

# Article The Characteristics and the Influencing Factors of Rural Elders' Social Networks: Evidence from China

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Abstract: Due to the immature formal care system, social networks have provided a new way to solve the support dilemma for Chinese rural elders. With few studies exploring social networks from a multi-dimensional perspective, this study aimed to comprehensively explore the characteristics and associated factors of rural elders' social networks in China. Data were drawn from a national survey of 1126 rural elders in China. An Ordinary Least Squares linear regression model was used to analyze the factors associated with network size, network heterogeneity, and network strength (the weak link strength). The results showed that rural elders' social networks in China presented the characteristics of a smaller size, a lower heterogeneity, and a weaker strength of "the weak link" (that is, the tendency to associate with external network members). Individual factors, family factors, and community factors, especially income, marital status, and number of children, were important influencing factors of characteristics of China's rural elders' social networks. These findings highlighted the importance of family, children, and formal support in rural China, offering implications for policy-making and service delivery. More attention should be paid to the relevant factors to enrich the social networks of rural elders and to ensure their happy lives in later years.

Keywords: rural elders; social network; associated factors; China



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## 1. Introduction

Population aging has become a crucial demographic trend in the world today. The Decade of Healthy Ageing (2021–2030), issued by the World Health Organization, showed that during the time of 2015 to 2050, the proportion of the worldwide population aged 60 and over would increase from 12% to 22% [1]. As the country with the largest aging population in the world, China is facing great challenges of dealing with elder problems. By the end of 2021, China had 267 million people aged 60 and above, two-thirds of which were from rural areas [2], indicating that the population aging in rural areas is much more severe. The proportion of people aged 60 and above in rural China reached 7.99% [3], which aroused great concern about rural elders' later-life support. Unfortunately, rural China's immature health and social welfare system cannot address the tasks brought about by the rapid aging issue. As a consequence, the insufficient support resources in most rural areas are increasingly pressing for the requirement of other supports. Social networks contain abundant support resources, which have an important impact on the quality of life for elders [4,5]. However, the developing urbanization in China has brought the population outflow from rural areas to cities, greatly changing the traditional rural family structure and bringing about significant impacts on the social relationships of Chinese rural elders [6]. Studying the present characteristics and influencing factors of Chinese rural elders' social networks would be helpful to understand their current social support situations, and to provide living resources for their later lives.

Social networks, i.e., the social relationships that people have [7], provide multiple resources that may translate into living advantages [8]. Social networks are diverse, and

they are influenced by multiple factors [9,10]. Individual characteristics, such as gender, age, and income, have a significant effect on social activities [11], as well as social network characteristics. Men and women have different social network characteristics [12,13]. Women would be likely to maintain more advantages in close social ties, while men usually reported higher levels of instrumental ties [14]. When getting older, social networks may narrow down to those closest relationships [15,16] and being widowed tending to be negative factors in maintaining social networks [17]. Education exerts a great influence on social networks, as those with higher level of education may tend to communicate with people of similar social status [18].

Family and community factors are also indispensable predictors of social networks, especially for elders [19–21]. After retirement, elders would rely more on family relationships, especially in countries where familism is highly emphasized [22]. Family members, such as children and siblings, make up important content of elders' social networks, with more family members indicating more social support and a better life quality [23,24]. Living arrangements are related to social network characteristics as well [25]. Elders living with others may have a better social network, and a change of living arrangements may result in a break-off of social relations and the reduction of social interactions [26]. Elders have a high living stability and small activity scope [27], which makes community factors, such as social ties with other community residents and community types, important for elders' social network characteristics [28,29].

However, very few studies have analyzed the social network and its characteristics systematically, especially with regards to elders' social networks [30,31]. In Chinese rural society, the proportion of rural elders is rising continuously, and their social networks undergo radical changes. For example, with rapid urbanization and insufficient farming income, many Chinese rural elders have migrated to cities for work [32], which would definitely influence their social networks. Additionally, informal traditional institutions such as the rural clan system promoted rural elders' social networks [33,34], but these factors have seldom been considered by academic researches. Social network plays a significant role in Chinese elders' social support in their later lives, and few concerns about the characteristics and influencing factors have been explored.

