

# Types of Social Group Participation and Long-Term Cognitive Preservation in Older Ages

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## Abstract

**Background and Objectives:** Participating in social groups predicts better cognitive preservation in older adults in the short term (<5 years). Long-term evidence with direct comparison between specific types of social groups is needed.

**Research Design and Methods:** In the Taiwan Longitudinal Study of Aging ( $n = 4,009$ , mean age 64 years), 1,479 individuals reported participation in at least 1 of the 4 common types of social groups at baseline in 2003, including socializing, volunteering, religious, and networking groups. Cognitive function was measured by a modified Short Portable Mental Status Questionnaire at years 0 (baseline), 4, 8, and 12. Linear mixed-effects models were used to estimate relative cognitive preservation (in %) compared with individuals who did not participate in social groups at baseline or compared with individuals who participated in different social groups at baseline.

**Results:** We found volunteering group participation was associated with most consistent cognitive preservation at year 4 (35%, 95% CI: +10% to +60%), 8 (+64%, +44% to +84%), and 12 (+57%, +24% to +89%) compared with the individuals who did not participate in social groups, and at year 12 compared with participants of other social groups (+65%, +16% to +114%).

**Discussion and Implications:** Our findings support a long-term prediction of better cognitive preservation among volunteering group participants.

**Keywords:** Cognition, Social participation, Volunteers

**Translational Significance:** Social participation has been shown to be associated with better cognitive outcomes in older adults, but there is limited evidence on which types of social groups are more protective than others as well as direct comparisons between social groups have been lacking. Participation in the volunteering group had significantly better and long-lasting cognitive preservation compared to participation in other social groups among community-dwelling older adults over a 12-year period. Our study findings have important implications for promoting healthy aging and encouraging social participation in older adults in communities.

## Background and Objectives

Participation in social groups at older ages has been associated with better cognitive function or less cognitive decline, that is, cognitive preservation, over several years (Cohn-Schwartz, 2020; Hsu, 2007; Kim et al., 2017; Tomioka et al., 2018). Although the definitions of “older ages” varied between studies, it usually begins at 60 or 65 years old. Similarly, the cognitive evaluations differ, with some focusing on cognitive function at the endpoint (Cohn-Schwartz, 2020; Hsu, 2007; Infurna et al., 2016) and others examining cognitive decline between baseline and endpoint (Kim et al., 2017; Tomioka et al., 2018). Commonly discussed social groups include

volunteering organizations, religious groups, political groups, neighborhood associations, senior citizen groups, and recreational groups such as sports teams or hobby clubs (Kelly et al., 2017). Although all these types of social groups have been shown to protect older adults from cognitive decline in at least one study, the definitions and distinctions between these groups are rarely clarified. Moreover, these definitions and the nature of social groups may vary significantly across countries and cultures.

Furthermore, evidence on long-term (>10 years) associations was relatively limited (Infurna et al., 2016). Most studies have observation periods ranging from 3 to 6 years,

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with cognitive function typically assessed at 2 time points, baseline and endpoint. It is possible that the cognitive benefit of social group participation in previous studies with shorter follow-ups could be attributed to reverse causation, suggesting that older adults with preserved cognitive function tend to participate in social groups and subsequently experience slower cognitive decline. In addition, the effect of social group participation on cognition, if any, might be linked to subtle and continuous modification in brain structure. As a result, it is important to examine the long-term associations between social group participation because earlier life stage and cognitive benefit to elucidate the true nature of this relationship.

It is also unclear which aspects of social group participation may be associated with cognitive preservation. Pioneering interventional studies have been relatively small and based only on more general social exposure without specific components of social mechanisms, and so far have not shown clear benefits on cognitive preservation (Carlson et al., 2008; Park et al., 2014). In observational studies, better cognitive preservation has been reported from participation in type-specific social groups such as religious groups (Lee & Yeung, 2019), volunteering groups (Griep et al., 2017; Han et al., 2020; Infurna et al., 2016), recreational groups such as sports and hobby clubs (Cohn-Schwartz, 2020; Tomioka et al., 2018), or social gatherings such as alumni groups or senior citizen associations (Kim et al., 2017; Lee & Yeung, 2019). However, these findings primarily compared participants in a given type of social group compared with nonparticipants of that group (Hsu, 2007; Tomioka et al., 2018). Without a more direct comparison between social groups, the cognitive preservation in participants of some but not other social groups in these studies could be due to chance, selective reporting of positive results, or different group-specific sample sizes.

