The relationship between social networks and subjective cognitive decline in Chinese younger older adults: the mediating effect of self-perception of aging

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Abstract

Background Previous studies have emphasized the impact of social networks on cognitive function, but limited attention has been paid to the relationship between social networks and subjective cognitive decline (SCD) and its underlying mechanisms. To provide a theoretical basis for the prevention and management of SCD, this study aimed to investigate the current situation of social networks and SCD among younger older adults, further elucidate the relationship between them, particularly by comparing the impacts of family networks and friend networks on SCD, and explore the role of self-perception of aging (SPA) as a mediator in above associations.

Methods In this cross-sectional study, we surveyed 652 younger older adults from six cities utilizing a general information questionnaire, the Lubben Social Network Scale-6 (LSNS-6), the Subjective Cognitive Decline Questionnaire (SCD-Q9) and the Brief Ageing Perceptions Questionnaire (B-APQ). Regression models were performed to explore the association between social networks and SCD, while the mediating effect of SPA was examined by using the bootstrap method to validate path effects.

Results Of the participants, 38.04% of individuals had SCD scores above 50. The prevalence of social isolation was 27.5%, with specific rates of 12.3% for family isolation and 44.9% for friend isolation. After adjusting for key demographic characteristics, it was found that social networks (B = -0.05, $p < 0.001$), especially friend networks (B = -0.07, $p < 0.01$), were negatively associated with SCD. Additionally, SPA was identified as a partial mediator in the relationship between social networks and SCD (B = -0.007, 95% CI: -0.032, -0.002), as well as friend networks and SCD (B = -0.011, 95% CI: -0.021, -0.004).

Conclusions Younger older adults exhibited a high risk of social isolation, with friend isolation being particularly severe. The significant prevalence of SCD among younger older adults has emerged as a pressing health concern. Social networks exhibited a negative association with SCD, with SPA serving as a mediating role in this relationship. Moving forward, comprehensive interventions aimed at addressing SCD in older adults should consider strategies to enhance social networks and improve SPA.

Keywords Younger older adults, Social networks, Subjective cognitive decline, Self-perception of aging

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Introduction

At present, China has entered a period of deep aging with younger older adults gradually becoming the majority of the aging population, and those aged 60 to 69 accounted for 55.83% of the elderly demographic [1]. Compared to advanced older adults, younger older adults are often perceived as indispensable and vital human resources, given their better health and stronger commitment to participate in socioeconomic activities [2].

Preserving cognitive function is fundamental to overall health and is essential for maintaining independence in daily living [3]. However, as age increases, older adults become more susceptible to experiencing cognitive decline. Driven by rapid population aging, China ranks first worldwide in the number of individuals living with dementia, accounting for approximately 25% of the global dementia population [4]. Alzheimer's disease (AD), a prevalent form of dementia among the elderly, has imposed a significant burden on China, greatly exceeding expectations and substantially impacting the global burden of dementia [5]. Therefore, identifying the early stages of AD and advancing efforts to combat it will not only slow the progression of the disease but also help to reduce the burden on families and society. In light of the current absence of curative therapies [6], subjective cognitive decline (SCD) plays an important role in the early identification and the prediction of disease progression of AD [7, 8]. That is because SCD is widely regarded as a preclinical stage of AD [9], occurring prior to the onset of mild cognitive impairment (MCI) [10]. It is a cognitive status situated between intact cognition and objective cognitive impairment, characterized by self-experienced persistent decline in cognitive capacity that is not related to any acute event [11]. A meta-analysis showed a widespread prevalence of SCD in older Chinese adults, peaking at 46.4% overall and 38% among those aged 60–69 years [12]. These epidemiological data fully highlight the urgency of comprehensively exploring the causes of SCD as early as possible to form preventive strategies.

Social networks encompass all formal and informal social relationships within a specific group of individuals, including both direct interpersonal connections and indirect relationships formed through shared environments and cultural contexts [13]. If an individual experiences limited network size, low network diversity, and infrequent interactions, this objective state is referred to as social isolation (SI) [14]. As people age, later-life transitions such as normative retirement and adverse life events may fundamentally reshape their social networks [15]. Hence, social isolation is prevalent among the elderly. Panel data from China revealed a higher incidence of social isolation among middle-aged and older adults, ranging from 33.66% to 39.95% [16]. However,

there is a relative scarcity of research specifically focusing on the social networks of younger older adults.

