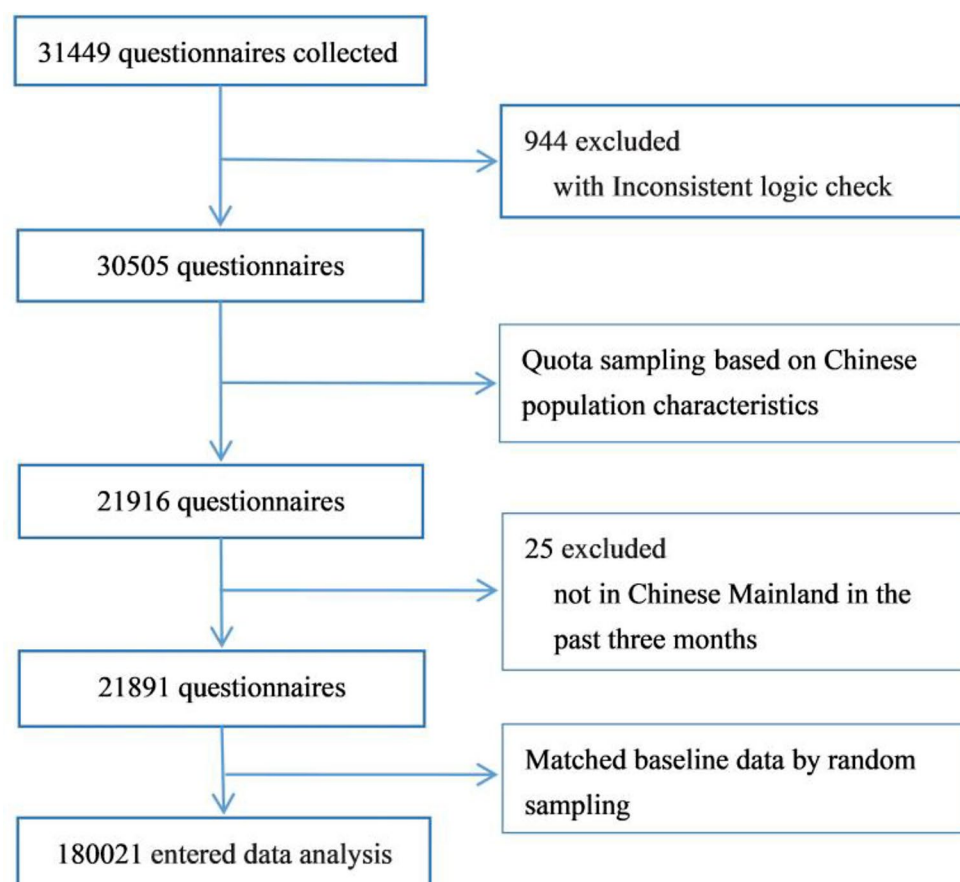
#### Characteristics of respondents in different life cycles

The male to female ratio of the public in different life cycles was close to 1:1. With the evolution of the life

cycle, the proportion of chronic diseases increased, and the highest was 57.22% in old age. The proportion of urban population in each cycle was all above 70.00%. The proportion of old age receiving government subsidies was the highest, at 30.68%. Only a few respondents had religious beliefs, while mature age was the lowest, at 2.47. Most owned a property, and mature age was 59.12%, which was also the lowest. The per capita monthly income of most households was below 6000 yuan, and each cycle was all above 80.00%. The detailed results are displayed in Table 2.

#### Respondents' acceptance of ACP

We collected data from all regions of mainland China, including 22 provinces, 4 municipalities and 5 autonomous regions. The average acceptance score of ACP throughout the entire life cycle varied among different provinces ( $P < 0.001$ ), with Xinjiang having the highest average score of 69.05 (25.90) and Gansu having the lowest score of 54.04 (21.70) (Fig. 3). To further analyze the issue, we compared the acceptance of ACP in different provinces of China by different life cycles. As shown in Fig. 4, Middle-aged respondents in Hunan is the highest at 76.41 (29.98), while middle-aged respondents in



**Fig. 2** Study flowchart



**Table 1** Demographic characteristics of non-matched and matched respondents

Baseline matching characteristics	Non-matched respondents				Matched respondents			
	(n = 21891)				(n = 18002)			
	n (%)				n (%)			
	Nonage	Mature age	Middle age	Old age	Nonage	Mature age	Middle age	Old age
<b>Gender</b>								
Male	1186 (54.78)	5341 (48.56)	2336 (50.69)	2077 (50.41)	859 (51.56)	4381 (48.67)	2121 (50.67)	1558 (49.48)
Female	979 (45.22)	5657 (51.44)	2272 (49.31)	2043 (49.59)	807 (48.44)	4620 (51.33)	2065 (49.33)	1591 (50.52)
P value	<0.001				0.056			
<b>Place of residence</b>								
Rural	703 (32.47)	2814 (25.59)	1378 (29.90)	1822 (44.22)	483 (28.99)	2554 (28.37)	1172 (28.00)	351 (27.02)
Urban	1462 (67.53)	8184 (74.41)	3230 (70.10)	2298 (55.78)	1183 (71.01)	6447 (71.63)	3014 (72.00)	2298 (72.98)
P value	<0.001				0.421			
<b>Per capita monthly household income(CNY<sup>a</sup>)</b>								
≤ 6000	1599 (73.86)	7564 (68.78)	3582 (77.73)	3491 (84.73)	1355 (81.33)	7331 (81.45)	3409 (81.44)	2615 (83.04)
6001–12,000	393 (18.15)	2347 (21.34)	777 (16.86)	499 (12.11)	238 (14.29)	1284 (14.27)	598 (14.29)	425 (13.50)
≥ 12,001	173 (79.91)	1087 (9.88)	249 (5.40)	130 (3.16)	73 (4.38)	386 (4.29)	179 (4.28)	109 (3.46)
P value	<0.001				0.388			

<sup>a</sup>CNY: Chinese Yuan (1 CNY=0.112 GBP=0.139 USD)

Fujian is the lowest at 46.14 (24.60). Most respondents had a high acceptance of advance care planning. Figure 5 shows the population distribution of public acceptance of advance care planning at different scoring scales in different life cycles. Further more, we compared the percentage of acceptance of ACP across different life cycles on different scoring scales (Fig. 6). We can see that regardless of which life cycle, the highest number of respondents choosing the score of 91 to 100. Besides these, the mean score during nonage was 67.13 (25.42), which is the highest, mature age was 63.87 (26.09), middle age was 63.5 (25.99), and old age was 63.54 (24.45) (Table 2).

