Prospective association between social engagement and cognitive impairment among middle-aged and older adults: evidence from the China Health and Retirement Longitudinal Study

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ABSTRACT

Objectives Cognitive impairment is a precursor of dementia. This study aimed to examine the association of social engagement with cognitive decline during the process of normal ageing.

Methods We used data from the China Health and Retirement Longitudinal Study. The cognitive functions were tested at baseline, and 2-year and 4-year follow-up visits. Social engagement was constructed as a comprehensive measure including the quantity and frequency of social activities. Activities of social engagement were classified into three types. Multilevel logistic model was fitted to evaluate the prospective association between social engagement and cognitive impairment.

Results After 2-year follow-up, compared with participants with the lowest level of social engagement, those with level-2, level-3 and level-4 social engagement had a 12% (OR=0.88, 95% CI 0.71 to 1.09, p=0.242), 17% (OR=0.83, 95% CI 0.71 to 0.97, p=0.020) and 25% (OR=0.75, 95% CI 0.61 to 0.93, p=0.008) lower risk for developing cognitive impairment, respectively. A similar pattern of significantly protective association was found at 4-year follow-up. Combined effect analysis showed that participants who attended one type of social engagement had a lower risk of developing cognitive impairment and the protective effect was even larger with those who attended two or three types of social engagement.

Conclusions Social engagement had a protective effect on cognitive impairment among middle-aged and older adults in China. Given the growing epidemic of dementia and rapid pace of ageing in low-income and middle-income countries, our study shed lights on comprehensive and tailored public health programmes for improving social engagement, to delay cognitive impairment at mid-age and later life.

INTRODUCTION

In most cases, the pathological cognitive impairment process may serve as a precursor of dementia,1,2 which is diagnosed by severe neurocognitive disorder with social or occupational dysfunction. In the population-ageing society, dementia has been a serious public health problem with the number doubling during the past two decades.3 Cognitive impairment, which often begins at age around 45, is a pathophysiological process of brain changes associated with age.4,5 Delaying the process of cognitive decline could prevent dementia at later life. Nearly 20% of Chinese adults aged 60 or above had mild cognitive impairment, of which 6% developed dementia.6 People with cognitive impairment have difficulty in performing daily living tasks and need more medical and family care, thus leads to a substantial economic and social impact.7,8 The burden of cognitive impairment is increasing on ageing populations in China.9 Therefore, it is necessary to identify potential influencing factors that could prevent individuals from cognitive impairment, such information is needed for designing public health interventions.10

Strengths and limitations of this study

This is the first nationally representative study that investigated the prospective association between social engagement and cognitive impairment in low-income and middle-income countries.

Social engagement had a significant protective effect on the cognitive impairment among individuals aged 45 years and over.

Relative to single type of social engagement, multiple types of social engagement showed a greater protective effect on cognitive impairment.

Comprehensive and tailored programmes for improving the enrolment of social engagement are imperative to slow down cognitive decline.

The observational nature of our study limited our ability to confirm a causal relationship between social engagement and cognitive impairment.

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Prior studies suggest that individuals who are more socially engaged tend to have better cognitive functions compared with the less engaged.\textsuperscript{11, 12} In general, social engagement refers to maintenance of social connections and participation in social activities.\textsuperscript{11, 13} Different hypotheses have been used to explain potential mechanisms of social engagement on cognitive impairment, including biological, behavioural and psychological aspects. Cognitive reserve is one of the most commonly referred hypotheses. It posits education or life experience influence neural processing and synaptic organisation, and contribute to increased reserve, thus allowing one to cope with cognitive decline better than others.\textsuperscript{14, 15} Social engagement includes participating in social activities, interacting with social members and sharing resources of education, culture, religion and politics that in turn enhance cognitive reserve.\textsuperscript{16} On the other hand, social engagement may also lead to more positive emotional status and lower stress, better diet and healthier lifestyle, which promote physiological and psychological well-being and better cognitive function.\textsuperscript{17, 18}

