Social support and the incidence of cognitive impairment among older adults in China : Findings from the CLHLS study

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Abstract

Objective: Social support is thought to be associated with cognitive impairment (CI) in the older adults. However, the longitudinal relationship between the distinct dimensions of social support and incidence of cognitive impairment remains unclear. This study aims to investigate the association between social support and the incidence of cognitive impairment among the older adults in China.

Method: We used longitudinal data (2005-2014) from the Chinese Longitudinal Healthy Longevity Survey (CLHLS, 2005-2014, mean follow-up years 5.32 ± 2.64). In total, 5930 participants (aged 81.7 ± 9.7 years, range 65-112 years, 48.9% male) were enrolled. Cognitive impairment was measured by the Mini-Mental State Examination (MMSE). Social supports included support from family (marital status; contact with children, siblings, relatives, friends and others; money received from children; children's visit; siblings' visit) and social community (social service, social insurance). We calculated subdistribution hazard ratios (SHR) of cognitive impairment by establishing Cox regression model, adjusting for residence, gender, age, education, participation in physical exercise, activities of daily living abilities, depressive symptoms, smoking and drinking.

Results: Children's visit and marital status were significantly associated with decreased incidence rate of cognitive impairment. However, social support from other resources did not consistently predict the incidence of cognitive impairment. Specifically, (1) participants who were married had a lower incidence rate of cognitive impairment compared to the widowed (SHR = 0.849, 95% confidence interval, 0.730-0.987, $p = 0.033$); (2) participants who had frequent visits from their children showed lower incidence of cognitive impairment compared to those who had not (SHR = 0.778, 95% confidence interval, 0.646-0.938, $p = 0.008$).

Conclusion: Social support from family predicts a lower incidence of cognitive impairment among Chinese older adults.

Introduction

Cognitive impairment not only weakens older adults' ability of independent living, but also causes physical diseases and psychological pain [1], and even increases their risk of death [2]. Therefore, the preservation and promotion of cognitive function are important for improving the older population's quality of life.

Social relationships, which are contingent on access to social networks, promote participation in social activities and provide access to social support [3]. A series of studies found that social support is a strong predictor of health-related quality of life, mental health as well as functional impairment [4–6]. Numbers of studies have also reported a significant association between social support and cognitive decline in older adults [7–10].

Although previous studies have demonstrated that social support is associated with cognitive function, the understanding of the role of social support in cognitive function is still limited. Social support, often divided into emotional, instrumental, and informational support, refers to a person's perception of the availability of help or support from others in their social network [11]. However, most of studies did not distinguish the sources of social support, which might be unclear to investigate the specific contribution of various social supports. For example, Andrew & Rockwood (2010) used the composite "social vulnerability index" to reflect social support [7], which included emotional/instrumental/informational support from close family members, relatives, friends and someone others. However, social support provided by different people might play different roles in cognitive decline. Interactions with close family members (especially those who live with them) were likely to be the most influential factors, while relationships outside the family or some instrumental/informational support from community might have minor effect on cognition decline. According to a previous study about empty-nest older adults, formal social support (social community services) did not satisfy their demands, but informal support (daily care from close family members) was more important for older adult's mental health [12].

In addition, social relationships are diverse under different cultural background. Previous study claimed that Chinese social network structure differs from that of Western countries, as the Chinese older adults are more likely to live with their children, and their social interaction is more family-centered [13]. English and Carstensen [14] further pointed out that, with aging, the social contact of older adults decreases, and the relations with their spouses and other family members comprise the better part of their social network. According to surveys on Chinese older adults, social support, especially emotional support from children, is one of the most important factors affecting mental health [15]. Therefore, it is worth of consideration of specific sources of social support and their different contributions to old folks' cognition in Chinese culture background.

In the present study, we focused on the relations between specific social support and cognitive impairment. We hypothesized that different sources of social supports make different contributions to cognitive decline among Chinese older adults, and support from close family members is most influential.

Methods

Study population

Data were obtained from the Chinese Longitudinal Healthy Longevity Survey (CLHLS). The CLHLS was initiated in 1998 and follow-up surveys were conducted in 2000, 2002, 2005, 2008, 2011 and 2014. The details of the study design and data collection of CLHLS have been fully described previously [16]. At first, the CLHLS project focused on the oldest section of the elderly population, aged 80 and older, from 22 provinces in mainland China. From 2002 onwards, the CLHLS included younger elders aged 65–79 as a comparison. The present study sample included 2005–2014 longitudinal datasets. The date in 2005 was set as baseline. From the 8175 participants in 2005, the data of 300 participants who lived in nursing

homes was deleted. Thereafter, we excluded the participants with cognitive impairment in 2005. Finally, 5930 valid participants without cognitive impairment were enrolled in the final analysis (see Fig. 1, the flowchart of sample size from 2005 to 2014).

Social support

Social supports were constituted by domains of emotional support and material support from family members and the others. Social support inside family included contact with spouse/children/other relatives, Children's frequent visit (yes/no), sibling's frequent visit (yes/no), care in sick (family members' care when participants are sick), the money that participants received from children, and the money that participants gave to children. In addition, marital status (married and living together; married but separated; widowed; divorced; never married) as a mixed variable was also included in the analysis.