#### Factors related to ACP acceptance level

Table 3 provides multiple linear stepwise regression results for respondents with different life cycles. We can find that public in nonage with higher scores of death education support level ( $\beta=0.58$ ), well-being index ( $\beta=0.08$ ), neighbor relations ( $\beta=0.04$ ), health literacy ( $\beta=0.06$ ), family social status ( $\beta=0.05$ ), were more willing to accept advance care planning, while having siblings ( $\beta=-0.04$ ) may hinder it. Mature aged public with medical insurance ( $\beta=0.02$ ), injury events ( $\beta=0.03$ ), multiple properties [2 ( $\beta=0.02$ ) or  $\geq 3$  ( $\beta=0.02$ )], and higher scores of death education support level ( $\beta=0.57$ ), health literacy ( $\beta=0.06$ ), family social status ( $\beta=0.06$ ), neighbor relation ( $\beta=0.05$ ), social support ( $\beta=0.05$ ), family health ( $\beta=0.02$ ), media contact ( $\beta=0.02$ ), had a greater acceptance, and well being index ( $\beta=-0.03$ ) probably was a hindrance factor. Moreover, in middle age, resident living in Western China ( $\beta=-0.04$ ), living alone ( $\beta=-0.03$ ), feeling mild depression ( $\beta=-0.05$ ) more likely refused advance care planning, and debt ( $\beta=0.04$ ), house[1 ( $\beta=0.06$ ) or 2 ( $\beta=0.04$ ) or  $\geq 3$  ( $\beta=0.05$ )], death education support

level ( $\beta=0.58$ ), health literacy ( $\beta=0.08$ ), social support ( $\beta=0.06$ ), family social status ( $\beta=0.04$ ) were contributing factors. In addition, for the elderly, injury event ( $\beta=0.04$ ), death education support level ( $\beta=0.62$ ), neighbor relation ( $\beta=0.08$ ), well-being index ( $\beta=0.06$ ) were driving factors, while having siblings ( $\beta=-0.03$ ) and having a child ( $\beta=-0.06$ ) perhaps were negative factors.

#### Discussion

##### Analysis of the acceptance status of advance care planning

This survey was based on the national sample of the public ( $\geq 12$  years old) in mainland China. The national sample could explore the differences and universality of provinces and life cycles. Our research showed that residents in different regions had different levels of acceptance of advance care planning, with Hunan, Xinjiang, and Beijing ranking among the top three in terms of acceptance scores, which were significantly higher than those in other regions. The acceptance scores of Gansu and Ningxia were significantly lower than other regions. It possibly was influenced by sample size, demographic characteristics, and of course, it might also be related to many factors such as local economy, culture, environment, and the development level of ACP. In mainland China, there are few public promotion activities and organizations except for the Beijing Life Wills Promotion Association and the later established Shenzhen Life Wills Promotion Association. Chinese people lack an effective way to obtain information about advance care planning. Studies in Japan, Australia, and Canada indicated that non-governmental organizations and legislative organizations were important driving factors for the development of ACP [29–31]. Medical personnel and the