Some studies have indeed sought the influencing factors of social networks, but most of them have been from a single perspective [35,36]. Our study divided the characteristics of social networks into three dimensions: network size, network heterogeneity, and network strength (the weak link), to explore the correlations of different dimensions. This distinction is important, because different measurements of social networks may have various effects [37]. Furthermore, in view of the social networks of China's rural elders having their own features, findings in other sociocultural contexts cannot be simply transferred to Chinese rural elders. The characteristics and influencing factors of Chinese rural elders' social networks need more in-depth analysis for their healthy aging. Based on the theoretical evidence, a conceptual framework of the current study was developed to determine the effects of the possible predictors on Chinese rural elders' social network characteristics (Figure 1).

Given the different findings in this area, our study is guided by the following research questions:

- 1. What is the current situation of Chinese rural elders' social networks?
- 2. What impacts do individual factors, family factors, and community factors have on the characteristics of Chinese rural elders' social networks?
- 3. How to improve Chinese rural elders' life quality by utilizing their social networks?



Predictors

Dependent variables

Figure 1. The conceptual framework of the present study.

## 2. Method

# 2.1. Participants

The participants were limited to those who were aged 60 and above and with rural pensions, including disabled elders and semi-disabled elders. A random sample of 30 participants from each village were interviewed, and a total of 1137 rural elders from 31 villages of 11 provinces in China were interviewed. The questionnaire survey was conducted by face-to-face interviews. For those who could not answer the questions by themselves, their questionnaires were completed by their caregivers instead.

## 2.2. Materials and Research Procedures

Our study drew references from representative national surveys, such as the Chinese General Social Survey, Chinese Social Survey, and China Health and Retirement Longitudinal Study. The questionnaire in our study covered six categories: (1) the basic information of the respondents and their families; (2) the agricultural production and income situations of the respondents and their families; (3) the leisure and consumption of the respondents and their families; (3) the leisure and social endowment insurance; (5) the respondents' social networks and social capital; and (6) the respondents' demands and participation for elder care services.

The final data came from 31 villages of 11 provinces in China, from 2019 to 2021, which were collected in two stages. The first stage was from July to August in 2019, and the second stage was from January to February in 2021. About 1170 questionnaires were distributed and 1137 questionnaires were recovered. After handling the missing values, the final sample size in the study was 1126.

#### 2.3. Measurement

Existing studies have generally used "name generator" and "position generator" to assess social network characteristics. The "name generator" requires respondents to identify different types of contacts in specific scenarios, followed by asking questions about these individuals (e.g., their sex, age, types of relationships, and geographic distance) [38]. "Position generator" was proposed by Lin [39], and respondents were asked if they personally know people (at the acquaintance level or higher) who have specific occupations of varying prestige. It is useful when measuring social network diversity and availability [40]. In this study, we used both methods to investigate Chinese rural elders' social network characteristics.

The characteristics of social networks can be captured by the network size [41], social connection [42], network heterogeneity [43], contact frequency [44], social participation [45], reciprocity [46], and the connection intensity [47]. In our study, we selected three indicators

that can properly reflect the characteristics of Chinese rural elders' social networks, namely their network size, network heterogeneity, and network strength (the weak link).

We asked the respondents "How many family members or relatives can you (1) meet or contact in a month; (2) talk about your privacy with; (3) ask for help from" and "How many friends can you (1) meet or contact in a month; (2) talk about your privacy with; (3) ask for help from" to measure their network size. Their scores could be assigned different values, and the answer can be divide into six categories: 0 = 0, 1 = 1, 2 = 2, 3 to 4 = 3, 5 to 8 = 5, and 9 and above = 9. We further divided the network size into the family network size and friends network size on the basis of consanguinity [48]. The score of the family members or relatives (ranging from 0 to 27) was taken as the index of the family network size, and the score of their friends (ranging from 0 to 27) was taken as the index of the friends network size. The sum of the index of the family network size and the index of the friends network size was recorded as a new index of overall social network size (ranging from 0 to 54), with a higher score indicating a larger network size.