Previous studies have demonstrated a marked influence of social networks on cognitive function. Schliep et al. [17] found social isolation elevated the risk of SCD among Americans aged 45 years and older by over twofold compared to those with normal social networks. Similarly, the cohort study of Cheng et al. [18] identified several social factors significantly associated with SCD, such as being married, having no living siblings, living alone, lacking close friends, and having less interaction with neighbors. Another longitudinal study [19] demonstrated that neighborhood social cohesion was positively associated with cognitive functions such as episodic memory, semantic verbal fluency, fluid reasoning and numeracy in older adults. Similarly, Tang et al. [20] showed that reduced neighborhood segregation could lessen the negative impact of loneliness on cognitive decline. Besides, scholars have delved deeper into the distinct roles of family networks and friend networks. A study argued that a greater proportion of friends in social networks was more important than that of family for better global cognition [21]. However, a longitudinal mediation model showed that a higher proportion of family networks was prospectively linked to lower friend interactions, in turn leading to worse memory [22]. Among Chinese older adults, the study by Shi et al. [23] contended that friend isolation had a more prominent predictive effect on cognitive function than family isolation, due to the larger cognitive stimulation provided by friend networks. Based on existing research evidence, it is necessary to explore whether family networks and friend networks have different effects on SCD in younger older adults. Furthermore, current research on the relationship between social networks and SCD lacks an in-depth analysis of the underlying mechanisms. Therefore, further investigation is warranted on the potential mediating mechanisms linking social networks and SCD.

Self-perception of aging (SPA) was defined as individuals' perceptions, expectations, and experiences related to their own aging process [24]. The heuristic model of Awareness of Aging proposed Awareness of Aging (AoA) as an integrated concept and placed key constructs of AoA, including SPA, within the context of life-span developmental processes. This model aims to understand how SPA interacts with other influencing factors and contributes to health outcomes [25]. Guided by this theoretical framework, it is hypothesized that SPA might mediate the relationship between social networks and SCD. Empirical studies have provided further evidence supporting this association. Results from research conducted in China indicated that both family networks and friend networks were positively correlated with aging

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attitudes [26]. A longitudinal study of Americans aged 65 and older found negative SPA was positively associated with social disconnectedness, characterized by negative social networks and low social engagement [27]. Similarly, elderly individuals experiencing social, family, and friend isolation were more likely to hold negative views about aging [28]. Furthermore, SPA has been identified as a predictor of cognitive function in the elderly [29]. Specifically, positive self-perception beliefs could serve as a stress buffer, potentially reducing dementia risk [30], while negative views of aging were associated with an increase in subjective cognitive complaints [31]. Although, pairwise correlation among social networks, SPA and cognitive function have been preliminarily examined, the mediating pathways of SPA between social networks and SCD remain underexplored in gerontological research.

Holding the principle of "early disease detection and early intervention in the population", this study focused younger older adults aged 60 ~ 74 as the research subjects, referring to previous literature [32, 33]. The aim was to investigate the current status of SCD and social networks, to further clarify the relationship between social networks and SCD, and to examine the mediating role of SPA. We speculate that the present study will enrich the exploration of the causes of SCD and provide valuable insights for formulating recommendations to intervene in SCD. This could further promote early prevention and treatment of AD and contribute to healthy aging.

Based on existing literature, this study proposes the following hypotheses: (1) social networks have a significant negative association with SCD in younger older adults; (2) the impact of friend networks on SCD is stronger than that of family networks in younger older adults; (3) SPA serves as a mediating factor in the relationship between social networks and SCD in younger older adults.