**Table 2** Respondent characteristics and ACP acceptance in different life cycles

Variables	Nonage			Mature age			Middle age			Old age		
	n(%)	M ± SD	P	n(%)	M ± SD	P	n(%)	M ± SD	P	n(%)	M ± SD	P
<b>Total</b>	1666(100.00)	67.13 ± 25.42	NA <sup>a</sup>	9001(100.00)	63.86 ± 26.09	NA	4186(100.00)	63.51 ± 25.99	NA	3149(100.00)	63.54 ± 24.45	NA
<b>P</b>	< 0.001 <sup>b</sup>											
<b>Gender</b>												
Male	859(51.56)	68.04 ± 25.24	0.129	6381(48.67)	61.74 ± 26.61	< 0.001	2121(50.67)	62.26 ± 26.26	0.002	1558(49.48)	63.46 ± 24.44	0.840
Female	807(48.44)	66.15 ± 25.58		4620(51.33)	65.87 ± 25.43		2065(49.33)	64.79 ± 25.66		1591(50.52)	63.63 ± 24.47	
<b>Highest educational level</b>												
Junior high or below	978(58.70)	66.37 ± 24.80	0.170	1100(12.22)	59.12 ± 26.21	< 0.001	1565(37.39)	61.63 ± 25.02	< 0.001	2001(63.54)	62.92 ± 24.30	0.035
Senior high or specialty	627(37.64)	68.57 ± 26.55		3418(37.97)	62.00 ± 26.80		1691(40.40)	63.59 ± 26.10		843(26.77)	63.86 ± 24.99	
Undergraduate or above	61(3.66)	64.43 ± 22.92		4483(49.81)	66.45 ± 25.21		930(22.22)	66.53 ± 27.13		305(9.69)	66.75 ± 23.75	
<b>Region</b>												
Eastern China	609(36.55)	68.01 ± 26.14	0.015	3027(33.63)	64.96 ± 26.77	0.001	1367(32.66)	65.48 ± 26.28	< 0.001	1426(45.28)	65.80 ± 23.15	< 0.001
Central China	505(30.31)	68.82 ± 24.55		3068(34.09)	64.14 ± 26.18		1427(34.09)	63.50 ± 26.19		823(26.14)	62.33 ± 25.36	
Western China	552(33.13)	64.6 ± 25.25		2906(32.29)	64.42 ± 25.19		1392(33.25)	61.57 ± 25.38		900(28.58)	61.09 ± 25.30	
<b>Whether having government subsidy</b>												
No	1562(93.76)	66.86 ± 25.53	0.098	8044(89.37)	63.81 ± 26.26	0.589	3702(88.44)	63.09 ± 26.10	0.004	2183(69.32)	63.38 ± 24.92	0.572
Yes	104(6.24)	71.13 ± 23.44		957(10.63)	64.27 ± 24.60		484(11.56)	66.68 ± 24.95		966(30.68)	63.91 ± 23.36	
<b>Whether having chronic disease</b>												
No	1559(93.58)	67.34 ± 25.29	0.201	7735(85.93)	63.56 ± 25.99	0.008	2736(65.36)	63.37 ± 25.72	0.637	1347(42.78)	64.81 ± 24.42	0.012
Yes	107(6.42)	64.08 ± 27.17		1266(14.07)	65.70 ± 26.59		1450(34.64)	63.77 ± 26.50		1802(57.22)	62.60 ± 24.43	
<b>Whether having injury events</b>												
No	1388(83.31)	66.92 ± 25.10	0.452	7574(84.15)	63.49 ± 25.89	0.002	3657(87.36)	63.77 ± 25.89	0.093	2767(87.87)	63.37 ± 24.51	0.273
Yes	278(16.69)	68.17 ± 27.00		1427(15.85)	65.85 ± 27.01		529(12.64)	61.73 ± 26.63		382(12.13)	64.83 ± 23.99	
<b>Place of residence</b>												
Rural	483(28.99)	65.21 ± 26.53	0.049	2554(28.37)	61.22 ± 26.15	< 0.001	1172(28.00)	61.81 ± 25.32	0.008	851(27.02)	63.85 ± 24.14	0.670
Urban	1183(71.01)	67.91 ± 24.92		6447(71.63)	64.91 ± 25.99		3014(72.00)	64.17 ± 26.23		2298(72.98)	63.43 ± 24.57	
<b>Marital status</b>												
Have no partner	1662(99.76)	67.07 ± 25.42	0.007	5108(56.75)	65.35 ± 25.84	< 0.001	304(7.26)	61.96 ± 28.48	0.322	482(15.31)	63.51 ± 25.89	0.973
Have a partner	4(0.24)	92.25 ± 8.06		3893(43.25)	61.91 ± 26.28		3882(92.74)	63.63 ± 25.79		2667(84.69)	63.55 ± 24.18	
<b>Whether having religious belief</b>												
No	1601(96.10)	67.10 ± 25.51	0.860	8779(97.53)	63.90 ± 26.07	0.432	4009(95.77)	63.58 ± 25.95	0.391	2912(92.47)	63.75 ± 24.45	0.105
Yes	65(3.90)	67.69 ± 23.27		222(2.47)	62.50 ± 26.60		177(4.23)	61.87 ± 26.97		237(7.53)	61.07 ± 24.37	
<b>Whether living alone</b>												
No	1514(90.88)	67.29 ± 25.27	0.418	7502(83.35)	63.98 ± 26.04	0.346	3771(90.09)	63.95 ± 25.78	0.002	2710(86.06)	63.53 ± 24.33	0.943
Yes	152(9.12)	65.53 ± 26.91		1499(16.65)	63.28 ± 26.32		415(9.91)	59.54 ± 27.59		439(13.94)	63.62 ± 25.20	
<b>Number of children</b>												
0	1661(99.70)	67.11 ± 25.44		5492(61.02)	65.18 ± 25.69	< 0.001	185(4.42)	60.87 ± 26.22	0.017	227(7.21)	64.34 ± 26.03	0.411
1	1(0.06)	81.00		1950(21.66)	62.62 ± 26.46		2335(55.78)	64.61 ± 26.62		1113(35.34)	64.01 ± 24.04	
2	2(0.12)	86.00 ± 16.97	0.550	1357(15.08)	60.43 ± 26.89		1324(31.63)	62.05 ± 25.65		1024(32.52)	63.86 ± 23.59	

Table 2 (continued)

