

Article

Social Network and Functional Health Status among the Elderly

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ABSTRACT

Background: In the absence of adequate public pension benefits, the older people in China have to rely on their social networks for old-age support. However, few empirical studies have been carried out to examine the pattern of social network and their impact on elderly health in China.

Methods: Using the dataset from two waves of the Chinese Longitudinal Healthy Longevity Survey (CLHLS) conducted in 2008 and 2014, we examined the characteristics of social network types and their impacts on the health status among the elderly. The dependent variables included the measures of self-rated health (SRH), activities of daily living (ADL), instrumental activities of daily living (IADL), and cognitive score (MMSE). K-means clustering method was used to construct the social network type, which was the primary factor we were interested in examining for association with functional health status. A random-effect regression model was utilized to control for the clustering effects within the observations over time.

Results: Four types of the social network were derived among the older people, and they were the diverse network (6.65%), family-focused network (32%), children-focused network (29.89%) and restricted network (31.45%). Compared with the restricted network, the diverse network was associated with the best functional health status and self-rated health among the elderly; the family-focused network was also associated with a better score of ADL, IADL, and MMSE but not significantly with SRH score; and the children-focused network was also associated with a better health status of all measures. Furthermore, social support from family members and friends positively influenced the health status of the elderly. In contrast, having social workers available when needed was associated with the reduced ADL, IADL, and SRH scores. This might be due to that those elderly with the worst health status are in a greater need for support from social workers, and hence, the reverse association may occur.

Conclusion: family- and children-focused network were primary types among the older people in China. Consistent with previous studies, while the diverse network was most beneficial for the functional health status in multiple measures, it only accounted for a small proportion. People with a restricted network had the worst health status.

KEYWORDS

Social network types, functional health status, elderly Chinese

INTRODUCTION

A social network is a group of individuals connected by interpersonal relationships (such as family, friends, acquaintances, and coworkers), which could provide supportive financial and emotional resources for individuals within a network. The importance of social network for health and well-being has been documented (1), especially for the

elderly, who are much more vulnerable without material and emotional support from their social relations (2). Aging can negatively influence the size of social networks for the older people and therefore reduces the potential resources they can mobilize. In addition to the financial resources embedded in their social networks, lacking social relations could lead to reduced health-related behaviors due to less exposure to health-related information and the absence of health management provided by their social ties (3).

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In the low- and middle-income countries, demographic aging increases the demand on health-care services and poses severe challenges to the social security systems (4). Over the past decade, China, as one of the middle-income countries, has begun to witness a rapid population aging. Although China has implemented a universal social pension system, premature population aging associated with other dramatic social changes, including urbanization and industrialization, further exacerbate the challenges (5). Without sufficient public pension, people have to rely on their social networks for old-age support, especially where traditional family is the primary caregiver for the elderly.

Individuals may have different types of the social network, which vary with network compositions and hence have differential impacts on health conditions. Several studies have discussed the influences of social network on both physical health and mental well-being across different countries. While some studies examined gender differences in quantity and quality of social relations and their associations with health outcomes (6); others investigated the specific characteristics of individual social networks and demonstrated that individuals could be consistently categorized into four types of the underlying network. Usually, individuals with a diverse network type maintain a wide range of social ties such as family, friends, and neighbors. Older adults with a friend-focused network are characterized by having frequent interactions with friends or neighbors but few or non-existent kinship ties; whereas those with a family-focused network have close links with family members but little contact with friends. Moreover, older adults with a restricted network type are portrayed as having limited social relations across all dimensions (7-9).

Some studies have shown that individuals with "diverse network" maintained the best health status, but individuals with "restricted network" reported the worst status (8-10). However, the impacts of "friend-focused network" and "family-focused network" on health conditions were inconsistent across various cultural contexts (10). Furthermore, existing literature indicates that various social network patterns have been found across different cultural and ethnic groups. Asian populations in the United States or their native countries are often characterized as a family-focused group, but the general population in the United States or European countries tended to maintain a friend-focused network (8, 10).

As a traditionally family-focused society, social network types among older adults in China could be different from what has been documented in western countries. In this study, using the data from the Chinese Longitudinal Healthy Longevity Survey (CLHLS), we aimed to examine the characteristics of social network and their impact on the health status among the elderly. To gain a better understanding of the effects of social networks on health conditions, we distinguished social network structure from the quality of social networks and examined the impact of both social network types (quantity of social network) and resources available within the network (quality of social network) on health conditions. We also utilized a more refined measurement of the elderly health—functional health status, which evaluates both physical and mental well-being of the elderly, including self-rated health (SRH), the activities of daily living (ADL), instrumental activities of daily living

(IADL), and cognitive score (MMSE).