Material and methods
Participants
Younger older adults were recruited through convenience sampling from July 2022 to October 2023 in six cities. Inclusion criteria were: (1) Aged 60 ~ 74; (2) Able to clearly understand and communicate in Chinese with clear consciousness; (3) Permanent population (≥ 6 months of residence in the locality). Individuals were excluded based on the following criteria: (1) Diagnosed with MCI, prodromal AD or AD; (2) Suffered from diseases resulting in cognitive decline, such as stroke, craniocerebral injury, brain tumors, Parkinson's disease and epilepsy; (3) Had serious mental illnesses, including depression, anxiety and schizophrenia; (4) Experiencing an acute or life-threatening illness; (5) Impaired in vision, hearing and speech.

According to Kendall's principle, the sample size should be 10 to 20 times the number of variables [34]. Given 24 variables in this cross-sectional study and a predetermined 20% non-response rate, the minimum required sample size was calculated to be between 300 and 600 participants.

Measurement
Social networks
The Lubben Social Network Scale-6 (LSNS-6), developed by Lubben [35] and translated into Chinese by Chang et al. [36], was used to measure the social networks among younger older adults. This instrument has two dimensions: family networks and friends networks, with three items in each dimension. The options of each item range from 0 to 5 points. Thus, the total score ranges from 0 to 30 points. Higher scores indicate stronger social connections, whereas a score of less than 12 indicates social isolation. The scores of the two sub-dimensions range from 0 to 15 points each. Family or friend isolation is defined as scores falling below the threshold of 6 points within either the family or Friend dimension. In this study, the overall Cronbach's α of the scale was 0.764. Additionally, the Cronbach's α for the family networks was 0.761, and for the friend networks, it was 0.795.

Subjective cognitive decline
This study utilized the Subjective Cognitive Decline Questionnaire (SCD-Q9) [37], which was converted into Chinese by Hao et al. [38], to assess the SCD of younger older adults. This questionnaire consists of 9 items, with 4 items focused on overall memory function and temporal comparison, and the remaining 5 items addressing activities of daily living. Each item offers either a two-category option (yes: 1; no: 0) or a three-category option (often: 1; occasionally: 0.5; never: 0). The total score ranges from 0 to 9 points, with a higher score reflecting a more severe degree of SCD. In this study, the Cronbach's α for the Chinese version of the questionnaire was 0.848.

Self-perception of aging
The Brief Ageing Perceptions Questionnaire (B-APQ) [39], adapted into Chinese by Hu et al. [40], was employed to evaluate individual's perceptions, expectations, and experiences related to aging. This scale comprises 17 items distributed across five dimensions: consequences and control negative, consequences positive, timelinechronic, control positive and emotional representations. The 5-point Likert scale is used for scoring, with responses ranging from 1 to 5 points, corresponding to"strongly disagree"to"strongly agree". The total score ranges from 17 to 85 points with higher scores indicating

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a more negative SPA among the elderly. In this study, the Cronbach's α of this scale was found to be 0.778.

Covariates

The covariates included sociodemographic variables, information on chronic diseases (yes; no), family history of AD (yes; no), lifestyle factors, daily sleep duration (< 6 h; 6 ~ 8 h; ≥ 8 h), and exposure to negative life events (yes; no).

The sociodemographic variables included gender (female; male), age (60 ~ 64 years old; 65 ~ 69 years old; 70 ~ 74 years old), marital status (married; others), education level (illiterate; primary school; junior school or above), personal monthly income (< 1000 CNY; 1000 ~ 3000 CNY; ≥ 3000 CNY), previous occupation (employee/civil servant/medical or education staff; farmer or worker; the unemployed; the self-employed) and place of residence (city; rural). The lifestyle variables included smoking (yes; no/ex-smoker), drinking (yes; no/ex-drinking), tea drinking habit (yes; no) and exercise (hardly or never; once per week or more).

Data collection

Before collecting data, all investigators, who had an educational background related to medicine or relevant research experience, underwent uniform training. This training covered the purpose, methodology and key considerations of the survey to minimize bias. Investigators were permitted to proceed with the survey only if they had completed the assessment and were deemed qualified. During the actual investigation, investigators explained the purpose of the study to the participants and guided them in filling out the questionnaire. Younger older adults were requested to complete the questionnaire on their own. If they could not read or write independently, investigators delivered standardized instructions, explaining the items one by one, and recorded the response on behalf of them. These responses were then verified with the participants for accuracy. After finishing the questionnaire, investigators reviewed it on the spot to avoid any omissions.