Variables	Nonage			Mature age			Middle age			Old age		
	n(%)	M ± SD	P	n(%)	M ± SD	P	n(%)	M ± SD	P	n(%)	M ± SD	P
≥ 3	2(0.12)	52.00 ± 2.83		202(2.24)	63.24 ± 25.19		342(8.17)	63.06 ± 22.32		785(24.93)	62.23 ± 25.63	
Number of properties owned												
0	237(14.23)	65.62 ± 26.42	0.003	1303(14.48)	58.94 ± 27.93	< 0.001	314(7.50)	58.75 ± 30.14	< 0.001	235(7.46)	62.23 ± 25.40	< 0.001
1	1033(62.00)	65.81 ± 24.72		5321(59.12)	63.04 ± 25.75		2788(66.60)	62.92 ± 25.41		2250(71.45)	63.04 ± 24.26	
2	305(18.31)	71.48 ± 26.63		1770(19.66)	67.85 ± 24.91		881(21.05)	65.22 ± 25.57		534(16.96)	63.89 ± 24.17	
≥ 3	91(5.46)	71.40 ± 24.73		607(6.74)	70.04 ± 25.65		203(4.85)	71.56 ± 26.74		130(4.13)	73.27 ± 25.25	
Whether having siblings												
No	544(32.65)	70.80 ± 24.36	< 0.001	3077(34.19)	65.61 ± 26.26	< 0.001	401(9.58)	63.53 ± 25.67	0.986	583(18.51)	65.17 ± 24.37	0.076
Yes	1122(67.35)	65.35 ± 25.74		5924(65.81)	62.96 ± 25.95		3785(90.42)	63.51 ± 26.03		2566(81.49)	63.18 ± 24.46	
Whether having debts												
No	1103(66.21)	66.31 ± 26.06	0.061	4888(54.31)	63.51 ± 25.96	0.165	2696(64.41)	63.04 ± 25.78	0.117	2635(83.68)	63.38 ± 24.90	0.354
Yes	563(33.79)	68.72 ± 24.06		4113(45.69)	64.28 ± 26.23		1490(35.59)	64.36 ± 26.37		514(16.32)	64.39 ± 22.01	
Per capita monthly household income(CNY <sup>c</sup> )												
≤ 6000	1355(81.33)	66.42 ± 25.57	0.052	7331(81.45)	63.01 ± 26.20	< 0.001	3409(81.44)	62.88 ± 25.88	< 0.001	2615(83.04)	63.10 ± 24.64	0.065
6001–12,000	238(14.29)	70.62 ± 24.20		1284(14.27)	67.57 ± 24.60		598(14.29)	65.39 ± 25.86		425(13.5)	65.35 ± 22.14	
≥ 12,001	73(4.38)	68.92 ± 25.73		386(4.29)	67.70 ± 27.31		179(4.28)	69.27 ± 27.63		109(3.46)	67.18 ± 27.84	
Whether having medical insurance												
No	285(17.11)	66.18 ± 28.37	0.528	707(7.85)	58.53 ± 29.03	< 0.001	166(3.97)	58.65 ± 24.90	0.014	180(5.72)	70.03 ± 26.57	0.001
Yes	1381(82.89)	67.32 ± 24.77		8294(92.15)	64.32 ± 25.77		4020(96.03)	63.71 ± 26.02		2969(94.28)	63.15 ± 24.26	
Career status												
Student	1631(97.90)	67.22 ± 25.23	0.633	3551(39.45)	66.54 ± 25.25	< 0.001	50(1.19)	55.06 ± 24.32	< 0.001	17(0.54)	53.82 ± 26.86	0.011
Have a job	171(1.02)	59.59 ± 32.41		3947(43.85)			2252(53.80)	64.74 ± 25.92		109(3.46)	57.83 ± 26.29	
Have no job	18(1.08)	65.83 ± 34.81		1503(16.70)	60.05 ± 27.57		1884(45.01)	62.26 ± 26.04		3023(96.00)	63.81 ± 24.34	
Depression												
No depression	774(46.46)	69.27 ± 25.47	0.004	3440(38.22)	65.23 ± 25.87	< 0.001	2023(48.33)	66.3 ± 25.37	< 0.001	1503(47.73)	67.23 ± 24.15	< 0.001
Mild depression	475(28.51)	64.89 ± 24.27		3321(36.90)	63.96 ± 25.58		1406(33.59)	60.58 ± 26.55		1041(33.06)	60.30 ± 24.74	
Moderate depression	219(13.15)	65.63 ± 24.73		1348(14.98)	60.89 ± 25.55		484(11.56)	60.17 ± 25.73		409(12.99)	58.41 ± 23.13	
Moderate to severe depression	121(7.26)	62.20 ± 27.51		642(7.13)	61.03 ± 28.09		220(5.26)	62.03 ± 25.24		157(4.99)	63.62 ± 23.28	
Severe depression	77(4.62)	71.35 ± 28.14		250(2.78)	67.09 ± 31.05		53(1.27)	71.47 ± 27.60		39(1.24)	68.33 ± 24.34	
Anxiety												
No anxiety	935(56.12)	68.10 ± 25.81	0.042	4465(49.61)	64.97 ± 25.74	< 0.001	2469(58.98)	65.10 ± 25.88	< 0.001	1812(57.54)	65.99 ± 24.78	< 0.001
Mild anxiety	455(27.31)	66.28 ± 24.12		3124(34.71)	63.30 ± 25.55		1283(30.65)	61.57 ± 26.07		998(31.69)	60.06 ± 23.59	
Moderate anxiety	180(10.80)	62.72 ± 25.57		1075(11.94)	60.06 ± 27.19		357(8.53)	58.89 ± 25.19		290(9.21)	59.90 ± 23.08	
Severe anxiety	96(5.76)	69.95 ± 26.56		337(3.74)	66.50 ± 30.40		77(1.84)	66.12 ± 27.74		49(1.56)	65.78 ± 26.48	

<sup>a</sup>NA: not applicable

<sup>b</sup><0.001: There was a statistically significant difference in acceptance among the four groups, nonage> mature age, middle age, old age. While there were no statistically significant differences between the others

<sup>c</sup>CNY: Chinese Yuan (1 CNY ≈ 0.112 GBP ≈ 0.139 USD)