Contact with family members was measured using three questions: The first three persons you talk to when you need to tell something about yourself, The first three persons you ask for help when you have problems/difficulties, and The first three persons with whom you usually talk frequently in daily life. For each question, the score was rated on one of the five responses (i.e. spouse, children, children in law, friends/neighbors, and other relatives). If the first listed person was spouse, then the item "spouse" scored 3; if the second listed person was spouse, then the item "spouse" scored 2; otherwise scored 1. The item "children" and "other relatives" scored under the same rule with "spouse". Composite scores were calculated separately for each item (ranging from 3 to 9). The higher the scores the better the relationship (Table 1). Children's visits and siblings' visits were recoded according to the question "Please list the family members that you are living with (including names, gender, age, relations, alive or not, and frequently visit or not)". The money received from children (money received, for short) was measured through three questions: "how much did you receive from your son(s) or daughter(s)-in-law last year?", "how much did you receive from your daughter(s) or son(s)-in-law last year?" and "how much did you receive from your grandchild(ren) last year?" Then, the sum of money of the three answers was calculated. The money given to children (money given, for short) was measured in the same way. Care in sick was assessed by the question: "who take care of you when you are sick?", and answers were classified into 4 categories: none, spouse, children, others (friends, neighbors, nurses).

Table 1
The recodification of questionnaire

	Daily talk	Tell something	Ask for help	Sum score
Spouse	0–3	0–3	0–3	0–9
Children	0–3	0–3	0–3	0–9
Children in law	0–3	0–3	0–3	0–9
Friends/neighbors	0–3	0–3	0–3	0–9
Other relatives	0–3	0–3	0–3	0–9
Notes: “Daily talk” refers to the question: “The first three persons to whom you usually talk frequently in daily life”; “Tell something” refers to the question: “The first three persons to whom you talk when you need to tell something of you”; “Ask for help” refer to the question: “The first three persons you asking for help when you have problems/difficulties”.				

Social support outside family included the social service and social insurance. Social service was assessed by 8 questions: “is personal care service available in your community?”, “is home visit service available in your community?”, “is psychological consulting service available in your community?”, “is daily shopping service available in your community?”, “is social and recreation service available in your community?”, “is human rights consulting service available in your community?”, “is healthcare education service available in your community?” and “is neighborhood-relation service available in your community?”. All answers were classified into 3 categories: yes, no, and unknown.

Social insurance was also assessed by 8 questions: “do you have retirement wage at present?”, “do you have pension at present?”, “do you have private old age insurance at present?”, “can you access to public free medical services at present?”, “can you access to the cooperative medical scheme at present?”, “do you have basic medical insurance at present?”, “do you have severe disease insurance at present?” and “do you have life insurance at present?”. All answers were classified into 3 categories: yes, no, and unknown.

In addition, considering the imbalance of numbers in answers of social service and social insurance (Table 2), social service and social insurance were also defined by the 8 questions together (whether the participants are available to any social insurance/social service), respectively.

Table 2
The measurement of social insurance and social service

Measurements	N		
	Yes	No	Unknown
Social insurance			
Do you have retirement wage at present?	1392	4537	1
Do you have pension at present?	279	5651	0
Do you have private old age insurance at present?	49	5881	0
Can you access to public free medical services at present?	489	5441	0
Can you access to the cooperative medical scheme at present?	616	5314	0
Do you have basic medical insurance at present?	638	5292	0
Do you have severe disease insurance at present?	258	5672	0
Do you have life insurance at present?	67	5863	0
Social service			
Is personal care service available in your community?	129	5797	4
Is home visit service available in your community?	575	5351	4
Is psychological consulting service available in your community?	312	5615	3
Is daily shopping service available in your community?	254	5672	4
Is social and recreation service available in your community?	722	5204	4
Is human rights consulting service available in your community?	483	5442	5
Is healthcare education service available in your community?	636	5289	5
Is neighborhood-relation service available in your community?	1267	4659	4

Cognitive impairment

Cognitive impairment was measured by the Mini-Mental State Examination (MMSE) [17]. The higher the score (0–30), the greater the cognitive ability of the participant. As the majority of the Chinese older adults had no formal education, several items of MMSE were simplified to make them more practical. The serial 7 subtraction was simplified to 3 subtraction, and reading and writing a sentence was replaced by verbally reporting as many names of food items as possible in one minute [18]. As over half of the participants (54%) received no formal education in the present study, we used education-based MMSE cut-off points to define cognitive impairment, that is, < 18 for participants with no formal education, < 21

for participants with 1–6 years of education, and < 25 for them with more than 6 years of education [19, 20].

Covariables

Several control variables were adjusted in Cox models, including gender, age, residence (rural, town, city), education (years of schooling), participation in physical exercise (yes vs. no), Activities of Daily Living (ADL) disability (6–18), smoking (yes vs. no), drinking (yes vs. no), score of depressive symptoms (3–15). ADL ability was measured using the Katz Index of Activities of Daily Living scale (Cronbach's $\alpha = 0.87$) [21]. Depressive symptoms were measured using three items about neuroticism ("I often feel fearful or anxious"), loneliness ("I often feel lonely or isolated"), and perceived loss of self-worth ("The older I get, the more useless I feel"). Participants answered on a five-point Likert scale, with "1" for "does not describe me at all" and "5" for "describes me very well". It is the recommended measurement of depressive symptoms in CLHLS database book [22]. The sum of scores on the three items was treated as the indicator of depressive symptoms, with higher scores indicating worse psychological well-being (Cronbach's $\alpha = 0.64$) [20]. Participation in physical exercise was measured by one question: "Did you usually exercise in the past?". Description of all variable showed in Table 3.