A few studies have examined the cross-sectional association between cognitive impairment and social engagement, the causal relationship, however, has been established. It is not clear whether social engagement leads to better cognitive performance, or rather that individuals with better cognitive function tend to participate more in social engagement.\textsuperscript{15, 19, 20} In addition, to our knowledge, few studies have explored the combined effect of multiple activities of social engagement on cognitive impairment giving the diverse activities might facilitate different cognitive functioning. However, activities of social engagement showed heterogeneity in prior studies. One key question remained unanswered: does the effect on cognitive function found in other settings apply to specific daily activities in Chinese culture, where the progress of ageing and urbanisation is unprecedented rapid and social activities change quickly. Furthermore, cognitive impairment appears to be more pronounced in low- and middle-income countries (LMICs), which further contribute to population burden of disease.\textsuperscript{21, 22} Despite this, evidence on the potential protective association between social engagement and cognitive impairment in LMICs remains relatively scarce.

To fill this gap, this study aims to (1) assess the prospective association between social engagement and cognitive impairment among middle-aged and older people in China and (2) investigate single and the combined effects of different types of social engagement on cognitive impairment over time.

**METHOD**

**Study design, setting and population**

The China Health and Retirement Longitudinal Study (CHARLS) is a biennial prospective cohort study of nationally representative of Chinese adults aged ≥45 years and their spouses. CHARLS used multistage probability sampling to select 150 county-level units in which 450 communities chosen within 28 provinces of China.\textsuperscript{23} The survey included three phases: the baseline survey (2011–2012) with 17,708 participants recruited and enrolled, the 2-year follow-up survey (2013–2014) with 89% reviewed and the 4-year follow-up survey (2015–2016) with 73% finally reinterviewed.

We used data from 2 years and 4 years of follow-up visits (2011–2012, 2013–2014 and 2015–2016). Of the total 17,708 participants at baseline survey (2011–2012), 458 participants aged <45 years old and 3,666 did not complete the social engagement measures or cognitive testing, thus a total of 13,584 participants had cognitive assessment at the baseline. We excluded individuals who had dementia or cognitive impairment without dementia (CIND) at baseline (n=4,081), lost to follow-up at 2-year survey (n=1,650), with missing data in critical variables (n=928). For 4-years of follow-up visits, we excluded individuals who had dementia or CIND at baseline (n=3,900), lost to follow-up at 4-year survey (n=2,107), or missing data in critical variables (n=713). Figure 1 presented a flow chart for inclusion and exclusions of the study sample from the 2011–2012 CHARLS through the follow-up surveys.

**Measurements**

**Cognitive impairment**

In the CHARLS Survey, cognitive function was measured through a global cognitive function score based on two aspects of cognitive functions: episodic memory and mental intactness.\textsuperscript{24, 25} For episodic memory, each participant was asked to repeat as many as possible 10 Chinese nouns just read to him/her (immediate word recall), and then to recall the same 10-word list 5 min later (delayed recall). Answers to these questions were aggregated into a single episodic memory score ranging from 0 to 20.
Table 1  Two-year and four-year incidence of cognitive impairment among participants free of cognitive impairment at baseline: The China Health and Retirement Longitudinal Study