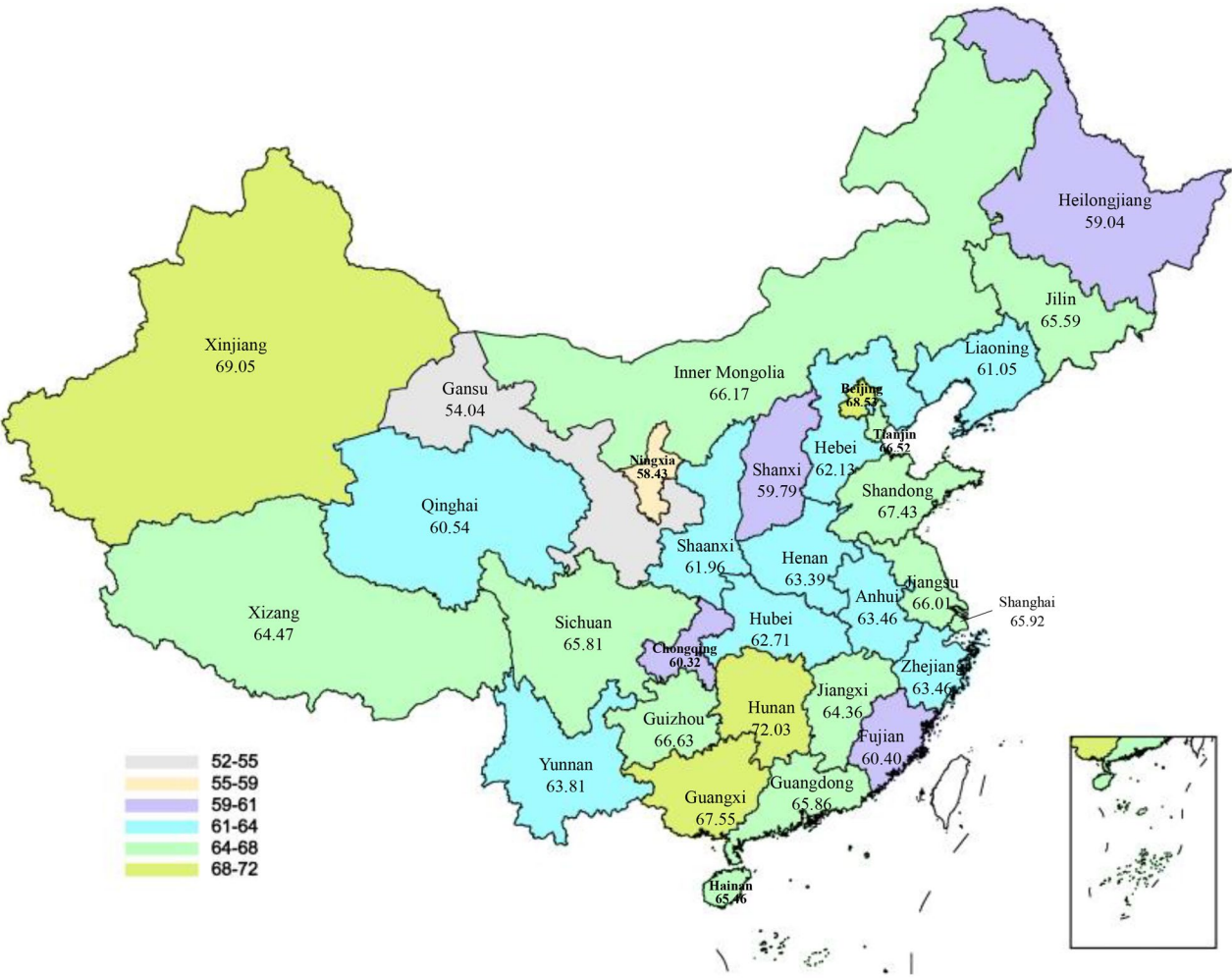


Fig. 3 Average acceptance of ACP in different provinces of China throughout all life cycle

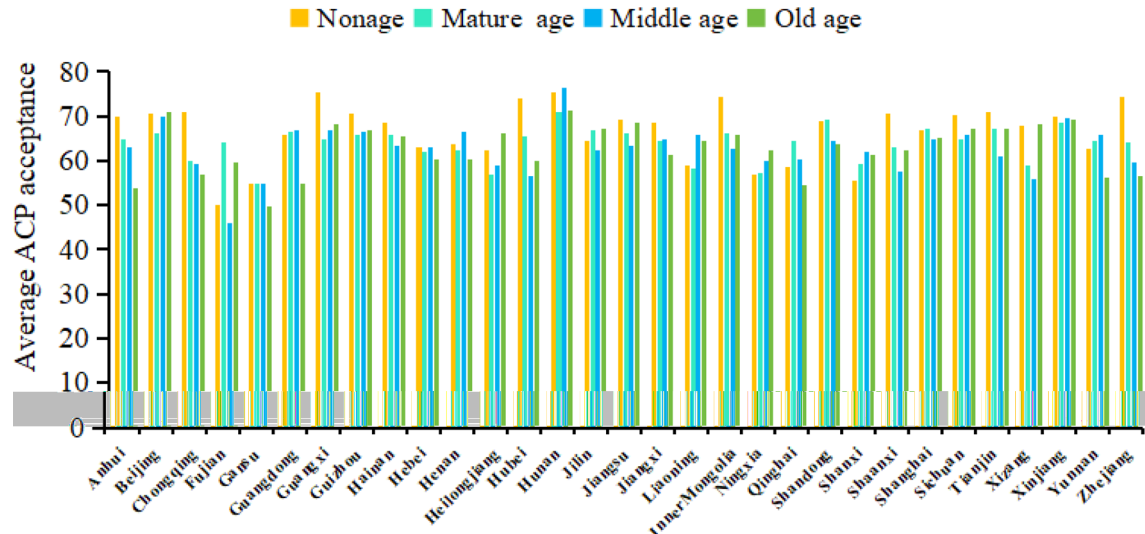
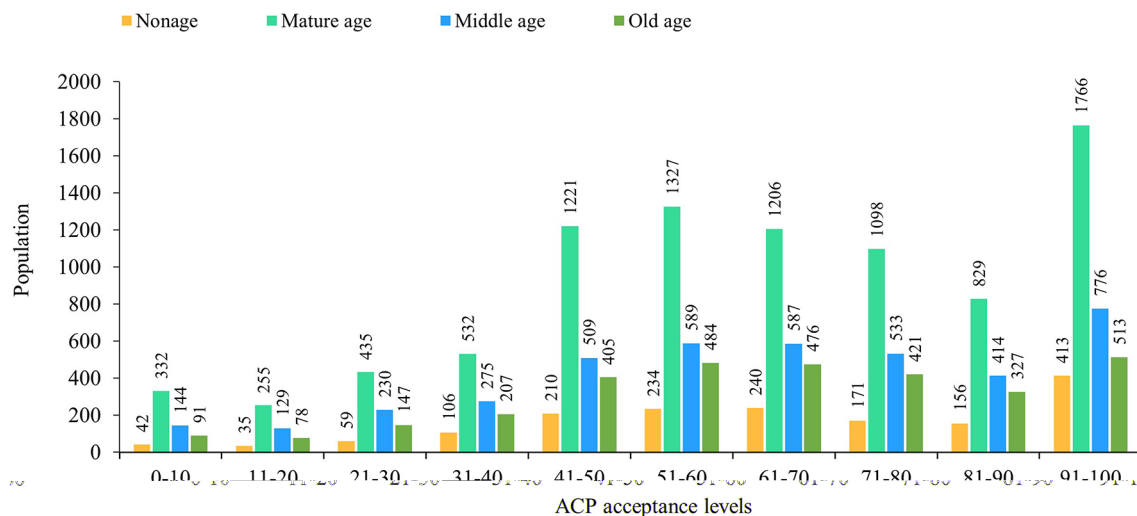
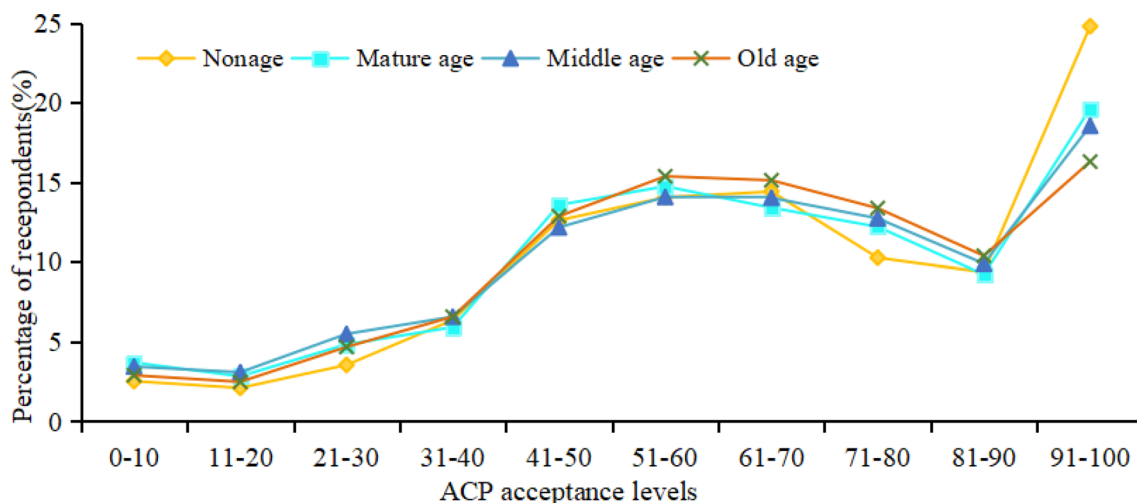


Fig. 4 Average ACP acceptance in different provinces of China for different life cycles



**Fig. 5** Population distribution on a different scale of ACP acceptance in different life cycles (total = 18002)



**Fig. 6** Comparison of ACP acceptance levels in different life cycles

government should provide targeted and evidence-based recommendations based on regional differences.