Analysis

Cox models were constructed to estimate the subdistribution hazard ratio (SHR) and the 95% confidence interval of cognitive impairment associated with social support. SPSS version 23.0 for Windows (SPSS Inc., Chicago, IL, USA) was used to collate, recode and analyze the dataset. The final event was defined as cognitive impairment. The time to an event was defined as the data from 2005 survey to the time of a diagnosis of cognitive impairment.

Firstly, in order to test the validity of the recoded variables in the present study, all variables were included in regression equation separately, only controlling for gender and age. The results were reported in Table 4. According to the result above, the composite scores of contacts with spouse/children/other relatives were excluded in the following analysis (as children's visits predicted the incidence of cognitive impairment while contact with family did not. The composite scores might not distinguish the difference of social support inside family).

Secondly, all types of social supports were examined separately (i.e. marital status, child visit, sibling visit, money give, money receive, care in sick, social insurance, social service), controlling for demographic variables (Table 5a, model 1). In addition, when children's visits and sibling visits were examined, children alive and sibling alive were additionally adjusted in the model respectively; when money giving and money received were examined, children alive was also controlled; when care in sickness was examined, children alive and marital status were additionally adjusted in the model. As social insurance and social service were measured by 8 yes/no questions respectively, we conducted Cox analysis both for the composite measurement (whether the participants are available to any social insurance/social service; Table 5a) and for each question (Table 5b).

Thirdly, demographic variables like gender, age, residence, education, depression, ADL, drinking, smoking, exercise were included in regression equation (Table 6, model 2). Finally, all variables were included in Cox regression model together (Table 6, model 3).

Results

Age, education, depressive symptoms, ADL, and contact with family were continuous variables in analysis, but for the clarity of results presentation, they were classified into several categories (for details of demographics, see Table 3). Out of 5930 participants at baseline, 1051 of them (17.2%) developed into cognitive impairment (mean follow-up years 5.11 ± 2.32), 2286 (38.5%) of them were dead in the follow-up (mean follow-up years 4.56 ± 2.21), 1475 (24.9%) were lost in follow-up (mean follow-up years 3.84 ± 1.69), and 1118 (18.9%) maintained normal cognitive status (mean follow-up years 9.06 ± 0.32) at the end of the survey. Among the age categories listed in Table 3, incidence of cognitive impairment ranged from 11.8% (age 65–74) to 21.2% (age 85–94). There was no significant difference of cognitive impairment incidence in education, residence, habits of smoking and exercise. However, gender, age, depression, ADL, drinking consistently predicted the incidence of cognitive impairment in model 1, model 2 and model 3.

Table 3
Sample characteristics

	CI rate (%)	Study population (n = 5930)	Status			
			Not CI (n = 1118)	CI (n = 1051)	Dead (n = 2286)	Lost (n = 1475)
Age						
65–74	11.8%	1694 (28.6%)	675	200	378	441
75–84	19.9%	1970 (33.2%)	377	393	682	518
85–94	21.2%	1568 (26.4%)	59	332	798	379
95–112	18.1%	698 (11.8%)	7	126	428	137
Gender						
Female	20.2%	3029 (51.1%)	556	611	1069	793
Male	15.2%	2901 (48.9%)	562	440	1217	682
Education						
0 years	19.9%	3195 (53.9%)	533	636	1326	700
1–6 years	14.3%	2031 (34.2)	440	291	783	517
6 + years	17.6%	704 (11.9)	145	124	177	258
Residence						
Rural	19.2%	3321 (56.0%)	695	637	1402	587
City	15.2%	1294 (21.8%)	186	197	365	546
Town	16.5%	1315 (22.2%)	237	217	519	342
Marital status						
Widowed	20.5%	3277 (55.3%)	403	671	1410	793
Married	14.6%	2457 (41.5%)	671	358	787	641
Separated	9.0%	145 (2.4%)	33	13	69	30
Divorced	16%	25 (0.4%)	4	4	11	6
Never married	19.2%	26 (0.4%)	7	5	9	5
ADL						

	CI rate (%)	Study population (n = 5930)	Status			
			Not CI (n = 1118)	CI (n = 1051)	Dead (n = 2286)	Lost (n = 1475)
Impaired (> 6)	18.7%	791 (13.3%)	17	148	425	201
Normal (6)	17.6%	5139 (86.7%)	1101	903	1861	1274
Physical exercise						
Yes	16.4%	2297 (38.7%)	387	377	879	654
No	18.6%	3633 (61.3%)	731	674	1407	821
Smoking						
Yes	15.0%	2216 (37.4%)	397	332	940	547
no	19.4%	3714 (62.6%)	721	719	1346	928
Drinking						
Yes	17.5%	1894 (31.9%)	324	332	802	436
No	17.8%	4036 (68.1%)	794	719	1484	1039
Depression						
3–8	17.2%	4637 (78.2%)	920	798	1737	1182
9–15	19.6%	1293 (21.8%)	198	253	549	293
Child visit						
Yes	17.3%	5022 (84.7%)	1007	870	1889	1256
No	19.9%	908 (15.3%)	111	181	397	219
Child alive						
Yes	17.7%	5679 (95.8%)	1091	1005	2174	1409
No	18.3%	251 (4.2%)	27	46	112	66
Sibling visit						
Yes	15.5%	1997 (33.7%)	554	310	644	489
No	18.8%	3933 (66.3%)	564	741	1642	986
Sibling alive						