Statistical analysis

The data were entered into the Questionnaire Star platform (www.wjx.cn) and were exported to the Excel format for independent verification by two researchers. First, categorical variables were presented as numbers and percentages, while continuous variables were expressed as means (standard deviation, SD) or medians (interquartile range, IQR) following the assessment of normality using the Kolmogorov–Smirnov test, Skewness-Kurtosis test and Q-Q plots. The score of SCD was converted into the percentage after standardization. A non-parametric test was used to compare the differences in SCD among younger older adults across general information. Second, Spearman's correlation analysis was employed to measure bivariate correlations between social networks, family networks, friend networks, SPA and SCD. Subsequently, the indirect effects of SPA on the relationship between social networks and SCD were tested using mediation analysis. The mediation models were conducted using Model 4 of the PROCESS macro with bootstrap resampling. The significance of the mediation effects was determined based on the 95% confidence interval (CI) excluding zero. The total effect was decomposed into the natural direct effect and the natural indirect effect. The mediation effect was quantified by the percentage mediated (PM), namely, indirect effect divided by the total effect. All statistical analyses were performed using SPSS version 26.0 (IBM, Armonk NY, USA) and statistical significance was considered at $\alpha = 0.05$. Missing values were addressed by multiple imputation methods.

Results

A total of 713 questionnaires were issued. After excluding 7 incomplete questionnaires, 48 cases suspected of MCI or dementia, and 13 cases suspected of moderate to severe depression, 652 effective questionnaires were recovered, resulting in an effective response rate of 91.44%.

Characteristics of participants

Among the 652 younger older adults, the mean age was 66.99 (standard deviation: 4.04), and 52.8% were female. The majority of participants were married (88.0%), reported no family history of AD (95.6%), and denied current smoking (75.6%), alcohol use (61.0%), regular tea consumption (54.9%), or negative life events (76.2%). Most of them (60.9%) have worked as farmers or workers before. A relatively larger proportion of younger older adults lived in the countryside (56.6%), received primary school education (37.9%), had a personal monthly income ranging from 1000 to 3000 CNY (50.2%), suffered from chronic diseases (57.4%), tended to exercise once a week or more (79.3%), and slept 6 to 8 h daily (54.3%).

The total score of social networks was 15.50 ± 6.00, with family networks scoring 9.00 (5.00) and friend networks scoring 6.00 (7.00). The prevalence of social isolation among younger older adults was 27.5%, with dimension-specific rates of 12.3% for family isolation and 44.9% for friend isolation. In the total sample, the score for SCD was 3.50 (4.50). More details can be seen in Table 2. After standardizing the score of SCD, 24.54% of younger older adults scored between 51 and 75, and 13.50% scored between 76 and 100.

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As presented in Table 1, significant differences in the score of SCD were observed across groups based on gender, age, education level, personal monthly income, previous occupation, place of residence, alcohol use, regular tea consumption, exercises and daily sleep duration. For example, among younger older adults, those who were female, older in age, had lower education levels, and lower personal monthly incomes tended to have higher score of SCD.

Bivariate correlations between social networks, SPA with SCD

The results of Spearman's correlation analysis (Table 2) suggested that there were mutually significant correlations between social networks, SPA and SCD. Specifically, social networks were negatively associated with SPA ($r = -0.177$, $p < 0.01$) and SCD ($r = -0.185$, $p < 0.01$). A positive correlation was observed between SPA and SCD ($r = 0.314$, $p < 0.01$). An analogous relationship was

Table 1 Social-demographic characteristics and comparison of SCD scores in different groups ($n = 652$)