In addition, in terms of life cycle, the acceptance score of ACP among nonage was significantly higher than mature age, middle age, and old age. This discovery was consistent with previous surveys conducted in China on patients and family members, and young patients were also more willing to know the truth about the disease and make medical decisions in advance than older patients [32]. This may be because young people have more active thinking, less susceptible to the influence of traditional Chinese customs, and more receptive to new things. Moreover, many schools attach great importance to life education, making students aware of the value and significance of life. However, Zhu, Huber and others found that older community residents tend to adopt a positive attitude towards advance care planning [13, 33]. There are differences between the research results, which may

be related to the local social culture and the development level of ACP.

### Analysis of influencing factors on the acceptance of advance care planning

#### Biological factors

Our research showed that during mature age, participants who had experienced injury events such as car accidents, falls, burns, suffocation or suspension, drowning, poisoning, firearm injuries, blunt instrument injuries, and sharp instrument injuries within the past year were more willing to accept ACP. Lum et al. found that fearing of poor experiences during death and near death increased patients' participation in advance care planning [34]. These experiences perhaps exacerbate residents' anxiety about the future and hope to alleviate this anxiety through advance care planning. Given that accidental injuries (such as car accidents, drug overdoses,

**Table 3** Stepwise regression analysis of factors related to ACP acceptance in different life cycles

Variables	Unstandardized coefficients		Standardized coefficients	t	P	95%CI		VIF <sup>e</sup>
	B	SE	Beta			Lower limit	Upper limit	
<b>Nonage<sup>a</sup></b>								
<b>Whether having siblings (Ref: No)</b>								
Yes	-2.17	1.06	-0.04	-2.04	0.042	-4.25	-0.08	1.06
<b>Death education support level</b>	0.54	0.02	0.58	29.62	<0.001	0.50	0.56	1.07
<b>Happiness index</b>	0.32	0.09	0.08	3.61	<0.001	0.15	0.49	1.34
<b>Neighbor relations scores</b>	0.86	0.41	0.04	2.10	0.036	0.06	1.67	1.22
<b>Health literacy scores</b>	0.26	0.10	0.06	2.62	0.009	0.06	0.45	1.22
<b>Family social status scores</b>	0.85	0.39	0.05	2.18	0.029	0.09	1.61	1.16
<b>Mature age<sup>b</sup></b>								
<b>Whether having medical insurance (Ref: No)</b>								
Yes	2.10	0.82	0.02	2.58	0.010	0.51	3.70	1.04
<b>Whether having injury events (Ref: No)</b>								
Yes	2.01	0.60	0.03	3.37	0.001	0.84	3.19	1.03
<b>Number of properties owned (Ref: 0)</b>								
2	1.53	0.77	0.02	1.98	0.048	0.01	3.04	2.04
≥ 3	2.19	1.06	0.02	2.07	0.038	0.12	4.26	1.52
<b>Death education support level</b>	0.54	0.01	0.57	65.34	<0.001	0.52	0.55	1.13
<b>Health literacy scores</b>	0.28	0.05	0.06	5.81	<0.001	0.19	0.38	1.31
<b>Family social status scores</b>	1.25	0.18	0.06	7.11	<0.001	0.90	1.59	1.13
<b>Neighbor relations scores</b>	0.91	0.18	0.05	5.09	<0.001	0.56	1.29	1.13
<b>Perceived social support scores</b>	0.42	0.08	0.06	5.34	<0.001	0.26	0.57	1.91
<b>Happiness index</b>	-0.22	0.05	-0.05	-4.70	<0.001	-0.31	-0.13	1.72
<b>Media contact scores</b>	0.13	0.06	0.02	2.19	0.029	0.01	0.24	1.54
<b>Middle age<sup>c</sup></b>								
<b>Whether having debts (Ref: No)</b>								
Yes	2.12	0.67	0.04	3.14	0.002	0.80	3.44	1.07
<b>Whether living alone (Ref: No)</b>								
Yes	-2.50	1.08	-0.03	-2.31	0.021	-4.62	-0.37	1.07
<b>Region (Ref: Eastern China)</b>								
Western China	-2.30	0.78	-0.04	-2.95	0.003	-3.83	-0.77	1.38
<b>Number of properties owned (Ref: 0)</b>								
1	3.03	1.23	0.06	2.46	0.014	0.62	5.44	3.45
2	2.78	1.38	0.04	2.02	0.044	0.08	5.48	3.23
≥ 3	6.22	1.90	0.05	3.28	0.001	2.50	9.94	1.70
<b>Depression (Ref: No depression)</b>								
Mild depression	-2.90	0.86	-0.05	-3.36	0.001	-4.59	-1.21	1.70
<b>Death education support level</b>	0.54	0.01	0.58	46.04	<0.001	0.52	0.57	1.08
<b>Health literacy scores</b>	0.43	0.07	0.08	6.03	<0.001	0.29	0.57	1.27
<b>Perceived social support scores</b>	0.43	0.10	0.06	4.39	<0.001	0.24	0.62	1.28
<b>Family social status scores</b>	0.56	0.16	0.04	3.51	<0.001	0.25	0.87	1.04
<b>Old age<sup>d</sup></b>								
<b>Whether having injury events (Ref: No)</b>								
Yes	2.93	1.02	0.04	2.88	0.004	0.94	4.93	1.04
<b>Whether having siblings (Ref: No)</b>								
Yes	-2.01	0.92	-0.03	-2.19	0.029	-3.82	-0.21	1.20
<b>Number of children (Ref: 0)</b>								
1	-2.86	1.41	-0.06	-2.03	0.042	-5.61	-0.10	4.23
<b>Death education support level</b>	0.59	0.01	0.62	43.98	<0.001	0.57	0.62	1.12