	CI rate (%)	Study population (n = 5930)	Status			
			Not CI (n = 1118)	CI (n = 1051)	Dead (n = 2286)	Lost (n = 1475)
Yes	16.6%	3402 (57.4%)	846	566	1120	870
No	19.2%	2528 (42.6%)	272	485	1166	605
Money given						
Yes	15.8%	1580 (26.6%)	378	250	526	426
No	18.4%	4217 (71.1%)	717	776	1712	1012
Unknown	18.8%	133 (2.2%)	23	25	48	37
Money received						
Yes	18.1%	5038 (85.0%)	940	914	1993	1191
No	14.6%	734 (12.4%)	152	107	236	239
Unknown	19.0%	158 (2.6%)	26	30	57	45
Care in sick						
Yes	17.3%	5607 (94.6%)	1077	972	2167	1391
No	25.4%	130 (2.2%)	26	33	45	26
Unknown	23.8%	193 (3.2%)	15	46	74	58
Social insurance						
Yes	15.2%	2268 (38.2%)	431	344	702	791
No	19.3%	3662 (61.8%)	687	707	1584	684
Social service						
Yes	17.0%	1920 (32.4%)	342	326	658	594
No	18.1%	4010 (67.6%)	776	725	1628	881

Regarding social supports, marital status had a significant impact on the incidence of cognitive impairment. Model 3 in Table 6 showed that participants who were married had a 15.1% decreased risk of developing cognitive impairment compared to those who were widowed (SHR = 0.849, 95% confidence interval 0.730–0.987, $p = 0.033$). In addition, participants who were married but lived separately (the number of this group is small, 145) also showed a lower risk of developing cognitive impairment compared to the widowed (SHR, 0.389, 95% confidence interval, 0.224–0.677, $p < 0.001$).

Children's visits had a consistently impact on the incidence of cognitive impairment in model 1, model 2 and model 3 (Tables 5a and 6). Participants with children's frequent visits had a 22.2% decreased risk of developing cognitive impairment compared to those without (SHR, 0.778, 95% confidence interval, 0.646–0.938, $p = 0.008$; model 3).

Participants who gave money to their children had lower risk of cognitive impairment compared to those did not (SHR = 0.851, 95% confidence interval, 0.734–0.986, $p = 0.032$). However, there was no difference in risk of cognitive impairment between participants who received money from their children and those did not (SHR = 1.150, 95% confidence interval, 0.931–1.421, $p = 0.195$). Neither Cox univariate or multivariable analysis showed that social service was significant for predicting the incidence of cognitive impairment (SHR = 1.004, 95% confidence interval, 0.879–1.148, $p = 0.949$, model 1; SHR = 1.025, 95% confidence interval, 0.894–1.175, $p = 0.728$, model 3). Although social insurance and social service were significant in univariate analysis after controlling for sex and age (care in sick: SHR = 0.696, 95% confidence interval, 0.492–0.985, $p = 0.041$; social insurance: SHR = 0.862, 95% confidence interval, 0.755–0.984, $p = 0.028$; Table 4), but neither social insurance or social service was significant in further univariate analysis (controlling for all demographic variable) and multivariable analysis. In addition, the analysis based on single question about social insurance showed that, participants with server disease insurance and life insurance were exposed to lower incidence of cognitive impairment (Table 5b).

Table 4
The Cox univariate analysis of all variables

	SHR (95%CI)	p
Residence	Reference (rural)	
City	0.883 (0.751–1.037)	0.130
Town	0.923 (0.791–1.077)	0.294
Education	0.989 (0.970–1.008)	0.241
Depression	1.078 (1.050–1.107)	0.001***
ADL	1.138 (1.087–1.192)	0.001***
Drinking	1.243 (1.079–1.432)	0.003***
Smoking	0.970 (0.834–1.127)	0.687
Exercise	0.970 (0.854–1.103)	0.644
Marital status	Reference (widowed)	
Married	0.784 (0.677–0.909)	0.001***
Separated	0.378 (0.218–0.656)	0.001***
Divorced	0.754 (0.281–2.021)	0.575
Never married	1.553 (0.640–3.768)	0.330
Child visit	0.778 (0.646–0.938)	0.008**
Child alive	1.156 (0.785–1.701)	0.463
Sibling visit	0.876 (0.739–1.037)	0.123
Sibling alive	0.996 (0.850–1.168)	0.964
Contact with spouse	0.982 (0.965–1.000)	0.052
Contact with children	1.007 (0.985–1.030)	0.537
Contact with children in law	1.015 (0.986–1.044)	0.321
Contact with relatives	0.999 (0.952–1.049)	0.972
Contact with friends and neighbors	1.011 (0.978–1.045)	0.520
Money given	Reference (no)	
Yes	0.819 (0.709–0.945)	0.006**

Note: All variables were included in model separately, after controlling for sex, age.