The protective effect of social engagement on cognition could be summarized through three pathways: physical, social, and cognitive activity. First, social participation results in more physical activities than staying home (Cohn-Schwartz, 2020; McPhee et al., 2016; Stephen et al., 2017). Second, social activity can help to enhance social interactions and complexity and may reduce the sense of isolation through social support and trust, which can reduce the sense of isolation and link to better cognitive function in later life (Child & Lawton, 2019; Kanamori et al., 2012; Malone et al., 2016). Finally, cognitively challenging situations involved in social participation and interaction could stimulate neural transmissions, improve cognitive functions, especially executive function and attention, and alter the brain structure (Carlson et al., 2008, 2015). As previous studies barely clarify the definitions and differences between social groups, it is possible that the social groups that involved broader aspects, more challenging cognitive stimulations and more active attendance could have more substantial cognitive protection.

Here we examine the long-term cognitive preservation (up to 12 years) associated with the participation of type-specific social groups in a nationally representative cohort study of older adults aged 50 and above in Taiwan. To clarify the impacts of specific social groups, we categorized the social groups through the underlying mechanisms and used a population who did not attend any social group as the comparison group. We hypothesized that participating in certain social groups which involved more active attendance and more cognitive stimulations might have more robust and long-term cognitive benefits. Identifying unique components of social

participation could provide valuable information for developing interventions and programs to promote cognitive health in older adults.

## Research Design and Methods

### Study Sample

The Taiwanese Longitudinal Study on Aging (TLISA) is a prospective cohort study of three nationally representative samples of Taiwanese older adults recruited in 1989 ( $n = 4,049$ , age 60 or older), 1996 ( $n = 2,462$ , age 50–66 years), and 2003 ( $n = 1,599$ , age 50–56 years) (Health Promotion Administration, 2007, 2015). Older adults and their families were interviewed face-to-face at recruitment and provided personal, medical, and psychosocial information, including social group participation and cognitive function. They were followed up every 4 years on average and updated their information during follow-up interviews. The study baseline (year 0) of the present study for all 3 samples was the 2003 interview, regardless of the year of recruitment. They were further followed up in year 4 (2007), year 8 (2011), and year 12 (2015). A university's Institutional Review Board approved this study.

### Social Group Participation

At the study baseline and the 3 follow-up interviews, individuals were asked, “Are you currently a member of these groups, or have you participated in these activities?” for 8 categories of social groups applicable to the age-appropriate Taiwanese population. They may choose none, one or more categories. For analytic purposes, they were combined into four social group types: socializing groups, networking groups, religious groups, and volunteering groups. *Socializing groups* included community groups, older adult organizations, and older adult learning clubs. These groups were largely open to the general population and provided activities to improve well-being. *Networking groups* included occupational or business associations, political parties, and clan associations. Access to these groups was more restrictive, and there was an emphasis on networking and commitment to a collective purpose. *Religious groups* were heterogeneous. According to the International Freedom Report in 2021, there are more than 22 religious beliefs in Taiwan, and the religious groups may include Buddhism, Taoism, Christianity, the Chinese folk religion, and others (American Institute in Taiwan, 2022). *Volunteer groups* are one of the categories originally asked in the TLISA questionnaire. It refers to the organizations or groups where the participants devote themselves to helping others. Volunteering groups were diverse in Taiwan, and common examples include volunteering in schools, hospitals, and religious or civil organizations.