Our data revealed a different social network type among the older adults in China, which is the children-focused, reflecting both the traditional Chinese family values and the influences of dramatic social transitions on elderly life during the past four decades in China. Also, consistent with previous studies, we noted that among the four types of social network identified, the diverse network type was the most beneficial for the older adults across all of the functional health indicators, while the restricted network was presented with the worst health status. In terms of the quality of social networks, our study demonstrated that resources available within individual social network had positive associations with not only enhanced functional health but also the better self-rated health among the older adults.

DATA AND METHODS

Data

Data were from the Chinese Longitudinal Healthy Longevity Survey (CLHLS), which is a national representative survey on the older people that covers 23 of the 31 provinces in China (11). We used the data from the 2008 baseline survey and the 2014 follow-up survey. CLHLS provides measures of family and household characteristics, individual's education, occupation, income, health-related behaviors, and health conditions as well as community-level characteristics among the older people in China. The 2008 baseline survey included 16,954 respondents aged above 65 years and of which 5245 respondents were still alive when the follow-up survey was conducted in 2014.

Measurements

Dependent variables. The outcomes were the health status of the elderly measured by the self-rated health (SRH), and functional health status of the activities of daily living (ADL), instrumental activities of daily living (IADL) and cognitive score (MMSE). SRH was coded as "1" if respondents answered "very good/good" to the question "how do you think your health status," "2" if the answered "fair," and "3" if they answered "bad or very bad." ADL (0-12), IADL (0-16) and MMSE scores (0-11) were obtained with the structured questionnaire, and higher scores indicated reduced functional health status for the elderly.

Independent variables. We measured two dimensions of an individual's social network. 1) The quantity of social network, which was derived from five indicators that measured different aspects of individuals' social relations, including social ties with the spouse, children, siblings, and other relatives, friends as well as the participation in social activities. These five indicators were used to construct social network types; 2) the quality of social network evaluates the resources available within the private social network. Based on the survey question, "did you always talk to, share with, or seek help from family members, friends, or social workers when you need?" three binary variables were coded. The first variable was coded as "1" if family members were available when needed; "0" otherwise. The second variable was coded as "1" if friends were available when required; "0" otherwise. The third variable

was coded as "1" if social workers were available when needed; "0" otherwise. Each of these variables measures the quality of social networks with family members, friends, and the social support system.

Covariates. Covariables were used to control for potential confounding effect in the statistical modeling, and they included sociodemographics such as age, gender, years of education, place of residence, self-rated socioeconomic status, along with health-related behaviors such as smoking, drinking, regular exercise.

Statistical analysis

We first used the K-means clustering method to construct social network types based on five standardized social network indicators. The K-means cluster method minimizes the within-cluster variation so that observations are most similar to each other within the cluster. This approach randomly assigned initial cluster centroids according to a predefined number of clusters and then calculated the distance between each observation and each of the cluster centroids. After classifying the observations by choosing the nearest cluster centroid for each observation, the cluster centroids were updated; the process repeated until there was no further change in the within-cluster variation (12).

After classifying individuals into four types of social network, we first performed an Analysis of Variance (ANOVA) or t-test to examine whether the differences in health status across various groups are statistically significant. Moreover, because the data was from a longitudinal study, in which variables were repeated-measured over time, we utilized random-effect regression model to control for the clustering effects within the observations and examine the effects of both the quantity and quality of social network on functional health indicators. The equation of the random-effect regression model is briefly described as:

$$Y_{it} = \beta_0 + \beta \cdot X'_{it} + \varepsilon_i$$

Where Y_{it} measures functional health status for individual i at time t , X'_{it} represents independent variables and control variables for each individual at each time point. ε_i is the random effect at the individual level, which is distributed as a standard normal distribution with a mean of 0 and a standard deviation of 1. Since the ADL, IADL and MMSE scores were measured as continuous variables; linear random-effect regression models were performed; whereas SRH was coded as an ordinal variable, an ordered logistic random-effect regression model was performed. The data were analyzed using the software Stata 15.1.