	SHR (95%CI)	p
Unknown	1.026 (0.689–1.529)	0.899
Money received	Reference (no)	
Yes	1.179 (0.963–1.443)	0.111
Unknown	1.347 (0.898–2.021)	0.150
Care in sick	Reference (no)	
Yes	0.696 (0.492–0.985)	0.041*
Unknown	1.244 (0.793–1.951)	0.341
Social insurance	0.862 (0.755–0.984)	0.028*
Social service	1.025 (0.899–1.168)	0.714
Note: All variables were included in model separately, after controlling for sex, age.		

Table 5
a. The Cox univariate analysis of social support

Social support	Model 1	
	SHR (95%CI)	p
Marital status	Reference (widowed)	
Married	0.816 (0.703–0.947)	0.008**
Separated	0.376 (0.216–0.652)	0.001***
Divorced	0.582 (0.216–1.569)	0.285
Never married	1.350 (0.555–3.284)	0.508
Child visit	0.760 (0.632–0.912)	0.003**
Sibling visit	0.871 (0.736–1.030)	0.107
Money give	Reference (no)	
Yes	0.836 (0.723–0.966)	0.015*
Unknown	0.938 (0.596–1.476)	0.781
Money receive	Reference (no)	
Yes	1.109 (0.901–1.365)	0.331
Unknown	1.178 (0.750–1.850)	0.477
Care in sick	Reference (no)	
Yes	0.715 (0.502–1.020)	0.064
Unknown	1.048 (0.657–1.671)	0.844
Social insurance	0.910 (0.787–1.052)	0.202
Social service	1.004 (0.879–1.148)	0.949
Note: The variables were included in model separately, after controlling for demographic variables including sex, age, residence, depression, ADL, drink, smoking, education, exercise. When child visit and sibling visit were examined, child alive and sibling alive was additional adjusted in the model respectively; when money give and money receive were examined, child alive was also controlled; when care in sick was examined, child alive and marital status were additional adjusted in the model.		

Table 5

b. The Cox univariate analysis of social insurance and social service

Measurements	SHR (95%CI)	p
Social insurance		
Do you have retirement wage at present?	0.906 (0.738–1.112)	0.346
Do you have pension at present?	1.139 (0.847–1.533)	0.390
Do you have private old age insurance at present?	0.703 (0.333–1.483)	0.355
Can you access to public free medical services at present?	0.900 (0.768–1.053)	0.189
Can you access to the cooperative medical scheme at present?	0.877 (0.718–1.071)	0.197
Do you have basic medical insurance at present?	0.807 (0.633–1.029)	0.084
Do you have severe disease insurance at present?	0.647 (0.452–0.926)	0.017*
Do you have life insurance at present?	0.462 (0.219–0.975)	0.043*
Social service		
Is personal care service available in your community?	1.159 (0.766–1.753)	0.485
Is home visit service available in your community?	0.984 (0.800–1.209)	0.875
Is psychological consulting service available in your community?	0.957 (0.704–1.301)	0.777
Is daily shopping service available in your community?	1.057 (0.790–1.141)	0.710
Is social and recreation service available in your community?	1.002 (0.819–1.226)	0.984
Is human rights consulting service available in your community?	0.936 (0.737–1.187)	0.583
Is healthcare education service available in your community?	0.868 (0.694–1.086)	0.216
Is neighborhood-relation service available in your community?	1.120 (0.966–1.299)	0.133
Note: Each single question was included into model separately, controlled for sex, age, residence, depression, ADL, drink, smoking, education, exercise.		

Table 6
The Cox multivariable analysis

	Model 2		Model 3	
	SHR (95%CI)	p	SHR (95%CI)	p
Gender	0.792 (0.675–0.929)	0.004**	0.845 (0.714–0.999)	0.048*
Age	1.082 (1.074–1.089)	0.000***	1.074 (1.066–1.083)	0.001***
Residence	Reference (rural)		Reference (rural)	
City	0.927 (0.773–1.111)	0.412	0.921 (0.761–1.116)	0.402
Town	0.916 (0.783–1.072)	0.273	0.918 (0.793–1.077)	0.294
Education	0.998 (0.978–1.019)	0.884	1.004 (0.983–1.025)	0.714
Depression	1.068 (1.039–1.097)	0.001***	1.058 (1.029–1.087)	0.001***
ADL	1.125 (1.073–1.179)	0.001***	1.113 (1.059–1.169)	0.001***
Drinking	1.290 (1.112–1.497)	0.001***	1.282 (1.104–1.488)	0.001***
Smoking	0.900 (0.768–1.053)	0.189	0.900 (0.768–1.055)	0.193
Exercise	1.030 (0.898–1.182)	0.671	1.008 (0.878–1.157)	0.910
Marital status			Reference (widowed)	
Married			0.849 (0.730–0.987)	0.033*
Separated			0.389 (0.224–0.677)	0.001***
Divorced			0.543 (0.197–1.495)	0.237
Never married			1.005 (0.368–2.741)	0.993
Child visit			0.778 (0.646–0.938)	0.008**
Child alive			1.156 (0.785–1.701)	0.463
Sibling visit			0.876 (0.739–1.037)	0.123
Sibling alive			0.996 (0.850–1.168)	0.964
Money give			Reference (no)	
Yes			0.851 (0.734–0.986)	0.032*
Unknown			0.681 (0.300–1.541)	0.356
Money receive			Reference (no)	

Note: All variables were incorporated into model together.