### Cognitive Assessment

Cognitive function was briefly measured by a modified Short Portable Mental Status Questionnaire (SPMSQ) at the study baseline and all 3 follow-up interviews. Designed to assess global cognition, the original SPMSQ (Pfeiffer, 1975) consisted of 10 questions (score ranges 0–10) and was reported to be correlated strongly with Mini-Mental State Examination (correlation coefficient = 0.8) (Malhotra et al., 2013). Because not all SPMSQ questions were included in all TLISA waves, modified SPMSQ scores were used in 2 earlier analyses for older TLISA interviews (Chiao, 2019; Gleib et al., 2005). In the present study, an 8-point modified SPMSQ score

was used. The measures included: the date, day of the week, stress address, age, current president, mother's maiden name, and counting backward from 20 by 3's. The comparisons of these modifications are shown in [Supplementary Table 1 in Supplementary Material](#).

### Other Variables

Potential confounders were collected in baseline interviews (the year 2003). All confounders were self-reported. Being physically active was defined by self-reported exercise at least 3 times per week and at least 30 min each time.

Smoking was categorized as current and ever smokers. Alcohol consumption was defined as at least once a month and less than once a month. Eight comorbidities included hypertension, diabetes, stroke, heart diseases, lung diseases, renal diseases, arthritis, and depression. The first seven comorbidities were defined by having been diagnosed by a doctor. Depression was indicated by a score of 8 or above on a modified 10-item Center for Epidemiologic Studies Depression scale (CES-D; range 0–10; [Kohout et al., 1993](#); [Yen et al., 2010](#)).

Individuals who were institution-dwelling or interviewed by proxy were excluded. Individuals with missing information on social group participation, SPMSQ, or potential confounding factors at baseline were also excluded. Individuals with SPMSQ score <5 at baseline were further excluded because they might already have had significant cognitive impairment.

### Statistical Analysis

Mixed-effects models (using *meqglm* in Stata version 17) with random intercepts (at the individual level) were used to model the change of SPMSQ scores ( $\Delta\text{SPMSQ} = \text{SPMSQ}_{\text{time1}} - \text{SPMSQ}_{\text{time0}}$ ) between the study baseline and each follow-up, and the difference of  $\Delta\text{SPMSQ}$  between individuals who had participated in a type-specific social group at study baseline and individuals who did not report any social group participation ( $\Delta\text{SPMSQ}_{\text{social group}} - \Delta\text{SPMSQ}_{\text{reference group}}$ ). Because participation of different social groups was not mutually exclusive, four separate models were specified for each of the four types of social group participation investigated, where SPMSQ was predicted by a two-way fixed-effect interaction term between group participation (participating in the index group, participating in other groups only, and not participating in any group) and time (baseline, year 4, year 8, and year 12), adjusted for potential confounders at baseline as fixed-effect terms.

Because the magnitude of SPMSQ decline was subtle in a portion of the population, we introduced relative cognitive preservation (RCP%) to compare subtle cognitive changes between groups. The RCP% was defined as the proportion of SPMSQ decline prevented in a social group compared with the reference group over some time. RCP% was calculated by dividing the estimated difference of the SPMSQ change between groups ( $\Delta\text{SPMSQ}_{\text{social group}} - \Delta\text{SPMSQ}_{\text{reference group}}$ ) with the absolute number of the estimated SPMSQ change in the reference group over the same period ( $|\Delta\text{SPMSQ}_{\text{reference group}}|$ ). Therefore, when there was a cognitive decline in the reference group ( $\Delta\text{SPMSQ}_{\text{reference group}} < 0$ ), a positive RCP% suggested preservation of cognitive decline compared with the reference group (i.e., favorable outcome), whereas a negative RCP% suggested aggravation of cognitive decline compared with the reference group (i.e., unfavorable outcome). Assessment of RCP% was not appropriate when there was no cognitive

decline in the reference group. With multiple potential comparisons, we used  $p < .05$  as a guide for statistical significance in each comparison but used consistency of findings across comparisons to assess the robustness of findings.

