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Acceptance level of advance care planning and its associated factors among the public: A nationwide survey

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Abstract

Background Advance care planning (ACP) can contribute to individuals making decisions about their healthcare preferences in advance of serious illness. Up to now, the acceptance level and associated factors of ACP among the public in China remain unclear. This study aims to investigate the acceptance level of ACP in China and identify factors associated with it based on the socioecological model.

Methods A total of 19,738 participants were included in this survey. We employed a random forest regression analysis to select factors derived from the socioecological model. Multivariate generalized linear model analysis was then conducted to explore the factors that were associated with the acceptance level of ACP.

Results On a scale ranging from 0 to 100, the median score for acceptance level of ACP was 64.00 (IQR: 48.00–83.00) points. The results of the multivariate generalized linear model analysis revealed that participants who scored higher on measures of openness and neuroticism personality traits, as well as those who had greater perceptions of social support, higher levels of health literacy, better neighborly relationships, family health, and family social status, were more likely to accept ACP. Conversely, participants who reported higher levels of subjective well-being and greater family communication levels demonstrated a lower likelihood of accepting ACP.

Conclusions This study identified multiple factors associated with the acceptance level of ACP. The findings offer valuable insights that can inform the design and implementation of targeted interventions aimed at facilitating a good death and may have significant implications for the formulation of end-of-life care policies and practices in other countries facing similar challenges.

Keywords Advance care planning, Adults, Socioecological model, China, National survey

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Introduction

Advance care planning (ACP) refers to the process by which competent adults of any age and health status make advance decisions about their future end-of-life medical care preferences based on their circumstances and document and share these preferences with family members and healthcare providers [1]. ACP has gained increasing recognition worldwide as an important strategy to improve end-of-life care quality and people-oriented outcomes [2, 3]. Despite this recognition, ACP remains less widely popularized in many countries, including China [4]. China has the world's largest population and is experiencing a rapid aging process, which raises concerns about the quality of end-of-life care for older adults [5].

There have been some studies on participating and accepting ACP in Western countries. For example, a general population survey in Norway showed that more than nine out of ten people from 1035 responses wanted to participate in ACP [6]. A study on the residents of nursing homes in the United Kingdom found that about 79.5% of the participants chose ACP [7]. The research in China has been primarily focused on subpopulations, such as community healthcare workers [8], patients with chronic diseases [9], and cancer patients [10]. None of the existing studies have investigated the acceptance level of ACP among the public across China. As the completion of ACP relies on improved public awareness and greater openness to discuss death and end-of-life care [11], it is crucial to gain an understanding of the factors associated with ACP acceptance among the public.

The socioecological model provides a theoretical framework for comprehensively elucidating the intricate interconnections among individual characteristics, behaviors, interpersonal networks, community, and policy levels [12]. The socioecological model has been extensively applied in research to explore health-related attitudes and underlying determinants within a multidimensional framework [13–15]. In our research, we embrace the socioecological model as a theoretical framework to probe the acceptance level of ACP within the Chinese context.

Therefore, the purpose of this study is to explore the acceptance level of ACP and its associated factors based on the socioecological model among the public in China, providing important insights to improve end-of-life care in China.

Methods

Survey design and population

Between June 20 and August 31, 2022, a survey was carried out in 31 provinces, autonomous regions, special administrative regions, and municipalities in China. The survey employed a multistage sampling approach, based on the quota attributes of China's seventh national census data for cities, including gender, age, and urban-rural distribution. The specific quota method has been previously reported [16].

The present study utilized a face-to-face survey to collect questionnaire data. This study included Chinese participants aged 12 years or older who voluntarily consented to participate, possessed the cognitive ability to understand the questionnaire items, and could complete the questionnaires independently. For participants who possessed cognitive capability but were unable to complete the questionnaires due to mobility constraints, assistance with questionnaire completion was provided by interviewers.

The initial PBICR survey enrolled 21,916 participants. After excluding 2178 participants < 18 years old, a total of 19,738 participants were finally included in this study.

The Ethics Research Committee of the Health Culture Research Center of Shaanxi approved this study (No. JKWH-2022-02). All participants were required to provide informed consent before the collection of data, and the confidentiality of all collected data was anonymously and strictly maintained.

Survey instruments

Based on the prior studies [14, 17–19], this study comprehensively encompasses multi-level factors that may be associated with participants' acceptance level of ACP, based on the socioecological model depicted in Fig. 1. This study included factors across five levels: individual characteristics level (i.e., age group (18–44 years old, 45–64 years old, and ≥65 years old), gender (male vs. female), education level (junior high school and below, senior school and middle special school, junior college, and bachelor degree and above), diagnosed chronic disease (no vs. yes), personality traits, self-efficacy, health literacy, depression symptoms, anxiety symptoms, well-being, career status (student, have no job, have a job), and medical insurance type (self-pay, resident basic medical insurance, employee basic medical insurance, and commercial and multiple insurances)); individual behaviors level (i.e., smoking status (no vs. yes), drinking alcohol (no vs. yes), regular exercise (no vs. yes)); interpersonal networks level (i.e., have a spouse (no vs. yes), neighbor relations (a glide rating scale ranging from 1 (very poor) to 7 (very good)), perceived social support, family health, family communication, number of siblings (0, 1, 2, ≥3), family social status (a glide rating scale ranging from 1 (lowest) to 7 (highest)), family per capita monthly income (≤3000 Chinese Yuan, 3001–6000 Chinese Yuan, and ≥6001 Chinese Yuan)); community level (i.e., urban-rural distribution (urban vs. rural)).