Variables		N(%)	SCD	Z	*P* value
Gender	Male	308(47.2)	3.5(4)	−2.655	0.008
	Female	344(52.8)	4(4.88)		
Age(years)	60 ~ 64	191(29.3)	3(4.5)	18.779	<.001
	65 ~ 69	277(42.5)	4(4.5)		
	70 ~ 74	183(28.2)	4.25(4)		
Marital status	Married	574(88.0)	3.75(4.5)	−0.914	0.361
	Other	78(12.0)	3(4.75)		
Education level	Illiterate	171(26.2)	5(3.5)	51.581	<.001
	Primary school	247(37.9)	4(4.5)		
	Junior school or above	234(35.9)	3(3.5)		
Personal monthly income(CNY)	< 1000	139(21.3)	5(4.5)	32.643	<.001
	1000 ~ 3000	327(50.2)	3.5(4.5)		
	≥ 3000	186(28.5)	3(4.13)		
Previous occupation	Employee/civil servant/medical or education staff	100(15.3)	2.5(3.5)	50.857	<.001
	Farmer or worker	397(60.9)	4(4.5)		
	The unemployed	48(7.4)	5.5(4.25)		
	The self-employed	107(16.4)	2.5(3.5)		
Place of residence	City	283(43.4)	3(4)	−5.824	<.001
	Rural	369(56.6)	4.5(4)		
Chronic diseases	No	278(42.6)	3.5(4.5)	−1.712	0.087
	Yes	374(57.4)	4(4)		
Family history of AD	No	623(95.6)	3.5(4.5)	−0.552	0.581
	Yes	29(4.4)	3.5(2.25)		
Smoking	No	493(75.6)	3.5(4.5)	−0.74	0.459
	Yes	159(24.4)	3.5(4)		
Alcohol use	No	398(61.0)	4(4.5)	−2.19	0.029
	Yes	254(39.0)	3.5(4.13)		
Regular tea consumption	No	358(54.9)	4(4)	−2.5	0.012
	Yes	294(45.1)	3(4.5)		
Exercises	Hardly or never	135(20.7)	5(4)	−5.763	<.001
	Once a week or more	517(79.3)	3(4.5)		
Daily sleep duration(hours)	< 6	197(30.2)	4(4)	14.262	<.001
	6 ~ 8	354(54.3)	3.5(4.5)		
	≥ 8	101(15.5)	3(3.5)		
Negative life events	No	497(76.2)	3.5(4.5)	−0.953	0.34
	Yes	155(23.8)	4(5)		

SCD were shown as median (IQR)

Abbreviations: SCD Subjective cognitive decline, *IQR* Interquartile Range, *AD* Alzheimer's disease

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Table 2 The correlation between Social networks, SPA and SCD

Variables	Means (SD)/median (IQR)	Social networks	Family networks	Friend networks	SPA	SCD
Social networks	15.50(6.00)	1				
Family networks	9.00(5.00)	0.672**	1			
Friend networks	6.00(7.00)	0.878**	0.267**	1		
SPA	48.74(7.83)	−0.177**	−0.052	−0.196**	1	
SCD	3.50(4.50)	−0.185**	−0.090*	−0.201**	0.314**	1

Social networks and SPA were presented as means (SD). Other variables were expressed as medians (IQR)

Abbreviations: SD Standard deviation, *IQR* Interquartile Range, *SPA* Self-perception of aging, *SCD* Subjective cognitive decline

* $p < 0.05$

** $p < 0.01$

observed between friend networks with SPA ($r=−0.196$, $p< 0.01$), and SCD ($r=−0.201$, $p< 0.01$). As for family networks, they were negatively linked with SCD ($r=−0.090$, $p< 0.05$), but no significant association was found between family networks and SPA ($r=−0.052$, $p= 0.182$).

Mediation effect of SPA on the relationship between social networks and SCD

The mediation effect of SPA in the link between social networks, friend networks and SCD were further explored, as shown in Table 3. Under the premise of controlling for confounding variables, social networks had a direct negative impact on SCD (B $=−0.05$, $p < 0.001$). After adding SPA as a mediating variable, the influence of social networks on SCD remained negative and statistically significant (B $=−0.05$, $p < 0.01$). The bootstrap method presented that the mediating effect of SPA was significant (B $=−0.007$, 95% CI: $−0.032$, $−0.002$), validating that SPA was a partial mediator between social networks and SCD. The percentage of the effect mediated was calculated to be 13.2% (Table 4). This pattern was more pronounced for friend networks, showing a stronger indirect effect through SPA (B $=−0.011$, 95% CI: $−0.021$, $−0.004$), with the percentage mediated displayed as 15.9%. Figure 1 showed significant pathways of the final models between social networks, friend networks and SCD.