RESULTS

Descriptive analysis

Table 1 presents the descriptive statistics of all variables at the baseline survey. The mean age of participants was 85.78 years (SD, 11.4). Of the 16,954 individuals, 33% of them were still married; 43% were males, and 57% were females. The average years of education obtained was 2.42 years, and at least 50% of participants had no formal education (median=0). About 18% of the respondents subjectively rated their socio-economic status lower than others, and more than 80% of them lived in rural areas. The rate of cigarette smoking and alcohol uses was 17.49% and 17.30%, respectively; and 27% of respondents had regular exercise.

As for the health status, around 50% of the participants rated themselves in good health condition, while the mean value of ADL, IADL and MMSE were 0.99 (median=0), 6.11 (median=4) and 3.96 (median=3), respectively. In terms of social network indicators, the average frequency of home visits from children and siblings were 2.73 (median=3) and 0.80 (median=0), respectively. With regards to social activities, 86% of participants never played cards with a friend, and 88% of them never attended social events. Around 77% of participants were able to chat, share, and seek help from family members when needed. However, only 1% of the respondents were able to receive such support from friends. Also, the percentage of respondents who received such support from social workers was much lower (around 0.6%).

Social network types

Based on K-means clustering methods, consistent with previous literature (9, 13), we derived four social network types, and each was determined after comparing the means of the five indicators across four network types (Figure 1). Four social network types were defined, which were diverse network (6.65%), family-focused network (32%), children-focused network (29.89%), and restricted network (31.45%). The diverse network type was characterized as being supported by various social relations such as a spouse, children, siblings, friends, and was well integrated into society through frequently attending social activities. However, it only accounted for 6.65%, a small proportion of individuals in this sample. Three other network types were more frequent and of which family-focused network accounted for about 30%, referring to individuals who had frequent interactions with family members but few connections with friends and limited engagement in social activities. Another common network type was children-focused network, with children being their primary social relations. Finally, there were 31.45% of people with the restricted network, indicating that they had limited social links and were quite isolated from both their family and the general society.

Table 1. Descriptive statistics of dependent and independent variables

	Coding	Mean	M	SD	N	%
Dependent variables						
SRH	1=Good				7362	49.39
	2=fair				5132	34.43
	3=Bad				2413	16.19
ADL (min-max: 0-12)		0.99	0	2.41	16953	
IADL (min-max: 0-16)		6.11	4	6.15	16954	
MMSE (min-max: 0-11)		3.96	3	3.78	16954	
Quantity of social network						
No. children often come to visit		2.73	3	1.92	16954	
No. siblings often come to visit		0.80	0	1.33	16954	
Still married	1=Yes				5535	32.65
	0=No				11419	67.35
How often do you play cards with a friend?	0=Never				14520	85.64
	1=Not monthly, but sometimes				563	3.32
	2=Not weekly, but at least once a month				380	2.24
	3=Not daily, but once for a week				637	3.76
	4=Almost everyday				854	5.04
How often do you attend social activities	0=Never				14982	88.37
	1=Not monthly, but sometimes				807	4.76
	2=Not weekly, but at least once a month				458	2.7
	3=Not daily, but once for a week				275	1.62
	4=Almost everyday				432	2.55
Quality of social network						
Family members available	0=Not able to chat, share or seek help when need				673	3.97
	1=Able to do one chat, share or seek help when need				978	5.77
	2=Able to do two of chats, share or seek help when need				2299	13.56
	3=Able to chat, share and seek help when need				13004	76.7
Friends available	0=Not able to chat, share or seek help when need				14535	85.73
	1=Able to do one chat, share or seek help when need				1783	10.52
	2=Able to do two chats, share or seek help when need				456	2.69
	3=Able to chat, share and seek help when need				180	1.06
Social workers available	0=Not able to chat, share nor seek help when need				16609	97.97
	1=Able to do one chat, share or seek help when need				165	0.97
	2=Able to do two chats, share or seek help when need				86	0.51
	3=Able to chat, share and seek help when need				94	0.55
Socio-demographics						
Age		85.8	89	11.4	16954	
Years of education		2.42	0	5.05	16904	
Male	1=Yes				7252	42.77
	0=No				9702	57.23
Low SES status	1=Yes				3070	18.11
	0=No				13884	81.89
Living in the rural area	1=Yes				13603	80.23
	0=No				3351	19.77
Health behaviors						
Smoke	1=Yes				2966	17.49
	0=No				13988	82.51
Drinking alcohol	1=Yes				2933	17.3
	0=No				14021	82.7
Regular exercise	1=Yes				4645	27.4
	0=No				12308	72.6