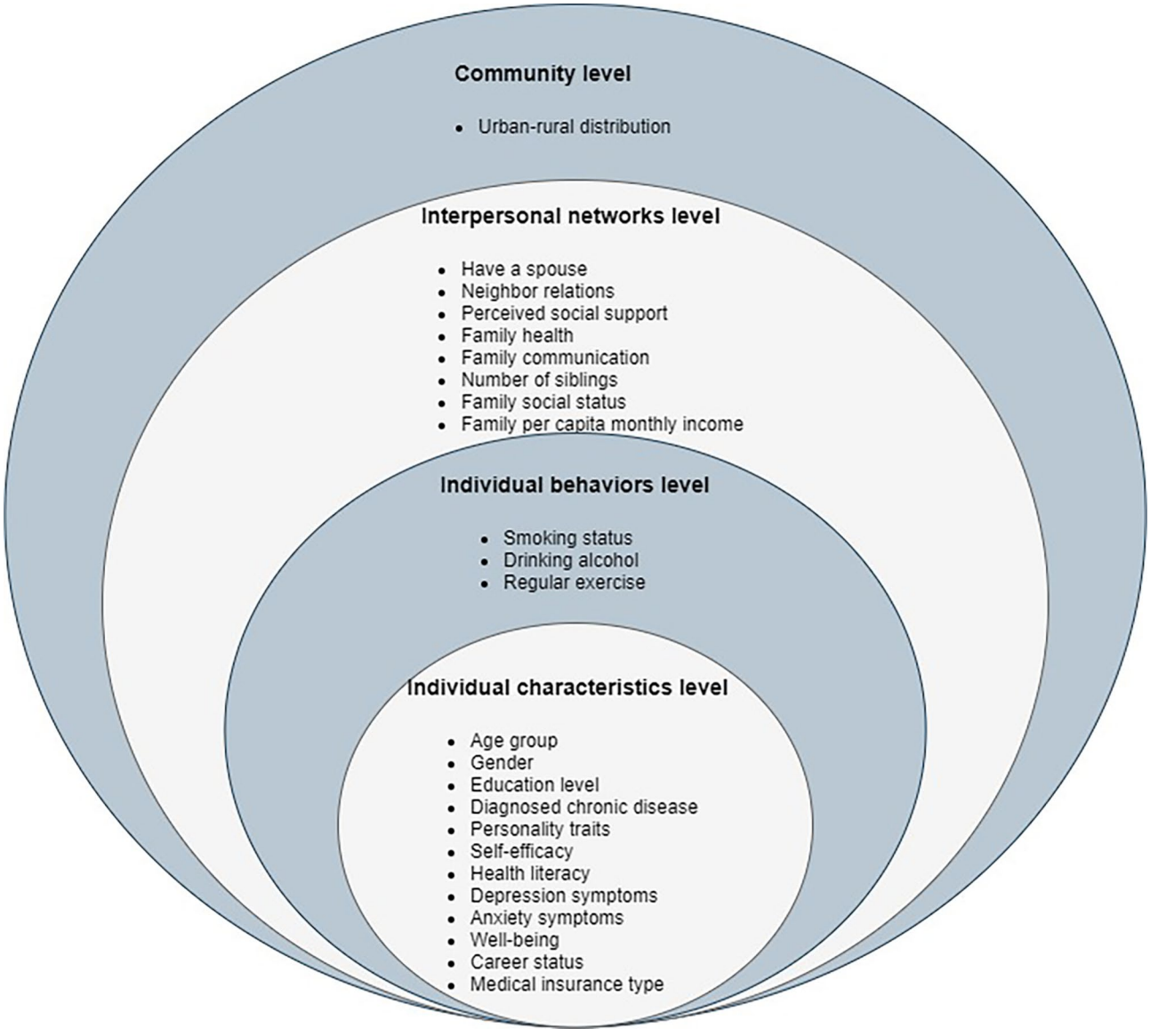

Fig. 1 Factors associated with the acceptance of advance care planning based on the socioecological model

Acceptance level of ACP

Before initiating the research, researchers explained ACP to participants. ACP (also known as advance directives, living wills, or healthcare proxies) refers to the process by which competent adults of any age and health status make advance decisions about their future end-of-life medical care preferences based on their circumstances and document and share these preferences with family members and healthcare providers [1]. After ensuring participants' comprehension of ACP, we assessed their attitudes by asking, 'What is your acceptance level of ACP?' The response was rated on a glide rating scale ranging from 0 (not accepting) to 100 (very accepting).

Personality traits

The personality traits of the participants were evaluated using the Big Five Inventory-10 (BFI-10) [20]. The BFI-10 includes five dimensions of personality: extraversion, agreeableness, conscientiousness, neuroticism, and openness. Each item is rated on a 5-point scale, scoring from 1 (totally disagree) to 5 (totally agree). Reverse items are scored from 1 (totally agree) to 5 (totally disagree). Higher scores represent higher magnitudes of personality traits. Given the limited number of items (i.e., two items per dimension) in the BFI-10, Cronbach's α was not calculated [21].

Self-efficacy

The perceived self-efficacy of the participants was assessed using the New General Self-Efficacy Scale-Short Form (NGSES-SF) [22]. The NGSES-SF consists of three items. Each item is rated on a 5-point scale, scoring from 1 (strongly disagree) to 5 (strongly agree). Total summed NGSES-SF scores ranged from 3 to 15, with higher scores indicating greater perceived self-efficacy. In this study, Cronbach's α of the NGSES-SF was 0.924.

Health literacy

The health literacy of the participants was measured using the Health Literacy Scale-Short Form (HLS-SF) [23]. The HLS-SF consists of nine items. Each item is rated on a 4-point scale, scoring from 0 (very difficult) to 3 (very easy). Total summed HLS-SF scores ranged from 0 to 27, with higher scores reflecting higher levels of health literacy. In this study, Cronbach's α of the HLS-SF was 0.937.

Depression symptoms

The depression symptoms of the participants were determined using the Patient Health Questionnaire-9 (PHQ-9) [24]. Each item is rated on a 4-point scale, scoring from 0 (never) to 3 (nearly every day). Total summed PHQ-9 scores ranged from 0 to 27, with higher scores conveying more severe depression symptoms. In this study, Cronbach's α of the PHQ-9 was 0.918.

Anxiety symptoms

The anxiety symptoms of the participants were appraised using the Generalized Anxiety Disorder-7 (GAD-7) [25]. Each item is rated on a 4-point scale, scoring from 0 (never) to 3 (nearly every day). Total summed GAD-7 scores ranged from 0 to 21, with higher scores denoting more severe anxiety symptoms. In this study, Cronbach's α of the GAD-7 was 0.940.

Well-being

The well-being of the participants was scrutinized using the World Health Organization Well-Being Index-5 (WHO-5) [26]. Each item is rated on a 6-point scale, scoring from 0 (never before) to 5 (all times). Total summed WHO-5 scores ranged from 0 to 25, with higher scores indicating greater well-being. In this study, Cronbach's α of the WHO-5 was 0.949.