Discussion
The characteristics of social networks and SCD
The score of social networks was lower than the results of Dodds et al., but both observed a similar trend that friend networks were smaller compared with family networks [41]. The heterogeneity of measuring instruments may explain this difference, primarily because the latter study employed the Lubben Social Network Scale-12 to assess the social networks of older adults.

Table 3 Mediation effects of SPA in the relation between social networks and SCD

Outcome variable	Predictor variable	R^2	F	B (95% CI)	t
SCD	Social networks	0.20	14.19	−0.05(−0.08, −0.02)	−3.39***
SPA	Social networks	0.20	14.85	−0.12(−0.21, −0.03)	−2.51*
SCD	Social networks	0.22	14.96	−0.05(−0.08, 0.02)	−2.99**
	SPA			0.06(0.03, 0.08)	4.36***
SCD	Friend networks	0.19	14.08	−0.07(−0.11,−0.03)	−3.25**
SPA	Friend networks	0.21	15.21	−0.20(−0.32,−0.07)	−3.08**
SCD	Friend networks	0.22	14.81	−0.06(−0.10,−0.02)	−2.75**
	SPA			0.06(0.03,0.08)	4.31***
SCD	Family networks	0.19	13.34	−0.06(−0.12,0.00)	−1.96
SPA	Family networks	0.20	14.17	−0.05(−0.23,0.14)	−0.49
SCD	Family networks	0.21	14.40	−0.06(−0.12,0.00)	−1.91
	SPA			0.06(0.03,0.08)	4,62***

Gender, age, education level, personal monthly income, previous occupation, place of residence, drinking, tea drinking habit, exercises and daily sleep duration were analyzed as control variables

Abbreviations: SCD Subjective cognitive decline, *SPA* Self-perception of aging

* $P < 0.05$

** $P < 0.01$

*** $P < 0.001$

The prevalence of social isolation among younger older adults was alarmingly high, with friend isolation reaching an even more concerning rate. Our findings were consistent with the those of Zhao et al. [42], underscoring the urgency to pay close attention to older adults' social networks, especially their friend networks. According to socioemotional selectivity theory, older adults demonstrate selective shrinkage of social networks, retaining fewer yet emotionally closer social partners [43]. Even though Chinese society is undergoing significant changes in family structure, leading to weaker family function [44], family networks typically have a steady foundation under the cultural background

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Table 4 Bootstrap tests for mediation models

Paths	Class of Effects	B	Standard Error	LLCI	ULCI	PM
Social networks—SPA—SCD	Total effect	−0.053	0.016	−0.084	−0.022	
	Direct effect	−0.046	0.016	−0.077	−0.016	
	Indirect effect	−0.007	0.003	−0.032	−0.002	13.2%
Friend networks—SPA—SCD	Total effect	−0.069	0.021	−0.111	−0.027	
	Direct effect	−0.058	0.021	−0.100	−0.017	
	Indirect effect	−0.011	0.004	−0.021	−0.004	15.9%

Abbreviations: LLCI Lower Limit of Confidence Interval, *ULCI* Upper Limit of Confidence Interval, *PM* The percentage mediated

of filial piety in China. In contrast, friend networks are formed through shared interest and common life stages, exhibiting greater relational autonomy [45]. Of note, friendships may be more likely to decay due to the need for frequent contact to sustain them, coupled with lower emotional closeness [46]. If elderly individuals experience the relocation or death of friends and do not make new acquaintances, their friend networks will shrink dramatically. More importantly, there may be potential competition between family networks and friend networks due to the constraints of time and cognition. The growth of friend networks could be impacted by the family networks [46]. Caught in the stalemate of familial obligations and individual aspirations, younger older adults might lean more towards domestic commitments, inadvertently alienating old friends and struggling to cultivate new friendships.