	Model 2		Model 3	
	SHR (95%CI)	p	SHR (95%CI)	p
Yes			1.150 (0.931–1.421)	0.195
Unknown			1.433 (0.674–3.048)	0.349
Care in sick			Reference (no)	
Yes			0.748 (0.521–1.073)	0.115
Unknown			1.099 (0.685–1.762)	0.696
Social insurance			0.947 (0.815-1.100)	0.475
Social service			1.025 (0.894–1.175)	0.728
Note: All variables were incorporated into model together.				

Discussion

In the present study, the association between social support and cognitive impairment was investigated by using a large population sample representative of Chinese older adults during a 9-year follow up. We found that emotional support from children (children's visit) and marital status were consistently associated with lower incidence of cognitive impairment in current analyses, while material support and support outside family were unstable variables associated with cognitive impairment among older adults. With aging, the social contact of older adults becomes relatively decreased, and the relations with spouse and family members are the major forms of social network [14]. Thus, we hypothesized that family relation is one of the major factors that influence the cognition of older adults. According to the cognitive reserve hypothesis [23], the social, emotional, and intellectual influences of marriage or people's living together goes beyond the influences that are known to be involved in leisure activities, such as decreased depression, stress, and cortisol level. The stable marital relation and good relation with children and relatives provide the older adults with daily care, family comfort, and social support [24]; however, those who are widowed, divorced, or living alone have a lack of spiritual and marital support, which may cause loneliness, insecurity, and negative attitude towards life [25], thus making them vulnerable to psychological and cognitive pathology [26].

The result in the present study initially confirmed the relations between social support and cognitive impairment. Consistent with previous studies [27, 28], we found that being widowed was associated with a lower incidence of cognitive impairment than being married. Although, the result also showed that participants who were married but lived separately were less likely to develop cognitive impairment than those who were widowed, the number of the group is relatively small (145 participants in "separated", 3277 in "widowed", 2457 in "married"), and this result should be interpreted with caution. We used multiple recoding measures to assess social supports provided by family members, friends and neighbors (i.e. composite scores of contact with spouse/children/siblings/relatives/friends/neighbors,

and children's/siblings' frequent visits). Result showed that composite scores were not associated with cognitive impairment, but children's frequent visits (yes/no) consistently predict the incidence of cognitive impairment. This might be that the composite variables did not reflect the availability of social support from family members, but the closeness of the relationships. Whereas children's visits reflected the direct contact between parents and children and it might be more appropriate in current analysis.

Interestingly, that participants who gave money to their children were exposed to lower risk of cognitive impairment than those who did not; while participants who receive money from their children showed no difference from those did not. First, the result might indicate that material support from children was not a vital factor associated with cognitive decline. Consistent to a previous study, Ellwardt et al., (2013) found that instrumental support did not buffer cognitive decline [9]. Second, in our study, material support provided by these older parents might reflect the emotional contact with their children and might not be just about material support. In general, the old parents in China lean on their children for financial support more or less. Therefore, the money or material support provided by parents is likely to be their care and love for their children rather than the simple financial support. Numbers of studies confirmed the current result, with the finding that both the provision and acceptance of social support play an important role in cognitive function in older adult [29–32].

According to Berkman's theoretical model, social support refers to a person's perception of the availability of help of support from others in their social network [11], which do not emphasize distinguishing the specific resources of social support. However, different resources of social support probably play different role in cognitive impairment. For example, a survey on Chinese older adults reported that emotional support from children is one of the most important factors affecting mental health [15]. Zhu, Hu, & Efird (2012) also found that, comparing to support from friends and important others, support from family was the most important indicator that predicted older adults' cognitive function [33].

However, previous studies in America reported opposite results. Brown et al., (2009) and Ficker et al., (2002) found that it was friends' support rather than family's support that had a bigger impact on cognitive function of older adults [34, 35]. Zhu et al., (2012) though these contradictory results could be explained from the perspective of cultural differences [33].

In Chinese family culture, the social networks of older adults are more family-centered, which empathizes the contact between older parents and other family members. In addition, traditional Chinese culture advocates filial piety, which is the reflection of the blood tie between parents and children in families. The traditional filial morality has importance functions to promote the personal morals and Chinese children are expected to take good care of and respect parents when they are old. For many old Chinese parents, children are their important spiritual pillar and the contact with children makes a great contribution to their happiness. The essence of filial piety is love, which implies gratefulness, respect, generosity, happiness, selflessness. Numbers of studies have found that filial piety were closely associated with subjective happiness, depression and life satisfaction [36–38]. The current result is consistent with the expectation, with the evidence that only children's visits but not sibling's visits predict the cognitive

decline of older adults. Neither social service, social insurance nor material support from children could consistently predict older adults' cognitive decline, which confirmed the irreplaceable role of emotional support from children.

There are some limitations in the present study. The measurement of social support was recoded according to the existing variables in CLHLS questionnaire, hence there are unavoidable repetition in contents of these variables. For example, measurement of the contact with children is repetitive in some extent with children's visit. However, current analysis distinguished the various resources of social support according to the existing variables, which make a difference comparing to previous studies.