### Additional Analysis

For certain findings of interest, we assessed the heterogeneity of RCP% associated with social group participation among baseline sex, age, level of education, and SPMSQ score subgroups, where a three-way interaction term was used (among group participation, time, and the characteristic of interest) to estimate subgroup-specific RCP%. A posthoc meta-analysis *Q*-statistic *p*-value (using *meta* in Stata version 17) was used to assess heterogeneity by subgroup. We additionally estimated the RCP% with a 4-year lagged period (i.e., to estimate cognitive change between year 4 and year 12) to assess whether an apparent RCP% was due to reverse causation. We also used an inverse probability weighting method ([Metten et al., 2022](#)) to assess whether some apparent RCP% may be due to nonrandom loss to follow-up, where the probability of losing followup was predicted by year of follow-up and other potential confounding factors. The lack of short-term memory functions in the modified SPMSQ may limit its sensitivity. To assess whether the modified SPMSQ score may underestimate the memory cognitive decline, for relevant findings, we conducted a sensitivity analysis by replacing the modified SPMSQ score (range 0–8) with a memory item-enhanced score (range 0–12), in which four memory items in the TLISA interviews were added to the modified SPMSQ score ([Supplementary Table 1](#)). Finally, we employed the SPMSQ < 5 to define having a cognitive impairment and examined the associations among social group participation and the incidence of cognitive impairment.

## Results

### Baseline Characteristics and Follow-Up By Type of Social Group Participation

Among 5,566 individuals in the TLISA cohorts (age 50 years or older at study baseline), they were excluded from the analysis baseline if they were suspected to have a cognitive impairment, including living in institutions ( $n = 92$ ), with a proxy report ( $n = 269$ ), and having an SPMSQ score <5 ( $n = 209$ ). Missing social activity ( $n = 190$ ) or missing SPMSQ ( $n = 664$ ) were further excluded. Those with missing baseline SPMSQ are older, more likely to be female, less likely to complete middle school, less likely to have a job, in the non-participation group, and had more comorbidities and shorter follow-up time. Among cognitively unimpaired individuals with available social activity and SPMSQ, those with missing potential confounders ( $n = 133$ ) were excluded. The percentage of missing was less than 5% in all potential confounders, and only 3% (133/4,142) of eligible study participants had one or more missing confounders. Of the 4,009 individuals remaining in the main analysis, 1,749 reported that they were regular participants of one or more types of social activities, including 818 regular participants in socializing groups, 547 regular participants in religious groups, 369 regular participants in volunteering groups, and 776 regular participants of networking groups. A total of 2,260 older adults did not report participation in any social groups at the baseline, and 586 older adults reported participation in more than one type of social groups.

**Table 1.** Personal Characteristics By Type of Social Group Participation at Baseline, Taiwan, 2003

Characteristic	Regular participants in social groups				Nonparticipants ( <i>n</i> = 2,260)
	Socializing ( <i>n</i> = 818)	Religious ( <i>n</i> = 547)	Volunteering ( <i>n</i> = 369)	Networking ( <i>n</i> = 776)	
Age in years, mean ( <i>SD</i> )	66.7 (9.7)***	62.1 (9.9) ***	59.6 (8.3) ***	63.9 (10.6)	63.9 (10.6)
Male, <i>n</i> (%)	427 (52.2)	285 (52.1)	186 (50.4)	597 (76.9%)***	1164 (51.5)
Completed middle school, <i>n</i> (%)	247 (30.2)	226 (41.3) **	179 (48.5) ***	349 (45.0%)***	767 (33.9)
Marital status, <i>n</i> (%)					
Married	619 (75.7)	410 (75.0)	300 (81.3) ***	651 (83.9) ***	1649 (73.0)
Widowed	178 (21.8) ***	102 (18.7)	54 (14.6)	89 (11.5)	458 (20.3)
Other	21 (2.6)	35 (6.4)	15 (4.1)	36 (4.6) ***	153 (6.8)
Having a job, <i>n</i> (%)	224 (27.4)**	217 (39.7) **	171 (46.3) ***	360 (46.4) ***	755 (33.4)
Being overweight or obese <sup>§</sup> , <i>n</i> (%)	382 (46.7)*	276 (50.5)	171 (46.3)	384 (49.5)	1095 (48.5)
Being physically active, <i>n</i> (%)	403 (49.3)***	245 (44.8) **	196 (53.1) ***	347 (44.7) ***	854 (37.8)
Current smokers, <i>n</i> (%)	165 (20.2) *	114 (20.8)	71 (19.2) *	236 (30.4) ***	550 (24.3)
Consuming alcohol at least once a month, <i>n</i> (%)	256 (31.3)	178 (32.5)	124 (33.6)	372 (47.9) ***	663 (29.3)
Two or more co-morbidities, <sup>†</sup> <i>n</i> (%)	264 (32.3)	163 (29.8) *	87 (23.6) ***	240 (30.9)	786 (34.8)

