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RESEARCH ARTICLE

Late-life social activity and subsequent risk of dementia and mild cognitive impairment

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Abstract

INTRODUCTION: Social activity is associated with better cognitive health in old age. To better translate epidemiological research for public health communication, we estimated relations of levels of social activity to average age at dementia onset.

METHODS: In the Rush Memory and Aging Project (MAP), we followed 1923 dementia-free older adults and conducted annual clinical evaluations of dementia/mild cognitive impairment (MCI).

RESULTS: During a mean follow-up of 6.7 (SD = 4.7) years, 545 participants developed dementia, and 695 developed MCI. Using Accelerated Failure Time models adjusted for age, sex, education, race/ethnicity, and marital status, we found predicted mean age of dementia onset for the least socially active was 87.7 years, approximately 5 years earlier than the most socially active (mean age = 92.2, $p < .01$); we found a similar 5-year difference in age at MCI onset by social activity.

DISCUSSION: Our findings highlight the value of social activity as a possible community-level intervention for reducing dementia.

KEYWORDS
dementia, mild cognitive impairment, prevention, public health, social activity

Highlights

- Accelerated failure time models estimated age at dementia onset by social activity level to aid interpretation.
- Higher social activity was associated with a 5-year older age at dementia onset.
- Economic research shows a 5-year delay translates to US$500,000 of healthcare savings per capita.
- Our findings help understand the public health significance of social activity.

1 | BACKGROUND

Dementia is estimated to impact over 50 million adults worldwide,[1] and global spending on dementia has reached an estimated US$263 billion annually.[2] Strategies to prevent or delay dementia thus remain critical. Evidence indicates that social engagement is associated with less cognitive decline and a lower risk of dementia[3–17] and may be an avenue for dementia prevention. Further demonstration of the magnitude of this association presented in ways that are interpretable to the general public could advance the case for this avenue of dementia prevention.

Social engagement is a multidimensional construct encompassing interrelated but distinct domains, including structural aspects (eg, social activity, social network size, marital status), functional aspects (eg, social support), and subjective psychosocial experience (eg, loneliness).[18,19] Among these domains, social activity appears to be a consistent and robust risk factor for cognitive health[3–6,18] and one that may be more amenable to population-wide intervention than other aspects of social engagement. However, one difficulty in translating epidemiologic research to public health interventions is the challenge of communicating the concept of relative risks; for example, a finding of 25% reduction in dementia risk associated with social activity is hard for the public to interpret.[20] For the general public and policymakers, it may be clearer to estimate the years by which a risk factor delays onset of dementia, a metric that is more easily linked to economic and health outcomes. For example, in the United States, a 5-year delay in dementia onset has been projected to reduce dementia costs by 40% in the next 30 years and would result in an additional 3 years of life for those who would have developed dementia.[21]

In our own previous research in the Rush Memory and Aging Project (MAP), we found that social activity was related to less cognitive decline.[9] In the current study, we continued our research on modifiable social activity and extended it to examine its associations with incident dementia and mild cognitive impairment (MCI), with a focus on estimating how differing levels of social activity are related to average age at dementia onset.

RESEARCH IN CONTEXT

1. **Systematic review**: The authors reviewed the literature using traditional sources (eg, PubMed). Additionally, the senior authors of this paper have published in this research area.
2. **Interpretation**: We focused on social activity since it may be more amenable to population-wide intervention than other aspects of social engagement. Further, to better translate epidemiological research findings for public health communication and intervention, we supplemented traditional hazard ratios with an estimate of how level of social activity was related to average age at dementia onset. We found that higher social activity was associated with a 5-year older age at dementia onset, compared to the lowest social activity group.
3. **Future directions**: The article provides a unique lens for understanding the public health significance of social activity. Given our findings that social activity is related to a 5-year delay in dementia onset – indicating important potential public health impact – our research suggests that key next steps may be the development of a large-scale randomized trial to test social activity interventions.

2 | METHODS

2.1 | Data

Established in 1997, the Rush MAP is a longitudinal clinical-pathological study, with continuous, open enrollment.[22] Participants are recruited from approximately 40 retirement and subsidized housing facilities in the Chicago metropolitan area. All participants agree to annual clinical evaluation. To date, roughly 2300 older adults have completed a baseline evaluation, with a follow-up rate of 90%. The average follow-up was 6.6 (SD = 5.2) years, and a quarter of participants were followed for more than 10 years, while 57% died over the study period. The MAP study was approved by an Institutional Review Board of Rush University Medical Center.

2.2 | Assessment of late-life social activity

Level of social activity was measured as the frequency of participation in six common social activities, adapted from an established scale[23–25] developed in cohorts with representation of Black older adults (19%). The chosen activities were not intended to capture all possible activities but to reflect the underlying latent construct of social activity in older adults. At cohort baseline, participants rated how often they engaged in each of six activities during the past year on a five-point scale: (1) once a year or less, (2) several times a year, (3) several times a month, (4) several times a week, (5) every day or almost every day. Item scores were averaged to yield a composite measure (range 1 to 5), with higher scores indicating greater social activity. Specific activities included the following: (1) going to restaurants, sporting events or Teletrack (off-track betting), or playing bingo, (2) going on day trips or overnight trips, (3) doing unpaid community/volunteer work, (4) visiting at relatives' or friends' houses, (5) participating in groups, and (6) attending church or religious services.