M, median

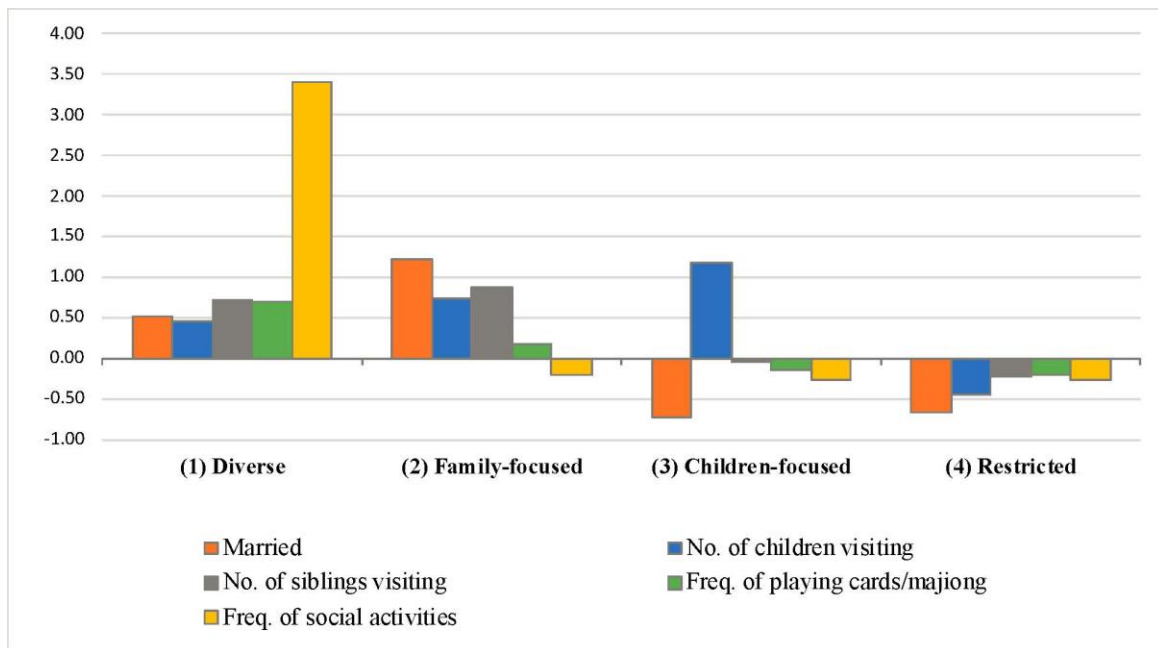


Figure 1. Social network types among the elderly in China

Quantity and quality of the social network and health status

Four networks derived from the quantity of social network have significant impacts on functional status, cognitive, and self-reported health (Table 2). The mean of ADL and IADL, MMSE, and SRH significantly increased in the diverse network, family-focused network, children-focused network, and restricted network ($p < 0.01$). The older people with the diverse network had the best conditions on ADL (mean=0.13), IADL (mean=1.41), MMSE (mean=1.44), and SRH (mean=1.49). Older adults with the family-focused network also had a slight increase in ADL (mean=0.47), IADL (mean=3.02), and MMSE (mean=2.14) and SRH (mean=1.69). However, individuals with children-focused network type had more inferior functional status on ADL (mean=1.17), IADL (mean=7.12), and more reduced cognitive functions of MMSE (mean=4.28), implying reduced health conditions across these three dimensions, but SRH did not change. Finally, the elderly with the restricted network had significantly reduced conditions in functional status (ADL and IADL), cognitive function (MMSE), and self-reported health (Table 2).

The quality of the social network also affected the health conditions of older people. In general, the older people who were with friends available in their social network had a better functional status as measured by ADL and IADL than those who were without friends available. i.e., with family members or social workers. Specifically, individuals who had friends available were significantly better in ADL (mean=0.35) than those without friends available (mean=1.46). Compared with those with friends available, individuals with family members available had slightly higher mean score of ADL (mean=0.99), which was still lower or better than those without family members available (mean=1.46, $p < 0.01$). However, we observed that the older people who were with social workers had worse ADL (mean=1.85), which was significantly worse than those without social workers (Mean=0.99). We found a similar pattern of IADL. Besides, cognitive functions, as measured by MMSE, were also better among the older people who were with friends available (mean=2.89) than those with family members (mean=3.66) and social workers (mean=4.29). Moreover, we noticed that individuals with social workers had a more inferior status of SRH (mean=1.78) than those with family members (mean=1.68) and friends available (mean=1.67).