The percentage of younger older adults with an SCD score exceeding 50 in our study aligned with the results for older adults aged 60 to 69 in a meta-analysis, yet it was lower than the pooled prevalence of 46.4% reported in that study [12]. However, our result was higher than the prevalence of SCD reported in Brazil (29.21%) for individuals aged ≥50 years [47], and even exceeded the estimate (one in four) based on the data from 15 countries [48]. The inter-study discrepancies could be attributed to the following factors. On the one hand, the heterogeneity of measuring tools was considered as an influencing factor. On the other hand, there were undoubted differences in race, age and other demographic factors as research sample differed. Although advanced age has been proved to be a risk factor for SCD in the community elderly [49], this study revealed the prevalence of SCD in younger older adults was still higher. Additionally, previous research has pointed out chronic diseases [50], loneliness [51], and various demographic characteristic [52] are associated with SCD, and they may similarly impact this group. Entering an aging trajectory characterized by shifts in social roles and physical decline, younger older adults become more vulnerable both physically and mentally, increasing susceptibility to SCD.

The association between social networks and SCD

Our study found that social networks had a significant negative effect on SCD, in accordance with the results observed in Koreans [53]. We also narrowed the perspective to reveal more specific associations. The results indicated that friend networks had a strongly negative association with SCD, but family networks did not, which was consistent with previous studies [54, 55]. Specifically, larger sizes and greater frequency of contact with friends had an impact on various cognitive domains including episodic memory, executive function, visuoconstruction, language and processing speed [55]. This may be because family networks placed emphasis on providing daily care and economic support, while friend networks focused on satisfying the needs of entertainment and socializing, which offer larger cognitive stimulation [23], as well as facilitating a wider range of social stimuli, new knowledge, and support sources [56]. Actually, the association between social networks and SCD has not been validated through diverse methods in various populations. The heterogeneity of the role of social networks on SCD is not fully explored. Thus, more discussion and exploration are needed to enrich the existing results and increase the explanatory power of the conclusions.

The mediating role of self-perception of aging

In this study, social networks could not only significantly affect SCD directly, but also exerted an indirect effect on SCD through SPA. Stress adaptation failure was thought to play a role in the pathogenesis of dementia [57]. In other words, negative SPA arising from age-related physical or cognitive decline and the shrinkage of social networks may act as a stressor, leading to changes in cortisol levels in the elderly. Subsequently, hypothalamic–pituitary–adrenal axis activation may accelerate neuronal loss in the hippocampus contributing to cognitive deterioration [58]. Conversely, increased social interactions foster positive emotional states, such as self-esteem, social competence and balanced emotions, thereby reducing stress [57]. Posteriorly, the resulting effects on SCD might be retarded or blocked. Apart from social networks, the mediation effect of friend networks

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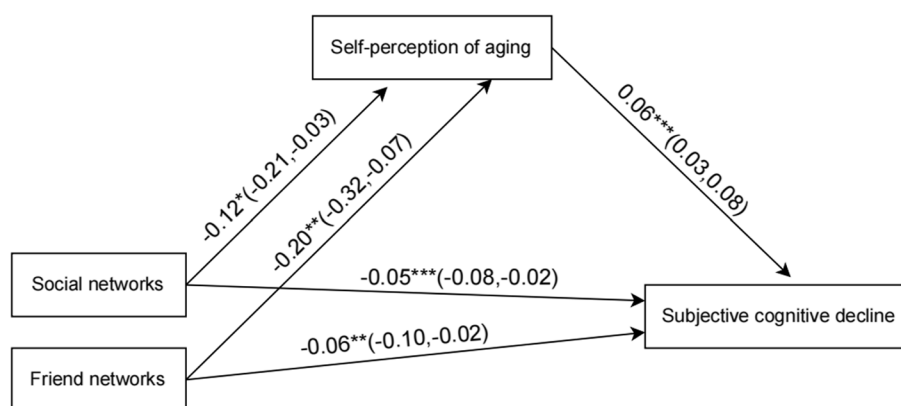
Fig. 1 The mediating effect of self-perception of aging on the relationship between social networks/friend networks and subjective cognitive decline. Note: 95% confidence intervals in brackets; *p < 0.05, **p < 0.01, ***p < 0.001