Notes: BMI = body mass index; *SD* = standard deviation.

<sup>§</sup>Overweight: BMI 24–26.9; obese: BMI  $\geq 27$ .

<sup>†</sup>Hypertension, diabetes, heart diseases, stroke, lung diseases, arthritis, renal diseases, or risk of depression (a score  $\geq 8$  according to the modified 10-item Centre for Epidemiologic Studies Depression scale).

\* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

The baseline characteristics of individuals by social group participation are shown in [Table 1](#). Volunteering group participants were the youngest, and networking group participants were predominantly men. Socializing group had the lowest percentage of completing middle school education, and the volunteering group and networking group had a higher percentage of having a job. Compared with individuals who did not report participation in any social group, social group participants were more physically active. Additional characteristics are listed in [Supplementary Table 2](#).

Most individuals had a full SPMSQ score (i.e., score 8 out of 8 for >79% in all groups) at baseline ([Table 2](#)). Thus, the mean baseline SPMSQ scores were close to 8 for all groups, with the highest in volunteering group participants (mean 7.9, *SD* 0.4) and lowest in socializing group participants and nonparticipants (mean 7.7, *SD* 0.7; [Table 2](#)). There was substantial attrition of individuals during the 12-year follow-up of the TLSA cohorts in all groups ([Table 2](#)). Not all individuals still reported participation in the same type of social groups in subsequent follow-up surveys. For example, by year 12 (the year 2015), 506 of the 818 socializing group participants at baseline (61.9%, or 506 in 818) remained in the study, of which 251 (49.6%, or 251 in 506) still reported participating in socializing groups. The percentage of nonparticipants increased from 58.8% at baseline to 71.5% at year 12 ([Table 2](#)). Independent baseline factors that were associated with loss to follow-up are shown in [Supplementary Table 3](#).

### Relative Cognitive Preservation by Type of Social Groups

In individuals who did not participate in social groups at baseline, there was a decline in SPMSQ score at year 4 (by  $-0.3$ , 95% CI  $-0.4$  to  $-0.3$ ), year 8 ( $-0.4$ , 95% CI  $-0.5$  to  $-0.4$ ), and year 12 ( $-0.2$ , 95% CI  $-0.3$  to  $-0.2$ ) compared with study baseline after adjustment of 18 potential confounding factors. RCP% in type-specific social group participation (compared

with nonparticipants of social groups at baseline) are shown in [Figure 1](#), with respective numbers listed in [Supplementary Table 4](#). There were consistent and significant positive RCP% among volunteering group participants compared with nonparticipants at year 4 (+35%, 95% CI: +10% to +60%), year 8 (+64%, +44% to +84%), and year 12 (+57%, +24% to +89%). By contrast, RCP% was not consistently positive in other social groups compared with nonparticipants. There was no material difference compared with the before and after adjustments ([Supplementary Table 3](#)). The RCP% in volunteering group participants could also be largely observed when compared with other social group participants combined ( $n = 1380$ ) at year 4 (+35%,  $-3\%$  to +74%), 8 (+46%, +5% to +87%), and 12 (+65%, +16% to +114%).