For the network heterogeneity, we set 12 questions about different situations that respondents may encounter in their daily lives, and different kind of social contacts or people with different relationships they would seek help from (e.g., acquaintances, neighbors, friends, brothers, sisters, relatives of their spouses, other close relatives, and so on). According to their answers, as long as the respondent asked one type of contact for help, the value of this contact was assigned as "1", no matter how many times they asked. If the respondent never asked the contact for help, the value of this contact was assigned as "0". The sum of the above 11 contacts' score was recorded as a new index (ranging from 0 to 11), with a higher score indicating a higher network heterogeneity.

For the strength of the network, we asked respondents about their frequency (never = 1, seldom = 2, sometimes = 3, and often = 4) of contact with their family members, clan members, relatives, neighbors, friends, and villagers. Family members, clan members, and relatives were classified as internal network members; and neighbors, friends, and villagers were classified as external network members. The sum score of the internal network and the sum score of external network created two new variables, namely internal network strength and external network strength. The range of both internal network strength and external network strength to 12, with the higher score indicating a stronger network strength. According to interaction frequency, emotional depth, intimacy, and reciprocity breadth, Granovetter divided social relations into strong relationships and weak relationship [49]. On the basis of Granovetter, we divided external network strength by the internal network strength, and the quotient was defined as the score of the weak link, which was used to measure the network strength. A higher score indicated that there is a stronger correlation with the external network members.

# 2.4. Predictors

Individual factors were captured by seven indicators: gender (male = 0, and female = 1), age, marital status (have no spouse currently = 0, and have a spouse currently = 1), education years, income (Ln), migrant work experiences (no = 0, and yes = 1), and self-rated health score (ranked on a scale of 0–5, with a higher score indicating a better self-rated health status).

Family factors were captured by three indicators: number of children, number of siblings, and living arrangements (living alone, living with spouse only, and living with children or others).

Community factors were measured by four indicators: whether there is an ancestral temple in the village (no = 0, and yes = 1), whether there are elder care service centers in the village (no = 0, and yes = 1), the distance between the village and the county (miles), and the region of the village (west region, middle region, and east region).

#### 2.5. Data Analysis

The statistical analysis consisted of three main steps. The first stage presented a descriptive overview of the variables, so that we could learn the features of the whole sample and the characteristics of the sample's social networks.

In the second step, we conducted a Pearson's test to examine the bivariate associations between the outcome variables and the characteristics of the social networks, so that we could examine the significance of each factor and have a preliminary knowledge of which factors had a stronger impact.

At last, we executed multivariate analyses with OLS linear regression to analyze the influencing factors of the social networks from three dimensions of network size (Model 1), network heterogeneity (Model 2), and network strength (the weak link) (Model 3). The regression model was set as follows:

$$\mathbf{y} = b_0 + b_1 x_1 + b_2 x_2 + \dots + b_n x_n + \varepsilon \tag{1}$$

In Equation (1), y represented the social network characteristics of elders,  $x_1, x_2, \ldots, x_n$  represented the predictors variable,  $b_1, b_2, \ldots, b_n$  represented the coefficients in the regression model, and  $\varepsilon$  represented the error items.

## 3. Results

The basic characteristics of the sample are shown in Table 1. In total, 53.7% of the respondents were women, 73.6% of the respondents had a spouse, and 68.5% of the respondents had no migrant work experiences. The mean age of the sample was 69.7 years old, and the oldest respondent was 94 years old. The average income logarithm was 8.6. The mean value of the education years was 3.9, which meant that most respondents had only attained the education level of primary school. On average, most of the respondents had a good self-rated health status. The average number of children was 3, and the range was from 0 to 8, while the mean number of siblings was 2.7, and the range was from 0 to 10. About half of the sample lived with a spouse; 38.5% lived with their children or others; while only 15.7% lived alone. Most respondents lived in the west region (55.2%), followed by the middle region (24.2%), and only 20.6% lived in the east region. The average distance between the village and the county was 15.1 miles, and the range was 1 to 83.