Perceived social support

The perceived social support of the participants was evaluated using the Perceived Social Support Scale (PSSS) [27]. The PSSS consists of three items. Each item is rated on a 7-point scale, scoring from 1 (strongly disagree) to 7 (strongly agree). Total summed PSSS scores ranged from 3 to 21, with higher scores indicating greater levels of perceived social support. In this study, Cronbach's α of the PSSS was 0.886.

Family health

The family health of the participants was assessed using the Family Health Scale-Short Form (FHS-SF) [28]. The FHS-SF comprises four dimensions: family/social/emotional health processes, family healthy lifestyle, family health resources, and family external social supports. The FHS-SF consists of ten items. Each item is rated on a 5-point scale, scoring from 1 (strongly disagree) to 5 (strongly agree). Reverse items are scored from 1 (strongly agree) to 5 (strongly disagree). Total summed FHS-SF scores ranged from 10 to 50, with higher scores conveying higher levels of family health. In this study, Cronbach's α of the FHS-SF was 0.827.

Family communication

The family communication of the participants was assessed using the Family Communication Scale-10 (FCS-10) [29]. Each item is rated on a 5-point scale, scoring from 1 (strongly disagree) to 5 (strongly agree). Total summed FCS-10 scores ranged from 10 to 50, with higher scores denoting greater levels of family communication. In this study, Cronbach's α of the FCS-10 was 0.966.

Statistical analysis

First, the Kolmogorov–Smirnov test was utilized to assess the normality of continuous variables. Continuous variables manifested non-normal distribution and were depicted using the median and interquartile range (IQR). Categorical variables were represented as numbers and percentages. Second, a random forest regression analysis was utilized to assess the significance of 28 variables derived from the socioecological model. The random forest regression method is a robust machine learning approach that integrates the concepts of ensemble learning and decision trees to produce precise predictions and assess the significance of variables [30]. This method is an expansion of the decision tree algorithm, in which numerous decision trees are generated using random subsets of both the data and features. The forecasts from these individual trees are subsequently combined to generate the ultimate output, resulting in enhanced resilience and predictive accuracy in comparison to a solitary decision tree. A significant benefit of random forest regression lies in its capacity to evaluate the significance of input variables within the model. Through the examination of each feature's influence on model performance, valuable insights into the intrinsic relationships can be presented within the data [31]. In this study, a random forest regression analysis was utilized to evaluate the significance of 28 factors originating from

the socioecological model. This method facilitated the ranking of variables according to their respective impact on the predictive efficacy of the model, thereby offering valuable insights into the primary determinants within the socioecological framework. Third, we integrated the top 50% of important factors from the random forest regression analysis into a univariate generalized linear model to examine the association between the study variables and the acceptance level of ACP. Fourth, study variables that exhibited statistical significance at the $P<0.05$ level in the univariate generalized linear model were included in the multivariate generalized linear model for further examination. The variance inflation factor (VIF) test was utilized to identify collinearity, with a max VIF of 2.41, indicating no collinearity.

All two-tailed $P<0.05$ was deemed to be statistically significant. All statistical analyses were executed utilizing Stata version 16.0 (StataCorp, College Station, TX, USA) and R software version 4.3.0.

Results

Participant characteristics

A total of 19,738 participants were included. In this study, 49.47% of participants were male, 27.99% had a medical diagnosis of chronic disease, 52.78% reported engaging in regular physical exercise, and 30.49% resided in rural regions. Participants had a median score of 64.00 (IQR: 48.00–83.00) points for accepting ACP (Table 1).

Insert Table 1**here.**

3.2 Factors associated with the acceptance level of ACP

The random forest regression analysis revealed that the top 14 factors associated with the acceptance level of ACP were as follows: family health, health literacy, perceived social support, neighbor relations, family communication, family social status, well-being, openness, education level, neuroticism, agreeableness, extraversion, self-efficacy, depression symptoms (Table 2). The results of the univariate generalized linear model analysis indicated that, except for the education level, all other factors showed a significant association with the acceptance level of ACP ($P<0.05$) (Table 3). The findings obtained from the multivariate generalized linear model analysis suggested that participants demonstrating greater levels of openness ($\beta=0.92$) and neuroticism ($\beta=0.28$) personality traits, enhanced health literacy ($\beta=0.67$), better neighborly relationships ($\beta=1.76$), heightened perceptions of social support ($\beta=0.85$), better family health ($\beta=0.34$), and elevated family social status ($\beta=1.55$), exhibited a proclivity towards accepting ACP. Participants with higher levels of subjective well-being (β = -0.11) and reported greater family communication levels (β = -0.33) showed a reduced likelihood of accepting ACP (Table 4).

Discussion

To our knowledge, this is the first study to investigate the acceptance level of ACP and its associated factors through a nationwide survey in China among the public. Based on a rating scale ranging from 0 to 100, individuals reported a median score of 64, indicating a moderately positive level of intention to accept ACP, as the midpoint of the scale is 50.

This study determined factors associated with the acceptance level of ACP utilizing the socioecological model, which can serve as a foundation for developing customized promotion strategies. Our results indicated that openness and neuroticism personality traits, health literacy, and well-being at the individual characteristics level; neighbor relations, perceived social support, family health, family communication, and family social status at the interpersonal network level were associated with acceptance level of ACP.

The study participants showed a moderately positive level of accepting ACP, as the midpoint of the scale is 50. This result is consistent with prior studies carried out in Hong Kong [32] and Macao [33], which are special administrative regions of China. The relatively positive attitudes towards ACP may be attributed to several underlying factors specific to the cultural and social context. One possible explanation is Chinese have respect for older adults, family values, and filial piety [34, 35]. These characteristics may shape attitudes towards end-of-life care and decision-making [36, 37], including the acceptance level of ACP. Another factor that may contribute to the relatively positive attitudes towards ACP is the increasing awareness of the importance of end-of-life care and the benefits of ACP [38, 39]. As populations age and healthcare needs to evolve, there may be a growing recognition of the need for a good death and person-centered care at the end of life [40, 41]. This may lead to a greater acceptance level of ACP as a means of ensuring that individuals' wishes are respected and their dignity is maintained [42]. These factors may have created an environment that is more receptive to ACP and more supportive of person-centered care at the end of life.