Table 2. The functional health status and self-reported health by different social network types in the elderly China

	ADL				IADL				MMSE				SRH				
	n	Mean	SD	sig	n	Mean	SD	sig	n	Mean	SD	sig	n	Mean	SD	sig	
Quantity of social network ^a				**				**				**				**	
Diverse network	1450	0.13	0.75		1460	1.41	3.03		1463	1.44	2.16		1435	1.49	0.66		
Family-focused network	6969	0.47	1.74		7021	3.02	4.85		7037	2.14	2.77		6776	1.69	0.75		
Children-focused network	6534	1.17	2.57		6558	7.12	6.05		6573	4.28	3.68		5766	1.68	0.73		
Restricted network	6869	1.62	2.95		6908	8.67	6.06		6915	5.29	3.96		5645	1.74	0.74		
Quality of social network ^b																	
Family members available	Yes	21112	0.99	2.39	**	21237	5.85	6.1	**	21273	3.66	3.67	**	19121	1.68	0.73	**
	No	794	2.02	3.68		796	7.60	6.47		2635	5.60	2.7		580	1.91	0.78	
Friends available	Yes	8593	0.35	1.33	**	8641	4.02	6.49	**	8600	2.89	3.07	**	8200	1.67	0.73	*
	No	13313	1.46	2.88		13392	7.13	4.96		15248	4.26	4.44		11501	1.70	0.74	
Social workers available	Yes	1017	1.85	3.25	**	1021	8.00	6.3	**	1023	4.29	3.9	**	866	1.75	0.73	*
	No	20889	0.99	2.4		21012	5.81	6.1		22885	3.70	4.59		18815	1.68	0.74	

*p<0.05, **p<0.01; a, ANOVA analysis was performed; b, t-test was performed

Multiple regression analysis

Table 3 shows the estimates of the multiple regression model on the functional and self-rated health status. We noted that, with a restricted network as the reference group, the diverse network was negatively associated with all the health indicators, ADL (Beta=-0.41;p<0.01), IADL(Beta=-2.15;p<0.01), MMSE (Beta=-0.85;p<0.01), and SRH (Beta=-0.462;p<0.01), indicating a better functional health status and self-rated health among the elderly. Moreover, the family-focused network was associated with better ADL, IADL, and MMSE performance (p<0.01) but had no significant influence on the SRH (p>0.05). Furthermore, compared with the restricted network, it seemed that the children-focused network was associated with a better performance of functional health status in ADL (Beta=-0.096; p<0.01), IADL (Beta=-0.22; p<0.01), MMSE (Beta=-0.27;p<0.01) and SRH (Beta=-0.078; p<0.05).

With adjustment for covariates, multiple regression analysis showed that the older people who were with family members or friends available in their network had better health status in all indicators, but those with social workers had more inferior health status. Individuals with family members (Beta=-0.744; p<0.01) or friends available (Beta=-0.811; p<0.01) had a better performance but those with social workers (Beta=0.523; p<0.01) had more reduced performance in ADL. Similarly were true for IADL. Also, the elderly with family members (Beta=-1.4; p<0.01) or friends available (Beta=-0.79; p<0.01) had a better cognitive function measured by MMSE, but those with social workers had no significant difference (Beta=-0.04; p<0.01). Moreover, the older people with family members (Beta=-0.308; p<0.01) and friends available (Beta=-0.136; p<0.01) had a better SRH, but those with social workers had a worse status of SRH (Beta=0.154; p<0.01).