It can be seen in Table 2 that most of the samples could meet or contact at least 3–4 family members or relatives in a month (40.1%) and talk about private affairs with (42.5%). When needing help, 24.2% of the respondents could ask 3–4 family members or relatives to offer help, while more of the respondents (35.4%) had no family members or relatives. A total of 27.4% of the respondents did not meet with or contact friends within a month, but 24.3% of the respondents could meet with or contact at least 3–4 friends within a month. In total, 37.7% of the samples had no friends whom they could talk about private affairs with, and 35.4% of the samples had no friends who could help them when they needed it. It can be seen that the rural elderly were more closely connected with their family or relatives than with friends, but also that they did not receive much social support from their family, relatives, and friends.

Answers to the network heterogeneity were not presented due to the limitations of space, of which children, spouses, friends, acquaintances, and neighbors were the primary options with which the respondent associated with. Their kinship and local relations were the main content of their social network, resulting in a low network heterogeneity. The respondents' network strength (their contact frequency with others) is shown in Table 3. It can be seen that the proportion of "Often" between the respondents and their family members (88.2%), villagers (62.6%), neighbors (58.1%), clan members (45.1%), relatives (41.3%), and friends (36.6%), was higher than that of "Never", "Seldom", and "Sometimes". It is indicated that the interaction of the rural elders was still based on blood, kinship, and geography, and that the internal network had a high network strength.

Characteristic		N (Mean)	% (SD)
Gender	Men	521	46.3
	Women	605	53.7
Marital status	Have no spouse currently	297	26.4
	Have spouse currently	829	73.6
Migrant work experiences	No	771	68.5
	Yes	355	31.5
Living arrangements	Living alone	177	15.7
	Living with spouse only	515	45.7
	Living with children or others	434	38.5
Whether there is an ancestral temple in the village	Yes	132	11.7
1 0	No	994	88.3
Elder care service centers	Yes	181	16.1
	No	945	83.9
Region	West region	621	55.2
Ū.	Middle region	273	24.2
	East region	232	20.6
Age		69.7	6.7
Income (Ln)		8.6	0.9
Education years		3.9	3.5
Self-rated health score		3.2	1.0
Number of children		3.0	1.2
Number of siblings		2.7	1.8
The distance between the village and the county		15.1	14.0

Table 1. Univariate description of the predictors and the key characteristics of the sample.

Note: N: number; and SD: Standard error.

Table 2. The social network size of the sample (measuring by social connection and support).

Number	Family Members or Relatives to Meet or Contact in a Month (%)	Family Members or Relatives to Talk about Privacy with (%)	Family Members or Relatives to Ask for Help from (%)	Friends to Meet or Contact in a Month (%)	Friends to Talk about Privacy with (%)	Friends to Ask for Help from (%)
0	3.1	9.8	35.4	27.4	37.7	35.4
1	6.0	12.8	8.7	6.5	10.7	8.7
2	25.8	21.6	17.8	17.3	23.4	17.8
3–4	40.1	42.5	24.2	24.3	18.7	24.2
5-8	15.5	8.5	6.0	12.1	5.2	6.0
<u>&gt;</u> 9	9.6	4.9	7.8	12.3	4.4	7.8

Table 3. The network strength (contact frequency with others) of the sample.

Answer	Family Members (%)	Clan Members (%)	<b>Relatives (%)</b>	Neighbors (%)	Friends (%)	Villagers (%)
Never	0.5	1.1	1.2	1.2	15.4	1.9
Seldom	2.0	18.3	17.6	9.9	14.7	13.9
Sometimes	5.4	31.6	36.0	26.9	29.5	21.7
Often	88.2	45.1	41.3	58.1	36.6	62.6

Table 4 shows the overall social network characteristics of the sample. For the network size, the average score of the family network size was 9.5; the average score of the friends network size was 6.8; and the average score of the overall social network size was 16.3. It indicated that the overall size of the sample's social networks was relatively small, and that the size of family networks was larger than that of friends networks. The mean score of the sample's network heterogeneity was 4.5, which was relatively low. The average score of the internal network strength and the external network strength of the sample were 10.4 and 9.8, which were close to the total score. It reflected that there was a high communication frequency with both internal network members and external network members, and that the communication frequency with internal network members was higher.