**Table 3** (continued)

Variables	Unstandardized coefficients		Standardized coefficients	t	P	95%CI		VIF <sup>e</sup>
	B	SE	Beta			Lower limit	Upper limit	
Neighbor relations scores	1.63	0.31	0.08	5.27	< 0.001	1.03	2.24	1.27
Happiness index	0.24	0.07	0.06	3.59	< 0.001	0.11	0.37	1.39

<sup>a</sup>In stepwise regression analyses, R<sup>2</sup> value was 0.407, adjusted R<sup>2</sup> value was 0.397, F value was 174.9, and D-W value was 1.977

<sup>b</sup>In stepwise regression analyses, R<sup>2</sup> value was 0.389, adjusted R<sup>2</sup> value was 0.387, F value was 190.5, and D-W value was 2.015

<sup>c</sup>In stepwise regression analyses, R<sup>2</sup> value was 0.399, adjusted R<sup>2</sup> value was 0.395, F value was 102.3, and D-W value was 2.013

<sup>d</sup>In stepwise regression analyses, R<sup>2</sup> value was 0.443, adjusted R<sup>2</sup> value was 0.438, F value was 95.5, and D-W value was 1.976

<sup>e</sup>VIF: variance inflation factor

etc.) are the main cause of death among young people, they should be given the opportunity to understand and independently choose available medical care plans, and should be encouraged to complete advance care planning.

Gender and the presence of chronic diseases had statistical significance in the corresponding life cycle in univariate analysis, but the above variables were not included in the multiple regression model, indicating that they might be related to the acceptance of ACP, but do not play roles as the main influencing factors.

### Psychological factors

Advance care planning can be seen as a health behavior, and mental status can directly influence the execution of people's health-related behaviors [35]. Interestingly, our study found an opposite effect of the well-being index on acceptance of ACP in nonage, mature age and old age. Respondents in mature age with higher well-being index were more reluctant to accept advance care planning, while respondents in nonage and in old age with higher well-being index had higher acceptance. It may be because the residents in mature age with a high well-being index are full of expectations and vision for life, lack the perception of future risks [36]. For minors, happiness comes more from the family. People with strong happiness tend to have family harmony, which makes them more inclined to make family decision and express their desire for advance care planning. For the elderly, happiness is the sum of lifetime achievement and victory. Older people with a higher happiness index are able to face death more calmly, they are better able to adapt to daily decisions, perceive and interpret social situations.

Another important discovery was that for the middle-aged population, individuals with mild depression were more likely to reject advance care planning than those without depression. Ye et al. also found the impact of depression on attitudes towards ACP in their research [37]. In fact, people with a tendency towards depression are more likely to be indecisive and have difficulty making plans in advance. However, the relationship between depression and advance care planning is not clear. No

significant impact of depression on the public in other life cycles was found in this study.

Other factors, such as anxiety and self-efficacy, were not included in the regression model. Although self-reported anxiety and self-efficacy have not shown notable relationship with the acceptance of ACP, future clinical diagnosis or prospective studies may still affect respondents' attitudes towards advance care planning.

### Interpersonal factors

This survey found that there was a significant correlation between social support and the acceptance of ACP during adolescence and middle age, and residents with higher social support scores were more likely to accept advance care planning. Previous studies showed similar results [38]. But this phenomenon was not been found in other life cycles. This doesn't seem strange, as it aligns with the famous psychologist Erikson's theory of psychosocial development. For adolescence and middle-aged people, the establishment of social support systems seems more important than other cycles, so it is not difficult to understand the significant impact of social support on advance care planning during adolescence and middle age.

In terms of neighbor relationship factors, we found that the better the relationship between family and neighbors, the higher their acceptance of advance care planning during nonage, adolescence age, and old age. However, no significant difference was found during middle age. As is well known, middle-aged people play multiple social roles, and interpersonal relationships are more complex. Neighborhood relationships are only a small part of the social system, and the degree of their relationship may not have a important impact on a certain behavior or plan.

In addition, we found that there was a negative correlation between the presence of siblings and the acceptance of advance care planning in nonage and old age. Meanwhile, we also found that elderly people with one child may be less willing to accept advance care planning than those without children. A cross-sectional survey in Australia also found the similar result [39]. The only children

probably receive more attention from their parents, and they are more eager to express a certain wish. Elderly people with siblings and one child are reluctant to discuss death with family members, probably because they want to protect their loved ones from being affected.

### **Environmental factors**

The results of this study indicated that compared to the eastern region, middle-aged participants in the western region had a lower willingness to accept advance care planning. The significant gap in economic development, educational resources, and medical level between the eastern and western regions of China may explain this phenomenon [40].

We found that middle-aged people who live alone were more likely to refuse advance care planning. This was also consistent with the research findings on social support. Gallagher's study also showed the similar result [41]. Middle aged individuals who live alone are more likely to engage in discussions with peers rather than family members because their family members are not around.

Those mature-aged people with medical insurance had a more positive attitude towards advance care planning. A previous foreign study [42] was similar to our survey results. This may be due to the less severe financial burden resulting from illness among those with medicare reimbursement. The less financial pressure, the more active in making medical decisions.

The study represented that middle aged people with debt had a more positive attitude towards advance care planning than those without debt. Presumably because they do not want to increase the financial burden on their families, so they express the desire to reject meaningless life support in advance.

We also found that participants in mature age with two or three properties, as well as middle-aged people with one or two or three or more properties, were more willing to accept advance care planning. Koss et al. also showed that private housing had a promoting effect on advance care planning [43]. In China, real estate is often regarded as an indicator of a person's socioeconomic status. Generally speaking, people with higher socioeconomic status receive a wider range of medical and educational resources, and pay more attention to the quality of death.

In mature age, we discovered that the more frequent media exposure, the stronger the willingness to accept advance care planning. The report by Cruz etc. also confirmed this result [44]. It is not difficult to understand that people can obtain more knowledge about healthcare, life education, and advance care planning through various media. Therefore, the higher the frequency of media exposure, the more likely it is to accept advance care planning. However, in other life cycles, we didn't find

an obvious relationship between the frequency of media exposure and ACP acceptance. This may be related to the distinct preferences of different populations in terms of exposure to media types and browsing information content.