Conclusion

In the present study, we found that emotional support from children (children's visits) and marital status were consistently associated with lower incidence of cognitive impairment in current analyses, while material support and support outside family were unstable variables associated with cognitive impairment among older adults.

Abbreviations

ADL:Activities of daily living; CLHLS:Chinese Longitudinal Healthy Longevity Survey; MMSE:Mini-mental status examination

Declarations

- Ethics approval and consent to participates

No ethics approval was required for this study since the datasets used are obtained from a public accessible database of the Chinese Longitudinal Healthy Longevity Survey (CLHLS; <http://opendata.pku.edu.cn/dataverse/CHADS>) with a signed data user agreement.

- Consent for publication

Not applicable

- Availability of data and material

The CLHLS datasets are publicly available at the Peking University Open Research Data on CLHLS (<http://opendata.pku.edu.cn/dataverse/CHADS>). Researchers may obtain the datasets after sending a data user agreement to the CLHLS team.

- Competing interests

Non-financial competing interests.

- Funding

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- Authors' contributions

SY: study design, analysis of the raw data, interpretation of data, revision of the manuscript. QY: further data analysis, revision of the manuscript. JX: revision of the manuscript. TL: further data analysis, interpretation of data, draft and revision of the manuscript. XZ: developed the research question, interpretation of data, revision of the manuscript. All authors contributed to and have approved the final manuscript.

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References

1. Frisoni GB, Fratiglioni L, Fastbom J, Guo Z, Viitanen M, Winblad B: **Mild cognitive impairment in the population and physical health: data on 1,435 individuals aged 75 to 95.** *The journals of gerontology Series A, Biological sciences and medical sciences* 2000, **55**(6):M322-328.
2. Oksala NK, Jokinen H, Melkas S, Oksala A, Pohjasvaara T, Hietanen M, Vataja R, Kaste M, Karhunen PJ, Erkinjuntti T: **Cognitive impairment predicts poststroke death in long-term follow-up.** *J Neurol Neurosurg Psychiatry* 2009, **80**(11):1230-1235.
3. Kelly, M. E., Duff, H., Kelly, S., Mchugh Power, J. E., Brennan, S., & Lawlor, B. A., et al: **The impact of social activities, social networks, social support and social relationships on the cognitive functioning of healthy older adults: a systematic review.** *Systematic Reviews* 2017, 6(1), 259.
4. Hajek A, Brettschneider C, Lange C et al: **Gender differences in the effect of social support on health-related quality of life: results of a population-based prospective cohort study in old age in Germany.** *Quality of Life Research* 2015, 25: 1159–68.
5. Hajek, André, Brettschneider, C., Lange, C., Posselt, T., Wiese, B., & Steinmann, S., et al: **Gender differences in the effect of social support on health-related quality of life: results of a population-based prospective cohort study in old age in Germany.** *Quality of Life Research* 2016, 25(5), 1159-1168.
6. Hajek, André, Brettschneider, C., Mallon, T., Carolin, V. D. L., Mamone, S., & Wiese, B., et al: **How does social support affect functional impairment in late life? findings of a multicenter prospective cohort**

- study in Germany. *Age and Ageing* 2017, 46(5), 813-820.
7. Andrew, M. K., & Rockwood, K: **Social vulnerability predicts cognitive decline in a prospective cohort of older Canadians.** *Alzheimer's Dementia* 2010, 6(4), 319-3250.
 8. Chen, T. Y., & Chang, H. Y: **Developmental patterns of cognitive function and associated factors among the elderly in Taiwan:** *Scientific Reports* 2016, 6, 33486.
 9. Ellwardt L, Aartsen M, Deeg D, & Steverink N: **Does loneliness mediate the relation between social support and cognitive functioning in later life?** *Social Science & Medicine* 2013, 98, 116-124.
 10. Windsor TD, Gerstorf D, Pearson E, Ryan LH, Anstey KJ: **Positive and negative social exchanges and cognitive aging in young-old adults: differential associations across family, friend, and spouse domains.** *Psychology and Aging* 2014, 29(1), 28-43.
 11. Berkman LF, Glass T, Brissette I, Seeman ET: **From social integration to health: Durkheim in the new millennium.** *Social Science & Medicine* 2000, 51(6), 843-857.
 12. Larsson K, Silverstein M. **The effects of marital and parental status on informal support and service utilization: a study of older swedes living alone.** *Journal of Aging Studies* 2004, 18(2), 231-244.
 13. Gleib DA, Landau DA, Goldman N, Chuang YL, Rodriguez G, Weinstein M: **Participating in social activities helps preserve cognitive function: an analysis of a longitudinal, population-based study of the elderly.** *Int J Epidemiol* 2005, 34(4):864-871.
 14. English T, Carstensen LL: **Selective Narrowing of Social Networks Across Adulthood is Associated With Improved Emotional Experience in Daily Life.** *Int J Behav Dev* 2014, 38(2):195-202.
 15. Lu MX, Guo C: **Present Situation of the Empty Nest Elderly's Mental Health and Research Commentary.** *Advances in Psychological Science* 2013, 21 (2): 263-271.
 16. Yi Z, Vaupel JW, Zhenyu X, Chunyuan Z, Yuzhi L: **The Healthy Longevity Survey and the Active Life Expectancy of the Oldest Old in China.** *Population: An English Selection* 2001, 13(1):95-116.
 17. Folstein MF, Folstein SE, McHugh PR: **"Mini-mental state". A practical method for grading the cognitive state of patients for the clinician.** *J Psychiatr Res* 1975, 12(3):189-198.
 18. Zeng Y, Feng Q, Hesketh T, Christensen K, Vaupel JW: **Survival, disabilities in activities of daily living, and physical and cognitive functioning among the oldest-old in China: a cohort study.** *Lancet* 2017, 389(10079):1619-1629.
 19. Zhang M, Katzman R, Salmon DP, Jin H, Cai G, Wang Z, Qu G, Grant I, Yu E, Levy P *et al*: **The prevalence of dementia and Alzheimer's disease in Shanghai, China: Impact of age, gender, and education.** *Annals of Neurology* 1990, 27(4):428-437.
 20. Zhu X, Qiu C, Zeng Y, Li J: **Leisure activities, education, and cognitive impairment in Chinese older adults: a population-based longitudinal study.** *Int Psychogeriatr* 2017, 29(5):727-739.
 21. Katz S: **Assessing self-maintenance: activities of daily living, mobility, and instrumental activities of daily living.** *J Am Geriatr Soc* 1983, 31(12):721-727.
 22. Smith J, Gerstorf D, Li Q: **Psychological resources for well-being among octogenarians, nonagenarians, and centenarians: differential effects of age and selective mortality.** . The