| Variables                      | Two-year follow-up | Four-year follow-up |
|-------------------------------|--------------------|---------------------|
|                               | N  | Cognitive impairment | P value | N  | Cognitive impairment | P value |
| Total, n (%)                  | 6920 | 1290 (18.6)        | <0.001 | 6859 | 1574 (23.0)        | <0.001  |
| Age, n (%)                    |     |                    |         |     |                    |         |
| <60                           | 4394 | 675 (15.4)         | 4442    | 816 (18.4)         | 1914    | 541 (28.3)         |
| 60–69                         | 1945 | 411 (21.1)         | 1914    | 541 (28.3)         | 1914    | 541 (28.3)         |
| 70–79                         | 527  | 180 (34.2)         | 463     | 193 (41.7)         | 40      | 24 (60.0)          |
| 80 or above                   | 54   | 24 (44.4)          | 40      | 24 (60.0)          | 40      | 24 (60.0)          |
| Sex, n (%)                    |     |                    |         |     |                    |         |
| Female                        | 3165 | 667 (21.1)         | 3131    | 767 (24.5)         | 3728    | 807 (21.7)         |
| Male                          | 3755 | 623 (16.6)         | 3728    | 807 (21.7)         | 3728    | 807 (21.7)         |
| Education, n (%)              |     |                    | <0.001  |     |                    | <0.001  |
| Illiterate                    | 798  | 378 (47.4)         | 806     | 434 (53.8)         | 806     | 434 (53.8)         |
| Part of primary school        | 1143 | 325 (28.4)         | 1136    | 402 (35.4)         | 1136    | 402 (35.4)         |
| Primary school                | 1764 | 342 (19.4)         | 1744    | 440 (25.2)         | 1744    | 440 (25.2)         |
| Middle school                 | 1981 | 192 (9.7)          | 1996    | 235 (11.8)         | 1996    | 235 (11.8)         |
| High school or above          | 1234 | 53 (4.3)           | 1177    | 63 (5.4)           | 1177    | 63 (5.4)           |
| Marriage, n (%)               |     |                    | <0.001  |     |                    | <0.001  |
| Having spouse                 | 6387 | 1145 (17.9)        | 6341    | 1402 (22.1)        | 6341    | 1402 (22.1)        |
| No spouse                     | 533  | 145 (27.2)         | 518     | 172 (33.2)         | 518     | 172 (33.2)         |
| Residence, n (%)              |     |                    | <0.001  |     |                    | <0.001  |
| Rural                         | 3874 | 894 (23.1)         | 3947    | 1089 (27.6)        | 3947    | 1089 (27.6)        |
| Urban                         | 3046 | 396 (13.0)         | 2912    | 485 (16.7)         | 2912    | 485 (16.7)         |
| Smoke, n (%)                  |     |                    | 0.052   |     |                    | 0.451   |
| Current                       | 2312 | 444 (19.2)         | 2333    | 554 (23.8)         | 2333    | 554 (23.8)         |
| Former                        | 683  | 104 (15.2)         | 655     | 142 (21.7)         | 655     | 142 (21.7)         |
| Never                         | 3925 | 742 (18.9)         | 3871    | 878 (22.7)         | 3871    | 878 (22.7)         |
| Alcohol drinker, n (%)        |     |                    | <0.001  |     |                    | <0.001  |
| Current                       | 2536 | 395 (15.6)         | 2527    | 515 (20.4)         | 2527    | 515 (20.4)         |
| Former                        | 544  | 103 (18.9)         | 540     | 145 (26.9)         | 540     | 145 (26.9)         |
| Never                         | 3840 | 792 (20.6)         | 3792    | 914 (24.1)         | 3792    | 914 (24.1)         |
| Hypertension, n (%)           |     |                    | 0.106   |     |                    | 0.215   |
| Yes                           | 1792 | 357 (19.9)         | 1731    | 416 (24.0)         | 1731    | 416 (24.0)         |
| No                            | 5128 | 933 (18.2)         | 5128    | 1158 (22.6)        | 5128    | 1158 (22.6)        |
| Diabetes, n (%)               |     |                    | 0.478   |     |                    | 0.733   |
| Yes                           | 482  | 84 (17.4)          | 462     | 109 (23.6)         | 462     | 109 (23.6)         |
| No                            | 6438 | 1206 (18.7)        | 6397    | 1465 (22.9)        | 6397    | 1465 (22.9)        |
| Coronary heart diseases, n (%)|     |                    | 0.037   |     |                    | 0.027   |
| Yes                           | 894  | 144 (16.1)         | 870     | 174 (20.0)         | 870     | 174 (20.0)         |
| No                            | 6026 | 1146 (19.0)        | 5989    | 1400 (23.4)        | 5989    | 1400 (23.4)        |
| Stroke, n (%)                 |     |                    | 0.008   |     |                    | 0.059   |
| Yes                           | 166  | 44 (26.4)          | 146     | 43 (29.5)          | 146     | 43 (29.5)          |
| No                            | 6754 | 1246 (18.4)        | 6713    | 1531 (22.8)        | 6713    | 1531 (22.8)        |
| Depressive symptoms, n (%)    |     |                    | <0.001  |     |                    | <0.001  |
| Yes                           | 1999 | 499 (25.0)         | 1992    | 599 (30.1)         | 1992    | 599 (30.1)         |