was similarly significant. The possible explanation for this effect lies in the multiple role of friend networks: in addition to providing social support, friend networks encourage individuals to combat physical inactivity and sustain an active lifestyle [59], which collectively contribute to a positive attitude toward aging. And positive SPA was linked to better cognitive performance [60]. Relatively, family networks could not effectively improve SPA, nor did they show the subsequent effect on SCD. Altogether, the establishment of SPA as a mediation enriched the understanding of the mechanism underlying the relationship between social networks and SCD. Meanwhile, it highlighted and supplied the antecedents of SCD, offering a fresh perspective on preventing SCD. Although this cross-sectional data suggests that SPA partially mediates the social networks-SCD pathway, definitive conclusions require prospective cohort studies with longitudinal measurements.

Given the partial mediating effect of SPA in the relationship between social networks and SCD, it is rational to conclude that social networks impact SCD via multifactorial pathways. Previous studies have supported the mediating role of depression between social networks and cognition in older adults [61, 62]. Similarly, Kang's study found a complete mediation effect of psychological distress between neighborhood social cohesion and certain aspects of cognitive performance [19]. Furthermore, the underlying mechanisms were also explored from a physiological perspective. For example, Qi et al. found that chronic inflammation partially mediated the association of social isolation with cognitive function [63]. A cross-lagged panel model revealed the longitudinal mediating effect of sleep disturbance on the relationship between social isolation and cognitive function [64]. Given these findings, future research should prioritize modeling cross-mechanism interactions and testing multimodal interventions targeting these convergent pathways.

The findings of this study carry important implications for both policy development and future research directions. Specifically, the results highlight the necessity of strengthening social networks and improving SPA as integral components of targeted interventions for the prevention and management of SCD. Implementing evidence-based strategies can help mitigate the detrimental effects of SPA in older adults and foster social connections, thereby reducing the risk of SCD. For future research, it is essential to conduct longitudinal studies to establish strong causal inferences and address existing gaps in understanding the complex relationship between social networks and SCD trajectories, thereby generating more robust evidence.

Limitations
This study still existed several limitations. First, the LSNS-6 scale assessed social networks of younger older adults only from family and friends, ignoring the strength of the relationship and not including other social relations such as neighbors. Second, causal inferences could not be checked and social networks were not considered as a time-varying variable in the cross-sectional survey. Longitudinal studies are needed to clarify the causal association and identify the time-varying characteristics of social networks in the future. Third, the information was based on younger older adults' self-reports, probably leading to certain self-report bias. Finally, there might be a selection bias due to the use of convenient sampling within a single province of China, which could affect the representativeness of the sample to some extent.

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Conclusion

The social networks of younger older adults require increased attention due to the great vulnerability of social isolation. Younger older adults with high SCD scores should not be ignored for its adverse effect. Our study confirmed the effect of social networks on SCD and further identified the mediating effect of SPA on above effects. These findings suggest that younger older adults should enhance social integration and strengthen social connections. Additionally, cultivating a positive attitude towards aging may be beneficial. Collectively, all these strategies could contribute to lowering the level of SCD.

Authors' contributions
CZ collected and analyzed the data, wrote the initial manuscript and revised manuscripts. SS conceptualized, designed the data collection methods, collected and inputted the data, conducted statistical analysis, drafted the initial manuscript. LW helped draft the initial manuscript and collected the data. YT collected the data. LZ and HX conceptualized the research, conducted data curation and statistical analysis, coordinated and supervised project administration, critically revised manuscript and approved the final manuscript as submitted.

Data availability
The datasets generated and/or analyzed during the current study are not publicly available due to the authors considering further publications, but are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
This observational study was approved by the Ethics Committee of Wenzhou Medical University (2022–022). All methods were performed in accordance with the relevant guidelines and regulations, and informed consent was obtained from each younger older adult.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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