There was little heterogeneity when we examined the RCP% in volunteering group participation 12 years after the study baseline by sex, age, and level of education ([Table 3](#),  $p > .05$  in all comparisons). Heterogeneity could not be assessed by baseline SPMSQ because there was an apparent negative RCP% (i.e., relative cognitive deterioration) among volunteering group participants with baseline SPMSQ  $< 8$  ([Table 3](#)). However, the case number was small and the confidence interval was wide.

We attempted to assess the RCP% between year 4 and year 12 in volunteering group participants, but the assessment was not appropriate due to no measurable cognitive decline in nonparticipants. The adjusted mean SPMSQ changes in volunteering group participants were not statistically superior to those in nonparticipants: the difference in SPMSQ change in volunteering group participants versus nonparticipants was +0.03, 95% CIL  $-0.06$  to +0.13 ([Table 4](#)).

There was no substantial change in relative cognitive preservation at year 12 in volunteering group participants when the inverse probability weighting method was used to account for nonrandom loss to follow-up (+67%, +40% to +95%, [Table 4](#)). There was also no substantial change when the

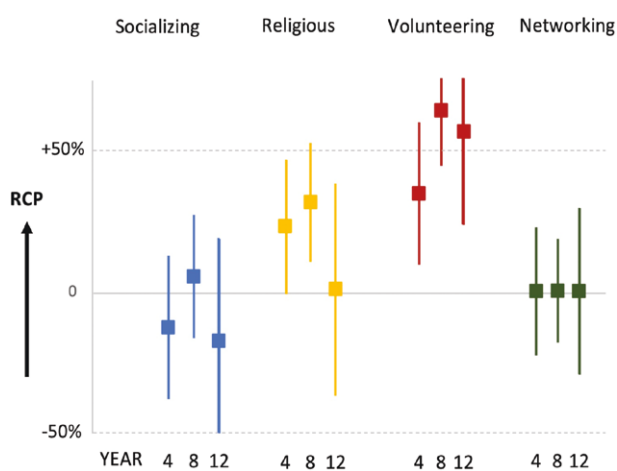


**Table 2.** Follow-up Characteristics By Type of Social Group Participation

Variable	Regular participants in social groups				Nonparticipants
	Socializing	Religious	Volunteering	Networking	
2003 (baseline)					
N	818	547	369	776	2,260
SPMSQ					
N (%) scoring 8 in SPMSQ	668 (81.7)	468 (85.6)	329 (89.2)	649 (83.6)	1,795 (79.4)
Mean (SD)	7.7 (0.7)	7.8 (0.6)**	7.9 (0.4)***	7.8 (0.6)**	7.7 (0.7)
2007 (year 4)					
N of follow up	720	485	341	682	1,885
N (%) still reported participation of the same social group compared with baseline	412 (57.2)	251 (51.8)***	158 (46.3)***	278 (40.8)***	1,364 (72.4)
Mean SPMSQ (SD)	7.4 (1.0)	7.7 (0.7)	7.7 (0.6)	7.7 (0.8)	7.4 (1.1)
2011 (Year 8)					
N of follow up	616	428	317	581	1,624
N (%) still reported participation of the same social group compared with baseline	326 (52.9)	207 (48.4)	124 (39.1)	258 (44.4)	1,164 (71.7)
Mean SPMSQ (SD)	7.4 (1.1)*	7.7 (0.8)***	7.8 (0.5)***	7.6 (0.9)***	7.3 (1.3)
2015 (Year 12)					
N of follow up	506	366	274	495	1,330
N (%) still reported participation of the same social group compared with baseline	251 (49.6)	146 (39.9)	98 (35.8)	174 (35.2)	951 (71.5)
Mean SPMSQ (SD)	7.7 (0.7)	7.7 (0.8)	7.9 (0.4)**	7.8 (0.6)	7.7 (0.7)

Notes: SD = standard deviation; SPMSQ = Short Portable Mental State Questionnaire.

\* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .



**Figure 1.** Relative cognitive preservation (RCP) by type of social group participation at years 4, 8, and 12 compared with nonparticipants of social groups, with adjustment for potential confounding factors.

analysis was replicated using memory item-enhanced score (+57%, +21% to +93%, Table 4).