Continued
For mental intactness, measures consisting of numerical ability, time orientation and picture drawing were used to formulate the score. The questions included: serial 7 subtractions from 100 (up to five times), naming the date of the investigation day (month, day, year and date of week), and redrawing a picture of two overlapping pentagons shown to him/her. Answers to these questions were aggregated into a single mental intactness score ranging from 0 to 10. The score of global cognitive function was the summation of episodic memory and mental intactness scores, ranging from 0 to 30 with a higher score indicating a better cognitive function. The cognitive tests used in CHARLS accorded with the Health Retirement Study and were adapted from the Telephone Interview for Cognitive Status, which provides a valid alternate to rate global cognitive function compared with the Mini-Mental State Examination. In addition, previous study had confirmed that the global cognitive function score demonstrated satisfactory validity and reliability among Chinese middle aged and older adults. According to the previous studies, respondent who scored from 0 to 6 were classified as a person with dementia, and 7 to 11 were classified as CIND. In the present study, a score of 11 or less was used as a cut point for having cognitive impairment.

Social engagement
To measure social engagement, participants were asked whether they had done any sorts of the following activities in the last month, which was a multiple-choice question including 10 activities. If the answer was “yes”, they were further asked about the frequency of activity. The activities surveyed include: (1) interactions with friends; (2) playing Mahjong, chess, cards or going to community club; (3) helping family, friends or neighbours who do not live with participants; (4) going to sport, social or other kind of club; (5) taking part in a community organisation; (6) voluntary or charity work; (7) caring for a sick or disabled adult who does not live with the respondents and who did not pay for the help; (8) attending educational or training course; (9) stock investment and (10) using internet. As for the frequency of each activity, four choices were given to the respondents, ‘almost daily’, ‘almost every week’, ‘not regularly’ and ‘none’ in the last month, measured by scores ‘3,’ ‘2,’ ‘1’ and ‘0,’ respectively.

A composite index of social engagement was constructed by summing the scores for all ten indicators, ranging from 0 to 18 with higher scores indicating better social engagement. Considering the distribution of scores, a four-point categorical rank variable was used to represent the scores of social engagement with score 0 classified into level 1, score 1 classified into level 2, score 2 or 3 classified into level 3 and score 4 or above classified into level 4, higher rank indicating higher scores of social engagement. In addition, based on the type of social engagement, activities surveyed were classified into three categories: leisure activities, social activities helping others and learning activities for new knowledge. In the 10 activities mentioned above, activities 1, 2, 4 and 5 were defined as leisure activities, 3, 6 and 7 as social activities helping others and 8, 9 and 10 as learning activities for new knowledge. To explore the single and combined effect of social engagement on cognitive impairment, our final analytic sample were classified into three categories, including those with none of social engagement, those with one type of social engagement and those with two or more types of social engagement.

Table 1

| Variables                      | Two-year follow-up |        |        | Four-year follow-up |        |        |
|-------------------------------|--------------------|--------|--------|--------------------|--------|--------|
|                              | N   | Cognitive impairment | P value | N   | Cognitive impairment | P value |
| ADL score, n (%)              |     |                    |        |     |                    |        |
| 0                             | 4921 | 791 (16.1)          | <0.001 | 4867 | 975 (20.0)          | <0.001 |
| 1~2                           | 6183 | 1107 (17.9)         |        | 6136 | 1366 (22.3)         |        |
| 3~6                           | 601  | 149 (24.8)          |        | 591  | 162 (27.4)          |        |
| Number of children, n (%)     |     |                    |        |     |                    |        |
| 0                             | 179  | 3 (15.8)            | <0.001 | 18   | 3 (16.7)            | <0.001 |
| 1–2                           | 4096 | 597 (14.6)          |        | 4079 | 727 (17.8)          |        |
| 3 or above                    | 2805 | 690 (24.6)          |        | 2762 | 844 (30.6)          |        |
| Weekly contact with children  |     |                    |        |     |                    |        |
| Yes                           | 6482 | 1183 (18.3)         | 0.001  | 6435 | 1460 (22.7)         | 0.046  |
| No                            | 438  | 107 (24.4)          |        | 424  | 114 (26.9)          |        |