Table 3. Random-effect regression estimates of social network on functional health status

	ADL			IADL			MMSE			SRH		
	Coef.	SE	Sig	Coef.	SE	Sig	Coef.	SE	Sig	Coef.	SE	Sig
Quantity of social network												
(Ref.= Restricted network)	0			0			0			0		
Diverse network type	-0.41	0.070	**	-2.15	0.141	**	-0.85	0.093	**	-0.426	0.072	**
Family-focused network	-0.16	0.048	**	-0.94	0.095	**	-0.49	0.063	**	-0.056	0.045	
Children-focused network	-0.096	0.040	**	-0.22	0.080	**	-0.27	0.053	**	-0.078	0.041	*
Quality of social network												
Family members available	-0.744	0.084	**	-0.38	0.168	**	-1.40	0.11	**	-0.308	0.094	**
Friends available	-0.811	0.032	**	-1.91	0.064	**	-0.79	0.042	**	-0.136	0.032	**
Social workers available	0.523	0.076	**	1.17	0.151	**	-0.04	0.1		0.154	0.077	**
Control variables												
Age	0.048	0.002	**	0.25	0.003	**	0.13	0.002	**	-0.009	0.002	**
Male	-0.058	0.040		-0.53	0.079	**	-0.45	0.054	**	0.053	0.039	
Smoke	-0.296	0.046	**	-0.68	0.091	**	-0.07	0.061		-0.168	0.045	**
Drink	-0.238	0.044	**	-0.66	0.088	**	-0.13	0.059	**	-0.427	0.045	**
Regular exercise	-0.753	0.036	**	-2.29	0.072	**	-0.82	0.048	**	-0.473	0.037	**
Years of education	-0.025	0.041		0.11	0.08		0.67	0.055	**	-0.031	0.039	
Lower SES status	0.124	0.024	**	0.48	0.048	**	0.39	0.032	**	0.794	0.027	**
Living in rural area	-0.55	0.043	**	-1.1	0.084	**	0.12	0.057	**	-0.155	0.043	**
Constant	-1.088	0.316	**	-12.8	0.636	**	-7.03	0.414	**			
Observation	21,662			21,775			21,812			19,471		
Individual	16,902			16,903			16,903			14,979		
Random effects	2.21	0.01		4.45	0.02		2.96	0.01		0.58	0.08	

*, p<0.05; **, p<0.01.

DISCUSSION

Based on the data analysis of a nationally representative sample, our study identified four types of social network among the elderly Chinese, which comprised diverse network type, family-focused network type, children-focused network type, and restricted network type. We also demonstrated that the diverse network type was the best for functional health status in ADL, IADL, MMSE, and SRH of the elderly, while the restricted network type was the poorest. The family-focused network type was

generally positive for the health status of the elderly, but not as beneficial as the diverse network type.

The primary network types in the Chinese elderly were family-focused network, restricted, and children focused network type. While the diverse network type was most beneficial, it only accounted for a small proportion (<7%). The next beneficial network type was family-focused, which was the most significant network type in China. It is interesting to note that the restricted network type accounted for more than 30%, but individuals with this

type of social network had the worst performance of health status. What differs from previous studies in the western countries is that, besides from family members (e.g., spouse, siblings or other relatives), there was a large proportion of the Chinese elderly whose social network was made up only by their children, likely due to the differences in culture. Additionally, during the past four decades, the urbanization and modernization in China have transformed the family structure into the so-called nuclear family, consisting of only parents and children. As a consequence, the proportion of children-focused network type has significantly increased.

Compared to the family-focused network type, child-focused network type was associated with poorer functional health among the elderly. Without social support from relatives and kinship members, adult children might not be able to provide adequate old-age care to their aging parents because they have to work full-time and take care of their young children. The situation is even worse for families in which both husbands and wives are from single-child family, the consequences of the former nationwide one-child policy initiated in the late 1970s and implemented during the past four decades. Because of the one-child policy, a couple who both are from the single-child family may have to take care of four parents and one child, which is called the "4-2-1" family structure (14). Therefore, the increasing proportion of children-focused network type among the elderly reflects the transformation of family structure in China and raises severe concerns about elderly health. Restoring and cultivating the function of the community could alleviate the old-age care burden of both individual family and the public system. Moreover, as our findings suggest, local social ties based on the community can help cultivate diverse social network types, which would be quite beneficial to elderly health.

Overall, the diversity in the social network is demonstrated to be a crucial element for the better functional health status of the elderly. However, the proportion of elderly with diverse network type is less than 7% while the percentage of the restricted network type is up to 31.45%. Since the dataset is nationally representative, this implies that only a small proportion of the elderly enjoyed the benefits of diverse social network support in China. Besides from the quantity of social network (social network types), our study showed that the quality of social network had significant effects not only on the functional health indicators of ADL, IADL, and MMSE but also on self-rated health.

CONFLICTS OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this paper.

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