Our study found a positive association between the acceptance level of ACP and higher levels of perceived social support and better neighbor relationships, which is consistent with prior research findings among older adults [43, 44]. The underlying reasons for these associations may involve multiple factors. First, individuals with stronger social support and good neighbor relationships may have easier access to information and resources related to ACP, which can increase their awareness and understanding of ACP [45, 46]. Second, social support may provide emotional and psychological encouragement for individuals to engage in proactive health behaviors, such as ACP [47, 48]. Third, social support and good

Table 1 Characteristics of participants ($n = 19738$)

Variables	Value
Individual characteristics level	
Age group (year), n (%)	
18–44	11,006 (55.76)
45–64	5940 (30.09)
≥ 65	2792 (14.15)
Gender, n (%)	
Male	9765 (49.47)
Female	9973 (50.53)
Education level, n (%)	
Junior high school and below	5730 (29.03)
Senior school and middle special school	4366 (22.12)
Junior college	2482 (12.57)
Bachelor degree and above	7160 (36.28)
Diagnosed chronic disease, n (%)	
No	14,213 (72.01)
Yes	5525 (27.99)
Personality traits (scores), median (IQR)	
Extraversion	6.00 (5.00–7.00)
Agreeableness	7.00 (6.00–8.00)
Conscientiousness	7.00 (6.00–8.00)
Neuroticism	6.00 (5.00–6.00)
Openness	6.00 (6.00–7.00)
Self-efficacy (scores), median (IQR)	11.00 (9.00–12.00)
Health literacy (scores), median (IQR)	18.00 (16.00–22.00)
Depression symptoms (scores), median (IQR)	6.00 (2.00–9.00)
Anxiety symptoms (scores), median (IQR)	4.00 (0–7.00)
Well-being (scores), median (IQR)	15.00 (10.00–20.00)
Career status, n (%)	
Student	4453 (22.56)
Have no job	5109 (25.88)
Have a job	10,176 (51.56)
Medical insurance type, n (%)	
Self-pay	1302 (6.60)
Resident basic medical insurance	10,486 (53.13)
Employee basic medical insurance	4732 (23.97)
Commercial and multiple insurances	3218 (16.30)
Individual behaviors level	
Smoking status, n (%)	
No	16,619 (84.20)
Yes	3119 (15.80)
Drinking alcohol, n (%)	
No	15,395 (78.00)
Yes	4343 (22.00)
Regular exercise, n (%)	
No	9320 (47.22)
Yes	10,418 (52.78)
Interpersonal networks level	
Have a spouse, n (%)	
No	7321 (37.09)
Yes	12,417 (62.91)
Neighbor relations (scores), median (IQR)	6.00 (5.00–7.00)
Perceived social support (scores), median (IQR)	15.00 (12.00–18.00)
Family health (scores), median (IQR)	39.00 (34.00–44.00)

Table 1 (continued)

Variables	Value
Individual characteristics level	
Family communication (scores), median (IQR)	39.00 (32.00–42.00)
Number of siblings, n (%)	
0	5146 (26.07)
1	4641 (23.51)
2	3849 (19.50)
≥ 3	6102 (30.91)
Family social status (scores), median (IQR)	4.00 (4.00–5.00)
Family per capita monthly income (Chinese Yuan), n (%)	
≤ 3000	6517 (33.02)
3001–6000	8126 (41.17)
≥ 6001	5095 (25.81)
Community level	
Urban-rural distribution, n (%)	
Urban	13,720 (69.51)
Rural	6018 (30.49)
Acceptance of advance care planning (scores), median (IQR)	64.00 (48.00–83.00)

Note: Total percentages within categories may not equal 100% due to rounding

Table 2 Feature importance of accepting advance care planning

Variables	Feature importance (%)
Family health	19.00
Health literacy	18.80
Perceived social support	13.10
Neighbor relations	7.60
Family communication	6.50
Family social status	4.70
Well-being	4.40
Openness	4.10
Education level	3.00
Neuroticism	2.60
Agreeableness	2.50
Extraversion	2.20
Self-efficacy	1.90
Depression symptoms	1.50
Conscientiousness	1.40
Anxiety symptoms	1.10
Career status	1.00
Medical insurance type	0.80
Number of siblings	0.80
Family per capita monthly income	0.70
Gender	0.40
Urban-rural distribution	0.30
Have a spouse	0.30
Smoking status	0.30
Regular exercise	0.30
Diagnosed chronic disease	0.30
Age group	0.20
Drinking alcohol	0.20

neighbor relationships may facilitate discussions and decisions regarding end-of-life care and advance directives [49], which may have a positive impact on attitudes toward ACP. In addition, social support may help eliminate barriers or stigma associated with discussing end-of-life care [50], thus increasing the likelihood of ACP acceptance level. These results offer valuable insights for policymakers. By emphasizing the reinforcement of social support networks within communities, promoting community engagement, and fostering supportive relationships, policymakers can establish environments conducive to discussions and decision-making regarding end-of-life care preferences.

The results of this study showed that individuals with greater health literacy and family health levels were inclined to accept ACP. Health literacy is the ability of an individual to obtain, comprehend, and use health information [51]. This ability may be associated with an individual's acceptance level of ACP. If individuals have adequate understanding and knowledge of ACP, they may be more likely to accept ACP and actively participate in the decision-making and implementation of ACP plans [52, 53]. Additionally, individuals with higher health literacy may be more willing to proactively explore various medical options and more likely to request information and support from healthcare professionals regarding ACP [54, 55]. Family health, as measured by four dimensions including family/social/emotional health processes, family healthy lifestyle, family health resources, and family external social supports [28], could also play a role in individuals' attitudes towards ACP. Previous research has suggested that individuals from families with healthy lifestyles and adequate health resources are more likely to

Table 3 Univariate generalized linear model of associations between study variables and the acceptance of advance care planning ($n = 19738$)