Variables		Mean	SD
Network size	Family network	9.5	5.3
	Friends network	6.8	6.5
	Overall network size	16.3	9.9
Network heterogeneity		4.5	2.0
Network strength	Internal network	10.4	1.6
C	External network	9.8	1.9
	The weak link	1.0	0.2

Table 4. The overall social network characteristics of the sample.

Note: N: number; and SD: Standard error.

Table 5 presents the association between the variables and the rural elders' social network characteristics via a Pearson's test. The bivariate correlations revealed that individual factors, family factors, and community factors were all significantly associated with the dimensions of social networks. For individual factors, the association between the variables of age, income, marital status, education, migrant work experiences, self-rated health score and social networks were more significant. For family factors, the association between the variables of number of children and number of siblings and social networks were more significant. For community factors, whether there is an ancestral temple in the village, regions, and the distance between the village and the county showed a more significant relationship with social networks. However, the bivariate correlations only showed an initial reflection of the relationships between the variables, and a further regression model was needed.

**Table 5.** Univariate association between study variables and social network characteristics: Pearson's test for correlations.

Variables	Family Network	Friends Network	Network Heterogeneity	Internal Network Strength	External Network Strength
Gender	-0.003	0.045	0.056 *	0.048	0.081 ***
Age	-0.008	-0.044	-0.144 ***	-0.140 ***	-0.132 ***
Income (Ln)	0.118 ***	0.215 ***	0.068 **	0.095 ***	0.176 ***
Marital status	0.115 ***	0.041	0.103 ***	0.177 ***	0.063 **
Education	0.051 *	0.115 ***	0.077 ***	0.080 ***	0.084 ***
Migrant work experiences	0.055 *	0.112 ***	0.055 *	0.122 ***	0.171 ***
Self-rated health score	0.136 ***	0.088 ***	0.068 **	0.136 ***	0.093 ***
Number of children	0.133 ***	-0.023	-0.110 ***	0.045	-0.079 ***
Number of siblings	0.090 ***	0.081 ***	0.050 *	0.043	0.002
Living arrangements					
Living alone	-0.166 ***	-0.039	-0.037	-0.137 ***	-0.023
Living with spouse only	-0.110 ***	-0.020	0.008	0.049	0.008
Living with children and others	0.236 ***	0.049	0.020	0.053 *	0.009
Whether there is an ancestral temple in the village	0.032	0.006	-0.147 ***	-0.144 ***	-0.064 **
Elder care service centers	-0.027	0.023	0.000	-0.008	0.097 ***
The distance between the village and the county	-0.074 **	0.054 *	-0.070 **	-0.146 ***	-0.068 **
Region					
West region	-0.113 ***	-0.144 ***	0.086 ***	0.020	-0.057 *
Middle region	0.066 **	0.128 ***	-0.077 **	0.063 **	0.070 **
East region	0.069 **	0.041	-0.025	-0.091 ***	-0.004

Note: Standard error in parentheses; \* p < 0.1, \*\* p < 0.05, and \*\*\* p < 0.01.

Table 6 presents the OLS linear regression analysis on the potential determinants with three models. In Model 1, for the individual factors, income, marital status, migrant work experiences, and self-rated health score were significantly positively associated with the network size. For the family factors, respondents with more children and more siblings were likely to have a larger network size. Compared with rural elders who live alone, those living with their spouses, children or others were more likely to have a larger network size. As for the community factors, whether there was an ancestral temple in the village

and the region were significant negative influencing factors. In Model 2, for the individual factors, income and marital status were significantly positively associated with the network heterogeneity, while other variables were not significant. It meant that respondents with higher income and respondents with spouses were more likely to have higher network heterogeneity. With regards to the community factors, whether there was an ancestral temple in the village, the distance between the village and the county, and the region were all significant negative factors. Model 3 showed the weak link strength. For the individual factors, income and migrant work experiences were significantly positively associated with the weak link strength, while marital status was negatively associated with the weak link strength. For the family factors, number of children and whether they were living with their children or others were significantly negatively associated with the weak link strength. In terms of the community factors, living in the villages with elder care service centers, further from the county, and living in the east region were significantly positively associated with the weak link strength.