In the analysis of the incidence of cognitive impairment, due to the few events of cognitive impairment, we were unable to conduct the inferential statistical analyses. Instead, we showed the number of events in each social group (Supplementary Table 5). The volunteering group had the lowest number of events among all social groups, which might indicate stronger cognitive benefit and was consistent with the main analysis.

## Discussion and Implications

In this large, nationally representative, prospective cohort study, we found that engaging in social groups focused on volunteering is robustly linked to maintaining cognitive function for an extended period, up to 12 years, in older adults, compared with nonparticipants or participants of other social groups. Other types of social groups did not reveal similar associations on cognitive preservation.

Prospective studies have reported a short-term (less than 6 years) association between volunteering and cognitive preservation, although the evidence is not consistent (Carlson et al., 2008; Griep et al., 2017; Kanamori et al., 2014; Schwingel et al., 2009; Tomioka et al., 2018). Evidence on associations for a longer duration is sparse and relatively old. To the best of our knowledge, there have only been four reports from the 21st century (Han et al., 2020; Infurna et al., 2016; Kim et al., 2017; Lee & Yeung, 2019): Two reports were analyses from the Korean Longitudinal Study of Aging (age 65–79 years followed from 2006) where the CI was too wide to be conclusive after 6 or 8 years of follow up (Kim et al., 2017; Lee & Yeung, 2019). The other two larger and longer reports were based on the US Health and Retirement Study suggested. In the 14-year study ( $n = 13,262$ , age > 60; Infurna et al., 2016), volunteering at baseline and persistent volunteering were both associated with a lower risk of cognitive decline (0.83, 0.79–0.87 for volunteering at baseline; 0.77, 0.74–0.81 for persistent volunteering). The other ( $n = 9697$ , age 51–74; Han et al., 2020) mainly examined the within-person associations of volunteer status (i.e., comparing the time they volunteered to when they

**Table 3.** Subgroup Analysis: Relative Cognitive Preservation (RCP) in Volunteering Group Participants at Year 12 Compared With Individuals Who Did Not Participate in Social Activities at Study Baseline, by Baseline Characteristics <sup>†</sup>.

Variable	RCP, % (95% CI)	p for heterogeneity
All	+57 (+24, +90)	—
Sex		
Female	+70 (+32, +108)	.42
Male	+44 (−10, +97)	
Age		
Below 60	+25 (−95, +145)	.80
60–69	+66 (+30, +101)	
70 and above	+56 (+6, +106)	
Education		
Primary school or below	+49 (0, +100)	.69
Graduated from middle school	+64 (+14, +114)	
Baseline SPMSQ		
0–7	Not appropriate <sup>§</sup>	—
8	+49 (+26, +72)	

Notes: CI = confidence interval; SPMSQ = Short Portable Mental State Questionnaire.

<sup>†</sup>Adjusting for age, gender, education, working status, marital status, BMI, exercise, alcohol use, smoking habit, comorbidities, and SPMSQ at baseline, where appropriate.

<sup>§</sup>No cognitive decline in the reference group.

**Table 4.** Additional Analyses for Relative Cognitive Preservation (RCP) in Volunteering Group Participants at Year 12 Compared With Individuals Who Did Not Participate in Social Activities at the Study Baseline <sup>†</sup>.

Variable	RCP, % (95% CI)
Year 12 vs year 4	Not appropriate <sup>§</sup>
Inverse probability weight method (year 12 vs year 0)	+67 (+ 40, + 95) ***
Using memory-item enhanced score (year 12 vs year 0)	+57 (+ 21, + 93) **

Notes: CI = confidence interval; SPMSQ = Short Portable Mental State Questionnaire.

<sup>†</sup>Adjusting for age, gender, education, working status, marital status, health behaviors, comorbidities, and baseline SPMSQ.

<sup>§</sup>No cognitive decline in the reference group.