Variables	β (95% CI)	*P* value
Family health	0.74 (0.69, 0.80)	< 0.001
Health literacy	0.98 (0.92, 1.05)	< 0.001
Perceived social support	1.36 (1.27, 1.46)	< 0.001
Neighbor relations	3.22 (2.93, 3.50)	< 0.001
Family communication	0.39 (0.35, 0.43)	< 0.001
Family social status	2.42 (2.14, 2.69)	< 0.001
Well-being	0.51 (0.45, 0.57)	< 0.001
Openness	1.76 (1.53, 2.00)	< 0.001
Education level		
Junior high school and below	Reference	
Senior school and middle special school	2.25 (1.24, 3.26)	< 0.001
Junior college	0.04 (-1.17, 1.24)	0.954
Bachelor degree and above	5.44 (4.55, 6.33)	< 0.001
Neuroticism	-0.54 (-0.78. -0.31)	< 0.001
Agreeableness	1.54 (1.30, 1.78)	< 0.001
Extraversion	0.84 (0.62, 1.07)	< 0.001
Self-efficacy	1.75 (1.60, 1.89)	< 0.001
Depression symptoms	-0.32 (-0.39, -0.25)	< 0.001

Table 4 Multivariate generalized linear model of associations between study variables and the acceptance of advance care planning ($n = 19738$)

Variables	β (95% CI)	*P* value
Family health	0.34 (0.27, 0.41)	< 0.001
Health literacy	0.67 (0.59, 0.76)	< 0.001
Perceived social support	0.85 (0.70, 0.99)	< 0.001
Neighbor relations	1.76 (1.46, 2.05)	< 0.001
Family communication	-0.33 (-0.39, -0.27)	< 0.001
Family social status	1.55 (1.27, 1.82)	< 0.001
Well-being	-0.11 (-0.18, -0.03)	0.007
Openness	0.92 (0.68, 1.15)	< 0.001
Neuroticism	0.28 (0.03, 0.52)	0.029
Agreeableness	0.15 (-0.11, 0.41)	0.253
Extraversion	-0.16 (-0.38, 0.07)	0.183
Self-efficacy	0.15 (-0.06, 0.36)	0.162
Depression symptoms	-0.02 (-0.09, 0.05)	0.655

prioritize their health and engage in proactive healthcare planning [56, 57]. This study underscores the importance of policymakers implementing interventions and policies that address both individual health literacy and family health dynamics to facilitate the adoption of ACP. By targeting these fundamental factors, policymakers can establish a conducive atmosphere that motivates individuals and families to participate in ACP conversations and make well-informed choices regarding their future healthcare preferences.

Our study revealed that individuals with higher family social status had a greater willingness to accept ACP. Similarly, a previous study also found that social status was positively associated with ACP adoption [58]. This result may be because individuals from high-social-status families may have access to better healthcare resources, including access to some healthcare providers who can give guidance and support in making end-of-life care decisions [59]. Moreover, individuals from high-social-status families may have greater social capital that can provide emotional and informational support on end-of-life care decision-making [60, 61]. Additionally, family social status was associated with individual attitudes and beliefs about end-of-life care [62]. Individuals from higher social status families may have been exposed to more discussions and information about end-of-life care, making them more aware of the benefits of advanced care planning. And they may be more likely to view ACP as a responsible and proactive approach to end-of-life care. However, it is important to acknowledge that the concept of social status is multifaceted and complex. Future research could be beneficial in exploring the specific

aspects of social status that are most strongly associated with ACP acceptance level. Addressing social inequalities and providing appropriate support and resources to individuals from lower social status is important for ensuring equitable access to healthcare services and promoting ACP.

In this study, our findings suggest that the personality traits of openness and neuroticism are factors associated with the acceptance level of ACP. Prior studies indicated that individuals with high openness tend to be more receptive to new experiences and ideas [63], and may be more likely to seek information and engage in proactive health behaviors [14], which may make them more willing to consider and accept new healthcare approaches, including ACP. Individuals with high levels of neuroticism may be more fearful and uncertain regarding the future and death [64, 65], leading them to be more willing to engage in end-of-life planning as a coping mechanism. Additionally, they may have a greater need for control and may view ACP as a means of exerting control over their future healthcare decisions [66]. Hence, policymakers should explore personalized education and support programs that consider individual personality traits to enhance the efficacy of strategies aimed at promoting ACP. Furthermore, expanding educational and promotional efforts, including community-based intervention initiatives, could greatly improve acceptance and comprehension of ACP. Potential initiatives may encompass public awareness campaigns disseminated through diverse media outlets, workshops held at community centers or healthcare facilities, and community forums designed to foster transparent conversations regarding end-of-life care preferences.

In addition, we found that individuals with elevated levels of well-being and family communication were less likely to accept ACP. This finding is consistent with previous studies that have shown that individuals with higher levels of well-being may be less likely to engage in end-of-life planning as they may perceive a lower risk of mortality or have a greater sense of control over their health outcomes [67, 68]. Similarly, individuals with strong family communication networks may feel less need for formal advance care planning, as they may rely on informal discussions and family decision-making in the event of a serious illness [69, 70]. It is crucial to acknowledge that these factors do not inherently impede ACP acceptance and could potentially be modified via focused education and support. For instance, individuals with elevated levels of well-being might derive benefits from interventions that underscore the significance of future planning and the potential advantages of ACP, whereas those with robust family communication networks may benefit from education regarding the importance of ACP conversations and the potential benefits of including healthcare providers in the decision-making process.

The present study exhibits various limitations that necessitate consideration. First, our study relied on cross-sectional data, which restricts the ability to make causal inferences regarding the acceptance level of ACP. Second, the data were acquired via self-reported responses, which could potentially be influenced by recall bias. Third, considering the heightened awareness and concerns surrounding health amidst the post-COVID-19 era, there exists a possibility for an overestimation in responses to health-related inquiries, including acceptance level of ACP, family health, and health literacy. Fourth, the disparity in age distribution among the participants constitutes a limitation in this study, with older individuals comprising a minority, approximately 12.74% of the sample. This imbalance in age distribution may introduce bias. As a result, the generalizability of the research findings may be constrained, limiting their applicability to other population groups. Fifth, the study's use of a single 0-100 scale rating to measure the public acceptance level of ACP may present limitations. While this approach offers simplicity, it might not fully capture the intricacies of public attitudes toward ACP. To address this concern, future research could explore incorporating multiple items or constructs to assess different dimensions of public perceptions related to end-of-life care and decision-making. Such a multi-dimensional approach would provide a more comprehensive understanding of the public's perspectives on ACP.