ADL, activity of daily living.
by personal factors, environmental factors, health condition and body functions.\textsuperscript{15,24}

The personal factors included age, gender (male or female), educational attainment (illiterate, part of primary school, primary school, middle school, high school or above), marital status (married and currently living with spouse or others), residence status (currently living in rural or urban areas), smoking status (current, former or never) and alcohol drinker (current, former or never). The health condition covariates included whether they had ever been diagnosed with hypertension, diabetes, coronary heart disease, stroke and self-reported depressive symptoms. For the body functions factors, a six-item summary in CHARLS that includes bathing, dressing, eating, getting in/out of bed, using the toilet and controlling urination was selected. The environmental factors mainly referred to family support in this study, including the number of children the respondents had, and whether he/she had a contact weekly with the children in person or by phone.

**Statistical analysis**

Descriptive statistical analysis and the Pearson $\chi^2$ test were used to analyse the difference in population characteristics between the cognitive impairment and non-cognitive impairment groups. Two pairs of multivariate logistic regression models were used to analyse the prospective association between the social engagement at baseline and incidence of cognitive impairment at 2-year and 4-year follow-up. The first pair of models focused on the social engagement as an independent predictor, and the second pair of models focused on the combined effect of different types of social engagement. All the models were adjusted for the covariates. To evaluate the potential bias due to non-response and attrition across difference survey waves, sensitivity analysis was conducted using the same models with the complete sample who participated in all three waves. The software Stata V.14.1 for Mac (Stata Corp, College Station, Texas, USA) was used for statistical analysis.

**Patient and public involvement**

Patients were not involved in the design or management of this research. We used data from the CHARLS with no direct involvement of participants in the design or conduct of the original cohort study.

**RESULTS**

**Population characteristics**

Table 1 describes the 2-year and 4-year incidence of cognitive impairment among the CHARLS participants and their subgroups who were free of cognitive impairment at baseline. Among 6920 middle-aged and older participants who were followed up for 2 years, 1290 (18.6%) developed cognitive impairment at 2-year follow-up. Among 6859 participants who went through 4-year follow-up, 1574 (23.0%) developed cognitive impairment at 4-year follow-up. The incidence of cognitive impairment was statistically significantly different among subgroups at 2-year and 4-year follow-up. For example, the incidence was higher in women (21.1% at 2-year follow-up, 24.5% at 4-year follow-up) than in men (16.6%, 21.7%), those who lived in rural (23.1%, 27.6%) than in urban (13.0%, 16.7%), those who lived without spouse (27.2%, 33.2%) than with spouse (17.9%, 22.1%) and those with depressive symptoms (25.0%, 30.1%) than without depressive symptoms (16.1%, 20.0%) (table 1).

**Prospective association between social engagement and cognitive impairment**

Table 2 shows the results of the first pair of multivariate logistic regression models. At 2-year follow-up, compared with participants with level-1 (the lowest level) social engagement, participants with level-2, level-3, and level-4 social engagement had a 12% (OR=0.88, 95% CI 0.71 to 1.09, p=0.242), 17% (OR=0.83, 95% CI 0.71 to 0.97, p=0.020) and 25% (OR=0.75, 95% CI 0.61 to 0.93, p=0.008) lower risk for developing cognitive impairment, respectively. A similar pattern of significantly protective association between social engagement and cognitive impairment was found at 4-year follow-up. For example, compared with the participants with level-1 social engagement, the participants with level-4 social engagement had a 27% (OR=0.73, 95% CI 0.60 to 0.89, p=0.002) lower risk for developing cognitive impairment at 4-year follow-up (table 2). We also explored the relationship of each social activity and cognitive impairment in middle-aged and older people at 2-year and 4-year follow-up (see online supplemental appendix 1).