\*p < .05. \*\*p < .01. \*\*\*p < .001.

did not volunteer) on slowing cognitive decline in 16 years. However, other types of social groups were not investigated in these two reports, so it was unclear whether this association was specific to volunteering. Our analyses indicate long-term cognitive preservation among those who participated in volunteering social groups compared with those who did not participate in social groups and, to a lesser extent, those who participated in other social groups. The finding suggests there may be a better cognitive outcome specific to volunteering social group participants.

The possible mechanism underlying a specific association between volunteering and long-term cognitive preservation was poorly investigated. It has been postulated that volunteering provides more intense and comprehensive social, cognitive, and physical stimulations, which collectively enhance mental and neurological health, ultimately benefiting cognitive function (Guiney & Machado, 2018). As the three

pathways were also mentioned in studies including other social groups, we emphasize the unique and stronger impact of volunteering due to its requirement for active involvement rather than passive participation. Compared with other social groups, some suggest volunteering additionally provides or implies a socially trusting environment that may reduce the perception of social isolation (Boyle et al., 2010; Chiao, 2019; Musick & Wilson, 2003). In addition, volunteering involves an altruistic contribution through which one gets a reflection of their capacity to give in the social network, and the ensuing happiness, self-efficacy, or even purpose in life may independently slow cognitive decline (Boyle et al., 2010; Han et al., 2020; Malone et al., 2016). However, direct evidence for these hypotheses is lacking. The association may not be causal, as individuals who volunteer may have other associated characteristics that prevent them from cognitive decline (confounding), or individuals who experience cognitive decline may also decide not to volunteer or stop volunteering. Although our findings suggested a specific type-specific association between participation in volunteering social groups and cognitive preservation in this cohort, we could not explore these mechanisms further.

To the best of our knowledge, this is the largest prospective study, if not the first, that has demonstrated the participation of volunteering groups was associated with long-term cognitive preservation, especially when compared with other types of social groups. The strength of this study included using a nationally representative sample, a longer follow-up period, and explicit comparison to participants in other social groups. We have also explored whether our findings were sensitive to adjustment for or stratification by potential confounding factors, loss to follow-up, and lack of short-term memory measured in the SPMSQ questionnaire. Nevertheless, this is an observational study, and we cannot confirm whether the observed cognitive differences were causal. As social groups in Taiwan were diverse and with arbitrary classification, we were unable to directly infer which component in the volunteering group was associated with relative cognitive preservation. Additionally, social groups can be culture-dependent, and comparing our findings with those from other settings might not always be appropriate. The cognitive assessment used in this cohort, SPMSQ, was a screening tool, which could be less sensitive to cognitive change across time. However, SPMSQ could be well-suited for large-scale cohort studies like the TLISA due to its ease of implementation. The fact that the SPMSQ was administered by trained interviewers in our study, as opposed to being self-administered, also helps reduce measurement error. The potential lack of sensitivity of SPMSQ would likely apply to all social groups, resulting in a non-differential information bias, and bias the results toward null associations. Furthermore, the observation that the absence of significant cognitive decline or even slight improvements in SPMSQ scores observed in the non-participation group may be due to the attrition of individuals experiencing more pronounced cognitive decline. This selection bias is also more likely to introduce a bias toward the null association, consequently underestimating the observed association between social participation and cognitive preservation.

## Conclusion

Our findings add to the growing body of evidence about social participation and cognitive preservation and suggest

the potential unique benefits of volunteering activities for cognitive health in later life. However, the mechanism underlying this association remains unclear, and causal inference cannot be made due to the observational nature of the study. These results may inform the development of community programs for older adults and future behavioral interventions to delay cognitive decline. Further research is needed to investigate the specific components and mechanisms of volunteering that contribute to cognitive benefits.

## Supplementary Material

Supplementary data are available at *Innovation in Aging* online.

## Funding

None.

## Conflict of Interest

None.

## Data Availability

The study was not preregistered. The raw data were non-available from the research team and can be applied for at the Health Promotion Administration, Ministry of Health and Welfare, Taiwan. Derived data supporting the findings of this study are available from the corresponding author on request.

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