Conclusions

This study has identified that multiple factors at the individual, family, and community levels within the socioecological model framework are associated with the ACP. Therefore, to achieve an effective promotion of ACP, it is imperative to adopt multi-level and multi-dimensional strategies and interventions aimed at enhancing individuals' and societies' awareness and acceptance level of ACP, which in turn will improve the feasibility and sustainability of ACP in practice.

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Author contributions
X.W. and Y.W. shared the first authorship of this work. Conceptualization: X.W. Methodology: X.W. Data validation and analyses: X.W. Data interpretation: X.W. Writing—original draft preparation: X.W. Writing—review and editing: X.W., Y.W., X.B., Q.Q., L.Y., L.G., L.Q., and S.Z. Supervision: X.W., Y.W., X.B., Q.Q., L.Y., L.G., L.Q., and S.Z. Final approval of manuscript: X.W., Y.W., X.B., Q.Q., L.Y., L.G., L.Q., and S.Z.

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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
The Ethics Research Committee of the Health Culture Research Center of Shaanxi approved this study (No. JKWH-2022-02). All participants provided informed consent before data collection, and all data were kept strictly confidential. Informed consent for minors was provided by a parent or legal guardian. All methods in our study were performed following the guidelines and regulations of the Declaration of Helsinki.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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References

1. Sudore RL, Lum HD, You JJ, et al. Defining Advance Care planning for adults: a Consensus Definition from a Multidisciplinary Delphi Panel. J Pain Symptom Manage. 2017;53(5):821–e832821. https://doi.org/10.1016/j.jpainsymman.2016.12.331.
2. Lum HD, Sudore RL, Bekelman DB. Advance Care Planning in the Elderly. Med Clin North Am. 2015;99(2):391–403. https://doi.org/10.1016/j.mcna.2014.11.010.
3. Houben CHM, Spruit MA, Groenen MTJ, et al. Efficacy of Advance Care Planning: a systematic review and Meta-analysis. J Am Med Dir Assoc. 2014;15(7):477–89. https://doi.org/10.1016/j.jamda.2014.01.008.
4. Ni P, Zhou J, Wang ZX, et al. Advance directive and end-of-life care preferences among nursing home residents in Wuhan, China: a cross-sectional study. J Am Med Dir Assoc. 2014;15(10):751–6. https://doi.org/10.1016/j.jamda.2014.06.006.
5. Chen X, Giles J, Yao Y, et al. The path to healthy ageing in China: a Peking University-Lancet Commission. Lancet. 2022;400(10367):1967–2006. https://doi.org/10.1016/s0140-6736(22)01546-x.
6. Sævareid TJL, Pedersen R, Magelssen M. Positive attitudes to Advance Care Planning - a Norwegian General Population Survey. BMC Health Serv Res. 2021;21(1):762. https://doi.org/10.1186/s12913-021-06773-x.
7. Garden G, Usman A, Readman D, et al. Advance care plans in Uk Care Home residents: a service evaluation using a stepped Wedge Design. Age Ageing. 2022;51(3). https://doi.org/10.1093/ageing/afac069.
8. Miao Q, Xing B, Li J, et al. The development of a questionnaire to assess the Willingness of Chinese Community Health Workers to implement Advance Care Planning. BMC Palliat Care. 2022;21(1):157. https://doi.org/10.1186/s12904-022-01046-8.
9. Yang Z, Hou B, Chen P, et al. Preference and influencing factors of Advance Care Planning for Chinese Elderly patients with chronic diseases: a mixed-methods Approach. J Hosp Palliat Nurs. 2021;23(2):178–86. https://doi.org/10.1097/njh.0000000000000734.
10. Xing YF, Lin JX, Li X, et al. Advance directives: Cancer patients' preferences and Family-based decision making. Oncotarget. 2017;8(28):45391–8. https://doi.org/10.18632/oncotarget.17525.
11. Hemsley B, Meredith J, Bryant L, et al. An Integrative Review of Stakeholder Views on Advance Care Directives (Acd): barriers and facilitators to initiation, documentation, Storage, and implementation. Patient Educ Couns. 2019;102(6):1067–79. https://doi.org/10.1016/j.pec.2019.01.007.
12. McLeroy KR, Bibeau D, Steckler A, et al. An Ecological Perspective on Health Promotion Programs. Health Educ Q. 1988;15(4):351–77. https://doi.org/10.1177/109019818801500401.
13. Olaniyan A, Isiguzo C, Hawk M. The Socioecological Model as a Framework for exploring factors influencing Childhood Immunization Uptake in Lagos State, Nigeria. BMC Public Health. 2021;21(1):867. https://doi.org/10.1186/s12889-021-10922-6.