**Single and combined effects of different types of social engagement on cognitive impairment**

Table 3 displays the single effects of each type of social engagement on cognitive impairment. At 2-year follow-up, every increase in leisure activities score reduced the likelihood of cognitive impairment by 5% (OR=0.95, 95% CI 0.92 to 0.99, p=0.015). The results showed a similar pattern in longer-term 4-year follow-up. Meanwhile, at 4-year follow-up, every increase in learning activities score reduced the likelihood of cognitive impairment by 47% (OR=0.53, 95% CI 0.36 to 0.80, p=0.002) (table 3). Table 4 demonstrates the second pair of multivariate logistic regression on the combined effect of different types of social engagement on cognitive impairment. At 2-year follow-up, compared with those who did not participate in any social engagement, participants who attended one type of the social engagement (any one of the leisure activities, social activities or learning activities) had a significantly lower risk of developing cognitive impairment (OR=0.86, 95% CI 0.76 to 0.96, p=0.028). The protection effect is even larger with the participants who attended two or three types of social engagement (OR=0.56, 95% CI 0.41 to 0.76, p<0.001). The results showed a similar pattern in the longer-term 4-year follow-up. Participants who attended one type of social engagement had a 13% (OR=0.87, 95% CI 0.78 to 0.97, p=0.034) lower risk of developing cognitive impairment, and for those who attended two or three types
of social engagement had a 41% (OR=0.58, 95% CI 0.44 to 0.77, p<0.001) lower risk of developing cognitive impairment (table 4).

**DISCUSSIONS**

To our knowledge, this is the first nationally representative study that investigated the prospective association between multidimensional social engagement and the incidence of cognitive impairment in LMICs. This study found that social engagement had a significant protective
and preventing social isolation.\textsuperscript{34,35} On the other hand, other activities are helpful for alleviating negative emotions for middle-aged and older people to communicate with each other, which is beneficial for alleviating negative emotions and preventing social isolation.\textsuperscript{34,35} Prior studies pointed out that loneliness, anxiety and poor life satisfaction were all associated with cognitive impairment.\textsuperscript{32,33}

On one hand, social engagement provides a platform for middle-aged and older people to communicate with each other, which is helpful for alleviating negative emotions and preventing social isolation.\textsuperscript{34,35} On the other hand, people who attended social activities had more opportunities to stimulating and expanding their minds through meaningful experience.\textsuperscript{36} Just as Berkman described the process as ‘use it or lose it’, more use of brain may slow down the process of cognitive impairment. In addition, our results confirmed the temporal relationship that social engagement leads to better cognitive function.\textsuperscript{36,38}

We also found a greater protective association between multiple types of social engagement and cognitive impairment relative to single type of social engagement. Different dimensions of activities may have different functions and areas of cognition-related application. Leisure activities, such as playing Mahjong or cards, made people more relaxed and freer from stress. Social activities helping others could provide a sense of fulfillment and companionship, which in turn bolster cognitive functioning.\textsuperscript{35,36} For learning activities, studies showed that internet use provided important platforms for cognitively stimulating activities to delay cognitive decline.\textsuperscript{24} Learning activities may generate a cognitive reserve buffer that promotes resilience to prevent or delay the development of cognitive impairment.\textsuperscript{35} Our results underscored the importance of attending different types of social engagement for delaying the process of cognitive impairment.

In summary, by enhancing social engagement with multiple types of activities, it could effectively alleviate the social and economic burden of cognitive impairment and further dementia among the middle-aged and older people. It is necessary to not only focus on the quantity of type of activities, but also the frequency that individuals take the activities. Generally, to improve social engagement of middle-aged and old population, a national strategy is required with joint actions from different perspectives in a combined effort. The government should create a better social environment by providing platforms for learning advanced knowledge and technologies, encouraging the older adults to actively participate in exercise activities, and increasing the internet penetration rate of older adults. The older-related associations or societies should initiate more social programmes that the older people can benefit from participating in such activities.