**Table 6.** OLS linear regression result of associations between the study variables and network size, network heterogeneity and network strength (the weak link strength).

Variables	Model 1 Network Size	Model 2 Network Heterogeneity	Model 3 Network Strength
	-1.060	-0.068	0.001
Gender (ref. female)	(0.670)	(0.141)	(0.015)
A	0.015	-0.009	0.000
Age	(0.052)	(0.011)	(0.001)
In some (I n)	2.032 ***	0.213 **	0.018 **
income (Lh)	(0.353)	(0.074)	(0.008)
Manital status (not have no snause summently)	2.366 **	0.501 **	-0.038 *
Marital status (ref. have no spouse currently)	(0.971)	(0.204)	(0.021)
Education	0.140	0.024	0.000
Education	(0.088)	(0.019)	(0.002)
Migrant work experiences (ref. have no migrant	2.294 **	0.041	0.030 **
work experiences)	(0.659)	(0.138)	(0.014)
Calf rated health same	0.821 **	0.059	-0.008
Self-rated health score	(0.286)	(0.060)	(0.006)
Number of shildren	1.068 ***	-0.150 **	-0.017 **
Number of children	(0.269)	(0.057)	(0.006)
N	0.390 **	0.021	-0.001
Number of sidlings	(0.162)	(0.034)	(0.004)
Living arrangements (ref. living alone)			
Living with spouse only	-0.988	-0.369	-0.032
Living with spouse only	(1.172)	(0.246)	(0.025)
Living with children or others	2.631 **	-0.077	-0.039 *
Living with children of others	(1.009)	(0.212)	(0.022)
Whether there is an ancestral temple in the village	-2.052 *	-0.961 ***	-0.009
(ref.no)	(1.056)	(0.222)	(0.023)
Elden compise company (not no)	-0.166	-0.034	0.058 **
Elder care service centers (rel.no)	(0.805)	(0.169)	(0.017)
The distance between the village and the county	-0.015	-0.017 ***	0.001 **
The distance between the vinage and the county	(0.022)	(0.005)	(0.000)
Region (ref. west)			
Middle region	3.395 ***	-0.552 ***	0.031
Whattle region	(0.883)	(0.154)	(0.016)
Fast region	3.175 ***	0.065	0.015 *
Lust region	(0.736)	(0.185)	(0.019)
Constant	-13.239 **	3.757 ***	0.896 ***
Constant	(4.828)	(1.013)	(0.105)
R-squared	0.133	0.076	0.066

Note: levels in the regressions; standard error in brackets; \* p < 0.1, \*\* p < 0.05, and \*\*\* p < 0.01.

### 4. Discussion

With insufficient formal resources, social network plays an important role in ensuring rural elders' life quality in their later years. Our study adopted representative datasets to investigate the factors associated with the social networks of rural elders in China. In line with previous studies, our results confirmed that the social networks of rural elders displayed the characteristics of a small size, a low heterogeneity and a weak external network strength [50,51]. Furthermore, we comprehensively investigated the situation of Chinese rural elders' social networks, from individual and family factors to community factors, with few studies exploring social networks from a multi-dimensional perspective. Our results provided new evidences on the value of informal support for China and other countries facing similar challenges in the problems of aging.