14. Wang X, Wu Y, Meng Z, et al. Willingness to Use Mobile Health devices in the post-covid-19 era: Nationwide Cross-sectional Study in China. J Med Internet Res. 2023;25:e44225. https://doi.org/10.2196/44225.
15. Tehrani H, Majlessi F, Shojaeizadeh D, et al. Applying Socioecological Model to improve women's physical activity: a Randomized Control Trial. Iran Red Crescent Med J. 2016;18(3):e21072. https://doi.org/10.5812/ircmj.21072.
16. Wang X, Wu Y, Chen Y, et al. Network Analysis for Inter-relationships of the Suboptimal Health Status with Depression and anxiety during the Covid-19 pandemic: a perspective of Predictive, Preventive, and Personalized Health. J Affect Disord. 2024;356:155–61. https://doi.org/10.1016/j.jad.2024.04.032.
17. Gallagher J, Bolt T, Tamiya N. Advance Care Planning in the community: factors of influence. BMJ Support Palliat Care. 2020. https://doi.org/10.1136/bmjspcare-2020-002221.
18. Ye L, Jin G, Chen M, et al. Prevalence and factors of discordance attitudes toward Advance Care Planning between older patients and their family members in the Primary Medical and Healthcare Institution. Front Public Health. 2023;11:1013719. https://doi.org/10.3389/fpubh.2023.1013719.
19. Wang X, Wu Y, Zhao F, et al. Subjective Dry Eye symptoms and Associated Factors among the National General Population in China during the Covid-19 pandemic: A Network Analysis. J Glob Health. 2023;13:06052. https://doi.org/10.7189/jogh.13.06052.
20. Fink M, Bäuerle A, Schmidt K, et al. Covid-19-Fear affects current safety behavior mediated by neuroticism-results of a large cross-sectional study in Germany. Front Psychol. 2021;12:671768. https://doi.org/10.3389/fpsyg.2021.671768.
21. Soto CJ, John OP. Short and extra-short forms of the big five Inventory–2: the Bfi-2-S and Bfi-2-Xs. J Res Pers. 2017;68:69–81. https://doi.org/10.1016/j.jrp.2017.02.004.
22. Wang F, Chen K, Du ZR, et al. Reliability and Validity Analysis and Mokken Model of New General Self-Efficacy Scale-Short Form (Ngses-Sf). PsyArXiv. 2022. https://doi.org/10.31234/osf.io/r7aj3.
23. Sun X, Lv K, Wang F, et al. Validity and reliability of the Chinese Version of the Health Literacy Scale Short-Form in the Chinese Population. BMC Public Health. 2023;23(1):385. https://doi.org/10.1186/s12889-023-15237-2.
24. Kroenke K, Spitzer RL, Williams JB. The Phq-9: validity of a brief Depression Severity measure. J Gen Intern Med. 2001;16(9):606–13. https://doi.org/10.1046/j.1525-1497.2001.016009606.x.
25. Spitzer RL, Kroenke K, Williams JB, et al. A brief measure for assessing generalized anxiety disorder: the Gad-7. Arch Intern Med. 2006;166(10):1092–7. https://doi.org/10.1001/archinte.166.10.1092.
26. Fung SF, Kong CYW, Liu YM, et al. Validity and psychometric evaluation of the Chinese Version of the 5-Item who well-being index. Front Public Health. 2022;10:872436. https://doi.org/10.3389/fpubh.2022.872436.
27. Wu YC, Chen K, Wang F et al. (2022) Development of a short version of the Perceived Social Support Scale: based on classical test theory and item response theory. PsyArXiv. https://doi.org/10.31234/osf.io/d95zg
28. Wang F, Wu Y, Sun X et al. (2022) Reliability and validity of the Chinese Version of a short form of the Family Health Scale. BMC Primary Care 23. https://doi.org/10.1186/s12875-022-01702-1
29. Dickey SL, Ouma C, Salazar M. Reliability and validity of a Family Cancer and Health Communication Scale. Am J Health Behav. 2019;43(4):739–52. https://doi.org/10.5993/ajhb.43.4.8.
30. Breiman L. Random forests. Mach Learn. 2001;45:5–32.
31. Liaw A, Wiener M. Classification and regression by Randomforest. R news. 2002;2(3):18–22.
32. Chan CWH, Wong MMH, Choi KC, et al. Prevalence, perception, and predictors of Advance directives among Hong Kong Chinese: a Population-based survey. Int J Environ Res Public Health. 2019;16(3). https://doi.org/10.3390/ijerph16030365.
33. Leong SM, Tam KI, Che SL, et al. Prevalence and predictors of willingness to make advance directives among Macao Chinese. Int J Environ Res Public Health. 2021;18(15). https://doi.org/10.3390/ijerph18157942.
34. Li WW, Singh S, Keerthigha C. A cross-cultural study of filial piety and Palliative Care Knowledge: moderating effect of culture and universality of filial piety. Front Psychol. 2021;12:787724. https://doi.org/10.3389/fpsyg.2021.787724.
35. Cai Y. Family-based consent for Organ Donation: benevolence and reconstructionist confucianism. J Med Philos. 2019;44(5):573–87. https://doi.org/10.1093/jmp/jhz016.
36. He L. Oa2 Chinese Migrant Peasant Workers and the contradictory demands of filial piety in neo-liberal Chinese society: a case study of filial end-of-Life