### Table 3

| Activity Type                                | Two-year follow-up OR (95% CI) | Two-year follow-up P value | Four-year follow-up OR (95% CI) | Four-year follow-up P value |
|----------------------------------------------|--------------------------------|---------------------------|--------------------------------|------------------------------|
| Leisure activities score                     | 0.95 (0.92 to 0.99)            | 0.015                     | 0.96 (0.92 to 0.99)            | 0.012                        |
| Social activities helping others score       | 0.93 (0.81 to 1.06)            | 0.253                     | 0.92 (0.81 to 1.05)            | 0.213                        |
| Learning activities score                    | 0.77 (0.60 to 1.00)            | 0.053                     | 0.53 (0.36 to 0.80)            | 0.002                        |

*Models were adjusted by the following covariates: age, sex, education, marriage, residence, smoke, alcohol drinker, hypertension, diabetes, coronary heart diseases, stroke, depressive symptoms, ADL, number of children and weekly contact with children.

### Table 4

| Social engagement (Ref: none)                | Two-year follow-up OR (95% CI) | Two-year follow-up P value | Four-year follow-up OR (95% CI) | Four-year follow-up P value |
|----------------------------------------------|--------------------------------|---------------------------|--------------------------------|------------------------------|
| One type                                     | 0.86 (0.76 to 0.96)            | 0.028                     | 0.87 (0.78 to 0.97)            | 0.034                        |
| Two or three types                           | 0.56 (0.41 to 0.76)            | <0.001                    | 0.58 (0.44 to 0.77)            | <0.001                       |

*Models were adjusted by the following covariates: age, sex, education, marriage, residence, smoke, alcohol drinker, hypertension, diabetes, coronary heart diseases, stroke, depressive symptoms, ADL, number of children and weekly contact with children.

ADL, activity of daily living.
kind of activities. The programmes need to be tailored to local context prior to implementing interventions, so the community can create convenient conditions for various social activities for the older. For families, it is necessary to encourage middle-aged and older people to spend more time on participating in more social activities. In China, intergenerational coresidence rates are relatively high and older adults undertake the responsibility of providing support for their adult children, such as raising their grandchildren and helping with housework, which occupied most of their daily time. Therefore, it is necessary for family members to give middle-aged and older people more free time to participate in social engagement.

This study has several limitations. First, the observational nature of our study limited our ability to confirm a causal relationship between social engagement and cognitive impairment. Our longitudinal study design facilitates the prospective associations in the present study, which underscored the need for research to capitalise on diverse social engagement to reduce the incident cognitive impairment. Second, due to data feasibility, the quality of social engagement cannot be measured. This might limit our ability to interpret how social engagement works against cognitive impairment. Nevertheless, our study built a comprehensive indicator to measure social engagement, taking into account the quantity and frequency of social engagement. Third, cognitive impairment measures were based on subjective assessment rather than clinical diagnosis, which may modify the estimated associations between social engagement and cognitive impairment. Despite these limitations, the strengths of this study included a national representative and population-based sample with 4 years of follow-up, the extracted participants who had cognitive impairment at baseline to identify the effect of the social engagement, as well as multidimensional constructs of social engagement and cognitive impairment.

CONCLUSION

Social engagement had a protective effect on cognitive impairment in middle-aged and older adults in China. Different types of activities should be encouraged to delay cognitive decline at mid-age and later life. Future studies are warranted to explore the causal relationship and multiple mechanisms between social engagement and cognitive impairment. Given the growing epidemic of cognitive impairment and rapid pace of ageing in LMICs, we believed that our study shed lights on the actions to develop comprehensive and tailored programmes for improving the enrolment of social engagement, to slow down the speed of cognitive impairment among the middle-aged and older population.

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