Netherlands: Springer.; 2008.

23. Mousavi-Nasab SM, Kormi-Nouri R, Sundstrom A, Nilsson LG: **The effects of marital status on episodic and semantic memory in healthy middle-aged and old individuals.** *Scandinavian journal of psychology* 2012, **53**(1):1-8.
24. Goudarz M, Foroughan M, Makarem A, Rashedi V: **Relationship Between Social Support and Subjective Well-Being in Older Adults**, vol. 10; 2015.
25. Theeke LA, Goins RT, Moore J, Campbell H: **Loneliness, depression, social support, and quality of life in older chronically ill Appalachians.** *J Psychol* 2012, **146**(1-2):155-171.
26. Ha JH, Ingersoll-Dayton B: **Moderators in the relationship between social contact and psychological distress among widowed adults.** *Aging & mental health* 2011, **15**(3):354-363.
27. Feng L, Ng XT, Yap P, Li J, Lee TS, Hakansson K, Kua EH, Ng TP: **Marital Status and Cognitive Impairment among Community-Dwelling Chinese Older Adults: The Role of Gender and Social Engagement.** *Dement Geriatr Cogn Dis Extra* 2014, **4**(3):375-384.
28. Sommerlad A, Ruegger J, Singh-Manoux A, Lewis G, Livingston G: **Marriage and risk of dementia: systematic review and meta-analysis of observational studies.** *J Neurol Neurosurg Psychiatry* 2018, **89**(3):231-238.
29. Barnes LL, De Leon CM, Wilson RS, Bienias JL, Evans DA: **Social resources and cognitive decline in a population of older African Americans and whites.** *Neurology* 2004, **63**(12), 2322–2326.
30. Pillemer SC, Holtzer R: **The differential relationships of dimensions of perceived social support with cognitive function among older adults.** *Aging & Mental Health* 2015, **20**, 727–735.
31. Pillemer S, Ayers E, Holtzer R: **Gender-stratified analyses reveal longitudinal associations between social support and cognitive decline in older men.** *Aging & Mental Health* 2018, 1-7.
32. Zunzunegui MV, Alvarado BE, Del ST, Otero A: **Social networks, social integration, and social engagement determine cognitive decline in community-dwelling Spanish older adults.***Journals of Gerontology* 2003, **58**(2), S93.
33. Zhu SZ, Hu J, Efird JT: **Role of social support in cognitive function among elders.** *Journal of Clinical Nursing* 2012, **21**, 2118–2125.
34. Brown SC, Mason CA, Spokane AR, Cruza-Guet MC, Lopez B, Szapocznik J: **The relationship of neighborhood climate to perceived social support and mental health in older Hispanic immigrants in Miami, Florida.** *Journal of Aging & Health* 2009, **21**(3), 431–459.
35. Ficker LJ, MacNeill SE, Bank AL, Lichtenberg PA: **Cognition and perceived social support among live-alone urban elders.** *Journal of Applied Gerontology* 2002, **21**(4), 437–451.
36. Chan C, Ho A, Leung P, Chochinov H, Neimeyer R, Pang S, et al. **The blessings and the curses of filial piety on dignity at the end-of-life: lived experience of Hong Kong Chinese adult children caregivers.** *Journal of Ethnic & Cultural Diversity* 2012, **24** (4), 277-296.
37. Khalaila R, Litwin H. **Does filial piety decrease depression among family caregivers?** *Aging & Mental Health* 2011, **15**(6), 679-686.

38. Pan Y, Jones PS, Winslow BW. **The relationship between mutuality, filial piety, and depression in family caregivers in china.** *Journal of Transcultural Nursing* 2017,28(5), 455-463.