Care in Langzhong City. BMJ Support Palliat Care. 2015;5(Suppl 1):A1. https://doi.org/10.1136/bmjspcare-2015-000906.2.
37. Liu X, Bai S. Mediating effect of filial piety between the Elderly's Family Resource Contribution and their Family Power: evidence from China. Front Psychol. 2022;13:829678. https://doi.org/10.3389/fpsyg.2022.829678.
38. Cheng HC, Ke LS, Chang SY, et al. Knowledge, attitudes, and behavioral intentions of Elderly individuals regarding Advance Care Planning: Questionnaire Development and Testing. PLoS ONE. 2022;17(7):e0272351. https://doi.org/10.1371/journal.pone.0272351.
39. Zhang X, Jeong SY, Chan S. Advance Care Planning for Older people in Mainland China: an Integrative Literature Review. Int J Older People Nurs. 2021;16(6):e12409. https://doi.org/10.1111/opn.12409.
40. Sillner AY, Madrigal C, Behrens L. Person-centered gerontological nursing: an overview across Care settings. J Gerontol Nurs. 2021;47(2):7–12. https://doi.org/10.3928/00989134-20210107-02.
41. Tomaselli G, Buttigieg SC, Rosano A, et al. Person-centered care from a Relational Ethics Perspective for the delivery of High Quality and Safe Healthcare: a scoping review. Front Public Health. 2020;8:44. https://doi.org/10.3389/fpubh.2020.00044.
42. Molony SL, Kolanowski A, Van Haitsma K, et al. Person-centered Assessment and Care Planning. Gerontologist. 2018;58(suppl1):S32–47. https://doi.org/10.1093/geront/gnx173.
43. Combes S, Gillett K, Norton C, et al. The Importance of Living Well Now and relationships: a qualitative study of the barriers and enablers to engaging Frail elders with Advance Care Planning. Palliat Med. 2021;35(6):1137–47. https://doi.org/10.1177/02692163211013260.
44. Boehmer U, Clark M, Sullivan M. Advance Care Planning by Unmarried women of different sexual orientations: the importance of Social Support. J Women Aging. 2010;22(4):306–20. https://doi.org/10.1080/08952841.2010.518884.
45. Smith-Frigerio S. You are not alone: linking peer support to Information and Resources for Mental Health Concerns in Advocacy Groups' Social Media Messaging. Health Commun. 2021;36(14):1980–9. https://doi.org/10.1080/10410236.2020.1808415.
46. Lu Q, Chang A, Yu G, et al. Social Capital and Health Information Seeking in China. BMC Public Health. 2022;22(1):1525. https://doi.org/10.1186/s12889-022-13895-2.
47. Mitchell AM, Kowalsky JM, Christian LM, et al. Perceived Social Support predicts Self-reported and Objective Health and Health Behaviors among pregnant women. J Behav Med. 2022;45(4):589–602. https://doi.org/10.1007/s10865-022-00306-5.
48. Han SH, Kim K, Burr JA. Social Support and Preventive Healthcare Behaviors among couples in later life. Gerontologist. 2019;59(6):1162–70. https://doi.org/10.1093/geront/gny144.
49. Lee J, Jung D, Choi M. Relationship of Social Support and Decisional Conflict to Advance directives attitude in Korean older adults: A Community-based cross-sectional study. Jpn J Nurs Sci. 2016;13(1):29–37. https://doi.org/10.1111/jjns.12081.
50. Zimmermann C, Swami N, Krzyzanowska M, et al. Perceptions of Palliative Care among patients with Advanced Cancer and their caregivers. CMAJ. 2016;188(10):E217–27. https://doi.org/10.1503/cmaj.151171.
51. Nutbeam D, Lloyd JE. Understanding and responding to Health Literacy as a Social Determinant of Health. Annu Rev Public Health. 2021;42:159–73. https://doi.org/10.1146/annurev-publhealth-090419-102529.
52. Grant MS, Back AL, Dettmar NS. Public perceptions of Advance Care Planning, Palliative Care, and Hospice: a scoping review. J Palliat Med. 2021;24(1):46–52. https://doi.org/10.1089/jpm.2020.0111.
53. Kermel-Schiffman I, Werner P. Knowledge regarding Advance Care Planning: a systematic review. Arch Gerontol Geriatr. 2017;73:133–42. https://doi.org/10.1016/j.archger.2017.07.012.
54. Papadakos JK, Hasan SM, Barnsley J, et al. Health literacy and Cancer Self-Management behaviors: a scoping review. Cancer. 2018;124(21):4202–10. https://doi.org/10.1002/cncr.31733.
55. Li S, Cui G, Kaminga AC, et al. Associations between Health Literacy, Ehealth Literacy, and Covid-19-Related Health behaviors among Chinese College Students: cross-sectional online study. J Med Internet Res. 2021;23(5):e25600. https://doi.org/10.2196/25600.
56. Zhou C, Zheng W, Tan F, et al. Influence of Health Promoting Lifestyle on Health Management Intentions and behaviors among Chinese residents under the Integrated Healthcare System. PLoS ONE. 2022;17(1):e0263004.
57. Wäsche H, Niermann C, Bezold J, et al. Family Health Climate: a qualitative exploration of Everyday Family Life and Health. BMC Public Health. 2021;21(1):1261. https://doi.org/10.1186/s12889-021-11297-4.
58. Nouri S, Lyles CR, Rubinsky AD, et al. Evaluation of Neighborhood socioeconomic characteristics and Advance Care Planning among older adults. JAMA Netw Open. 2020;3(12):e2029063. https://doi.org/10.1001/jamanetworkopen.2020.29063.
59. Phelan JC, Link BG, Tehranifar P. Social conditions as Fundamental causes of Health inequalities: theory, evidence, and Policy implications. J Health Soc Behav. 2010;51. https://doi.org/10.1177/0022146510383498. Suppl:S28-40.
60. Lee JK, Lin L, Magee C. Investigating the relationships between Social Capital, Chronic Health conditions and Health Status among Australian adults: findings from an Australian National Cohort Survey. BMC Public Health. 2020;20(1):329. https://doi.org/10.1186/s12889-020-8370-0.
61. Menardo E, Viola M, Pierluigi I, et al. Socioeconomic status, Cultural Capital, and Social Capital in adults: a structural equation Model. Psicothema. 2022;34(1):74–83. https://doi.org/10.7334/psicothema2021.231.
62. Noh H, Lee HY, Lee LH, et al. Awareness of Hospice Care among rural African-Americans: findings from Social determinants of Health Framework. Am J Hosp Palliat Care. 2022;39(7):822–30. https://doi.org/10.1177/10499091211057847.
63. DeYoung CG, Peterson JB, Higgins DM. Sources of Openness/Intellect: cognitive and neuropsychological correlates of the Fifth factor of personality. J Pers. 2005;73(4):825–58. https://doi.org/10.1111/j.1467-6494.2005.00330.x.
64. Zhang D, Fan M, Meng L, et al. Neuroticism and Fear of Covid-19 during the Covid-19 pandemic: testing the Mediating role of intolerance of uncertainty and Sense of Control among Chinese High School Students. Front Psychol. 2022;13:1010767. https://doi.org/10.3389/fpsyg.2022.1010767.
65. Pradhan M, Chettri A, Maheshwari S. Fear of death in the Shadow of Covid-19: the mediating role of perceived stress in the relationship between neuroticism and death anxiety. Death Stud. 2022;46(5):1106–10. https://doi.org/10.1080/07481187.2020.1833384.
66. Inozu M, Kahya Y, Yorulmaz O. Neuroticism and Religiosity: the role of obsessive beliefs, thought-control strategies and guilt in Scrupulosity and obsessive-compulsive symptoms among muslim undergraduates. J Relig Health. 2020;59(3):1144–60. https://doi.org/10.1007/s10943-018-0603-5.
67. Tamosiunas A, Sapranaviciute-Zabazlajeva L, Luksiene D, et al. Psychological Well-Being and Mortality: longitudinal findings from Lithuanian Middle-aged and older adults study. Soc Psychiatry Psychiatr Epidemiol. 2019;54(7):803–11. https://doi.org/10.1007/s00127-019-01657-2.
68. Kushlev K, Drummond DM, Diener E. Subjective well-being and Health behaviors in 2.5 million americans. Appl Psychol Health Well Being. 2020;12(1):166–87. https://doi.org/10.1111/aphw.12178.
69. Harvey SV, Adenwala AY, Lane-Fall MB. Defining familial interactions and networks: an exploratory qualitative study on family networks and surrogate decision-making. Crit Care Explor. 2021;3(8):e0504. https://doi.org/10.1097/cce.0000000000000504.
70. Olding M, McMillan SE, Reeves S, et al. Patient and family involvement in adult critical and intensive care settings: a scoping review. Health Expect. 2016;19(6):1183–202. https://doi.org/10.1111/hex.12402.

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