Furthermore, we found that minors, mature-aged people, and middle-aged people with higher family social status had higher acceptance of advance care planning. Martina et al. elucidated the important role of family factors in medical decision-making [45]. Family social status is a symbol of economy, quality, power, and ability. The higher the family status means the better the access to resources, the higher the cognitive level, and the stronger the self-control ability, which have a profound impact on people's judgments and decisions. However, no significant impact was found between family social status and the acceptance of ACP among the elderly. Therefore, targeted improvement of the accessibility and availability of advance care planning is crucial for those with low social status.

We found that during nonage, mature age, and middle age, respondents with higher levels of health literacy had a stronger willingness to accept advance care planning. This was similar to the results of multiple studies both domestically and internationally [17, 46]. One research found that people with higher levels of health literacy paid more attention to health and health knowledge, and had a greater understanding of diseases or treatment plans [47]. However, no significant impact of health literacy on the acceptance of advance care planning among the elderly was been found. Therefore it is important to select the appropriate population and methods to start the ACP program in mainland China.

It is worth mentioning that our study found that the support for death education was crucial for the impact of advance care planning. The higher the support for death education among respondents in all cycles, the higher their acceptance of advance care planning. A study also indicated that death education had a promoting effect on the acceptance and discussion of advance care planning [18]. Due to the unique cultural background of our country, people often do not want to mention or think about topics related to death, believing that discussing things related to death is unlucky, and thus showing an attitude of avoiding death.

Previous studies showed a positive correlation between religious belief, educational level, income, and willingness to accept advance care planning [48–50]. However, our study didn't discover a clear correlation between these factors and ACP acceptance. Besides, we didn't find a notable influence of family health and communication on advance care planning. On the one hand, it may be due to the generally low level of understanding of advance care planning among Chinese people [31], and on the other



hand, it is probably because of the protection for the family members.

In summary, this study analyzed the acceptance and related factors of advance care planning among different life cycle groups, and found that social factors and support for death education were key variables in improving the acceptance of ACP. Identifying these factors may help guide health personnel on how to best support the unique needs of each cycle group. However, based on Asian cultural characteristics, the dominant position of family members and doctors were considered crucial in the patient's end-of-life decision-making process [51]. Therefore, efforts should be made to promote education and training for advance care planning among health-care professionals, collaborate with the media, education related groups, and national institutions, strengthen life and death education for community residents, fundamentally solve problems, and promote the promotion and dissemination of ACP related knowledge.

Furthermore, different measures can be developed for different life cycles. Improvement of happiness can increase the acceptance of ACP among nonage. For mature-aged people, improving the economic level, strengthening medical insurance policies and media exposure of health related knowledge, can change their attitudes towards ACP. In educating middle-aged people, special attention should be paid to those who live alone, suffer from depression and poverty crisis. Raising awareness of ACP among progeny and siblings and play the role of family members are conducive to the promotion of ACP for the elderly. People in nonage have a relatively high level of acceptance of ACP, and they should strive to play a leading role in the family, enhance the willingness of adults and elderly people to accept it. By creating a healthy family atmosphere, the public can understand that ACP is a new starting point for humanitarianism, thereby choose it.

### Strengths and limitations

To our knowledge, this study is the first large-scale study on the acceptance of advance care planning among Chinese public aged 12 years and older, and it is also the first study of its kind to compare the acceptance of respondents and influence factors across different life cycles. It has guiding significance for the development of personalized and targeted intervention measures. Next, the survey questionnaire covers a comprehensive range of factors, it is more in line with the holistic and comprehensive idea under the modern medical mode. In addition, this study assigns quotas to participants in each life cycle based on gender, urban-rural, etc. to reduce the impact of confounding variables and inconsistent baselines on the results, in order to provide a more reasonable comparison of responses from different life cycle groups.

At the same time, the study also has certain limitations. Firstly, the study has boundedness due to its cross-sectional analysis. Secondly, advance care planning is a very sensitive topic, and self reporting is susceptible to comprehension or recall errors, leading to reporting bias. Thirdly, this study cannot determine the number of participants who reviewed online posters or surveys but decided not to complete the survey, thus, no response bias can be evaluated. Therefore, the reporting of research results needs to be cautious. Future research can further confirm its causal relationship through prospective studies. At the same time, a multidimensional scale of acceptance of advance care planning can be developed to reduce reporting bias.

### Conclusions

According to the results of this study, the public in mainland China has a high acceptance of advance care planning. As a public health initiative, it should be reasonable to popularize and implement advance care planning. In the decision-making process, the individual views of patients should be advocated and respected. In addition, we found that the acceptance and influencing factors of advance care planning varied among respondents with different life cycles. Due to individual differences among the public in each cycle, healthcare professionals and policy makers should emphasize voluntariness and targeting, personalized plans for initiating and implementing advance care planning.

### Acknowledgements

The authors express heartfelt thanks to all the all the participants in the study.

### Author contributions

Y.W., S.W., M.H., Y.W. designed the study; Y.W., L.C., X.S. collected data; Y.W., S.W., X.Z., Y.D. performed data analysis; Y.W., S.W. wrote the main manuscript. All authors reviewed the results, and revise and approved the final version of the manuscript.

### Funding

This study was funded by the General Project of Humanities and Social Sciences Research of the Ministry of Education (23YJA840006), Natural Science Foundation of Shaanxi Provincial Department of Education (23JK0615), and Xi'an Siyuan University Campus level Scientific Research Project (XASYB-B2307).

### Data availability

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

### Declarations

#### Ethics approval and consent to participate

This study scheme was approved by the Ethics Research Committee of the Health Culture Research Center of Shaanxi, China (JKWH-2022-02). All respondents voluntarily participated in this survey and obtained informed consent. For minors, we did not involve the collection of biological samples. We had an informed consent form specifically designed for minors that had been reviewed by the ethics review committee, and participants read and signed it in the presence of their parents or legal guardians. This study was conducted in accordance with the local legislation and institutional requirements.



## Consent for publication

Not applicable.

## Competing interests

The authors declare no competing interests.

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Received: 24 August 2024 / Accepted: 21 November 2024

Published online: 20 December 2024

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