We systematically explored the characteristics and possible predictors of Chinese rural elders' social networks. The bivariate associations and the OLS regression analysis confirmed the influences of these predictors, but it is worth mentioning that gender, age, and education were not significant factors in the regression analysis. In addition, income, marital status, and number of children were significant factors in all network dimensions, in both bivariate associations and the regression analysis, indicating that economic and family factors had significant effects on Chinese rural elders' social networks. As a formal support, China's pension system is one of the main path that enable rural elders to obtain their necessary living resources [52]. As of the end of 2021, 1.03 billion people in China were covered by basic old-age insurance and 1.36 billion were covered by basic medical insurance [53]. Notably, our sample had an average of only 600 yuan for the pension of rural elders per month, which was far lesser than that of urban elders, which, even so, accounted for a large part of their annual income. Low individual contribution levels and an excessive dependence on financial subsidies are persistent problems in the rural insurance system [54]. It is necessary to further invest in rural pensions and improve the residents' individual insurance contribution model, so that pension income can effectively alleviate the elders' multidimensional experiences of poverty [55] and expand their social network to obtain more living resources.

Family members such as children, spouses, and siblings were found to be significant in Chinese rural elders' social networks. In China, due to the national traditional and cultural background, Chinese rural elders' social networks were mainly based around family members, especially children and spouses [56]. However, our findings also confirmed the view that a deeply rooted family culture caused a network with less diversity [55]. There was a significant negative association between the number of children and the heterogeneity of their social networks. The possible explanation for this may be that the respondents with more children tended to live with their family, which is highly associated with social disconnection [57], thus resulting in a low network heterogeneity. Chinese rural elders' family network is highly associated with their daily care and financial support [58], but its function is declining with the change of the traditional rural family structure. To fully utilize the role of rural elders' social networks in their social support, not only should the traditional filial piety culture be emphasized, but more diverse networks are needed. Supportive measures would be taken to realize the potential for childbirth and strategic demographic goals for social support. We should promote the integration of family factors to establish an integrated healthcare system for rural elders, further ensuring that rural elders enjoy the fruit of reform and development in China, and live healthy and happy lives.

Public space is the important arena in which community members' social connections are generated, interacted, and sustained [59], whose role on social network cannot be ignored. In our findings, the elder care service centers played a positive role in Chinese rural elders' network strength, while the effects of an ancestral temple on the network size and network heterogeneity were negative. It might because an ancestral temple is only for clan members [60]. To expand and enrich rural elders' social networks, more public spaces for all village elders need to be built. China is creating diverse pension modes, such as mutual nursing homes and a medical–nursing care integration service, which might be profit to provide a public space for rural elders [61]. In the future, the rural communities and governments should provide more inclusive community elder care services to make up for a lack of family care, by building more public spaces for elders so that the goal

of healthy aging can be achieved. Our conclusions are not only suitable for the Chinese aging society, but are similarly suitable for many developing or aging countries. Based on our results, we believe policymakers should be aware of the relationship between the relevant factors of rural elders' social networks, to improve their social networks for their happy later lives.

A few limitations of the current study must be noted as well. First, the selection of variables for our study was based on existing studies and questionnaires, so there might be some omitted variables. Social network is a function of societal determinants. As a limit of our study, many variables failed to present in our analysis, such as occupation and social participation, which might produce some bias in the estimates. In future work, data can be obtained by different approaches, and, in addition, can embrace more influencing variables of the Chinese rural elders' social networks. Second, some evidences showed that when the explanatory variables are counting variables, and OLS is used for estimation, it may lead to inefficient, inconsistent, or even biased estimators [62]. The problem of endogeneity in the regression models was not tackled efficiently in our study, which may reduce the reliability of the results. With consideration to the confounders, further research should keep paying attention to possible biases. Finally, cross-sectional data adopted by our study made it impossible to control the confounders in causal inferences and explore the dynamic effects of the associated predictors on Chinese rural elders' social network characteristics.

#### 5. Conclusions

Empirical analysis found that the social networks of Chinese rural elders displayed the characteristics of a small size, a low heterogeneity and a weak external network strength. A Pearson's test showed the relevance between individual factors, family factors, community factors, and Chinese rural elders' social network characteristics. The OLS regression analysis confirmed the importance of possible predictors, of which economic factors (i.e., income), marital status, number of children and siblings, and the community public facilities were the most influential factors. These findings highlighted the importance of family, children, and formal support in rural China, offering implications for policy-making and service delivery.

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