2.3 | Assessment of other social engagement aspects

All variables were measured at baseline. In addition to demographics (including age, sex, years of education, and race/ethnicity),

we considered other variables that are part of the social engagement construct. We considered marital status in three categories: married, widowed, or separated/divorced/never married. Social network size was the number of reported children, family, and friends each participant had seen at least once a month. Social support was the average of four items from the Multidimensional Scale of Perceived Social Support, with higher values indicating greater perceived social support (range 1 to 5). Loneliness, or social isolation, was evaluated with five items from a modified version of the De Jong Gierveld Loneliness Scale, with a higher average score indicating more loneliness (range 1 to 5).

2.4 | Assessment of other covariates

We considered further potential confounders of the relationship between social engagement and cognitive health. All covariates were measured at baseline. We defined vascular risk factors as the sum of self-reported hypertension, diabetes, and cigarette smoking (one point for each, range 0 to 3). Vascular disease burden was the sum of self-reported claudication, heart conditions, congestive heart failure, and stroke (one point for each, range 0 to 4). Physical activity was measured as the total hours per week that a participant reported engaging in five common exercises. Disability was assessed by the Katz Activities of Daily Living (ADLs) scale and was the number of ADLs that a participant was unable to perform without help (range 0 to 6): walking across a small room, bathing, dressing, eating, getting from a bed to a chair, and toileting. Depressive symptoms were assessed as the number of symptoms reported based on the 10-item Center for Epidemiologic Studies Depression (CES-D) Scale (range 0 to 10). Neuroticism, a personality trait related to dementia onset,[26] is measured using 12 items from the NEO Five-Factor Inventory; responses were summed into a score from 0 to 48, with higher score representing worse neuroticism. Finally, we considered midlife income since current income in these older adults who are largely retired may not well reflect socioeconomic status (SES). We collected information on midlife income at baseline interview, where participants were asked to select one of 10 levels of total family income at the age of 40.

2.5 | Assessment of dementia and MCI

At each annual evaluation, participants underwent a three-stage process of clinical diagnosis.[27,28] First, a battery consisting of 21 cognitive tests across five cognitive domains was scored: episodic memory (word list, word list recall, word list recognition, East Boston immediate recall, East Boston delayed recall, Logical memory I and II), working memory (digits forward, digits backward, digit ordering), semantic memory (Boston naming, category fluency, reading test), perceptual speed (symbol digits modality test, number comparison, Stroop color naming, Stroop word reading), and perceptual orientation (line orientation, progressive matrices). Then, based on impairment rating from the battery and other clinical information, a neuropsychologist rendered a clinical judgment regarding the presence of cognitive impairment. A clinician then reviewed selected materials from cognitive testing, neurological examination, and structured medical history and made a diagnostic classification of dementia according to criteria of the joint working group of the National Institute of Neurological and Communicative Disorders and Stroke and the Alzheimer's Disease and Related Disorders Association (NINCDS/ADRDA).

The diagnosis of MCI was rendered to those who had neuropsychologist-ascertained impairment but did not meet diagnostic criteria for dementia. Participants without MCI or dementia were classified as having no cognitive impairment (NCI).

2.6 | Analytical population

From 1997, when MAP was initiated, to the end of 2022, a total of 2009 participants completed a baseline evaluation and had at least one follow-up evaluation, with <1% enrolled since/during the COVID-19 pandemic. The sample for incident dementia analysis excluded 86 participants who were determined to have dementia at baseline using the cohort evaluation, leaving 1923 individuals for analysis. For the incident MCI analysis, we further excluded 498 participants with MCI at baseline; the sample for incident MCI analysis included 1425 participants.

2.7 | Statistical analysis

First, multivariable Cox proportional hazards models were used to estimate hazard ratios for associations between social activity and time to incident dementia or MCI. In models for incident dementia, survival event was defined as the dementia diagnosis, while death or loss to follow-up was treated as right censoring, whichever came first; models for incident MCI considered MCI diagnosis as the survival event. In addressing potential confounding, we first adjusted for primary potential confounders: age, sex, years of education, race/ethnicity, and marital status; we treated age in years as linear, since we have conducted rigorous examination of the best way to control for age in the Rush Alzheimer's Disease Center cohort data and found a quadratic term did not meaningfully improve control for confounding. We then added social network size, social support, and loneliness to models, given the potential interconnectedness of social engagement constructs; approximately 10% of participants ($n = 197$) had missing values for these constructs at baseline and therefore were dropped in the corresponding models. We also considered the following covariates at baseline: vascular risk factors, vascular disease burden, physical activity, cognitive activity, disability, depressive symptoms, and midlife income. Since none of these variables meaningfully changed the estimates of social activity and the inclusion of these variables might reduce sample size due to missing values (see Table S1 for Cox model adjusting all variables), they were not included in the final models

presented here. We also assessed the proportional hazards assumption by examining Schoenfeld residuals, which suggested the assumption was satisfied.

In sensitivity analyses, because we were concerned that a low level of social activity may be an early symptom of cognitive impairment, we excluded participants who developed MCI or dementia within 2 years after baseline ($n = 365$) to address possible reverse causation.

Then, for our primary research, as part of our goal to better translate our findings for public health communication, we estimated age at diagnosis of dementia/MCI across levels of social activity. To improve interpretability, instead of the continuous score used in Cox proportional hazards models, we used tertile categories of social activity score; tertiles were chosen to assure an adequate number of observations within each analytical category. As a test of our decision, we did a sensitivity analysis categorizing social activity into quartiles. Next, we used Kaplan–Meier survival curves and accelerated failure time (AFT) models with age as the time scale, considering left truncation (ie, downward bias arising from the requirement that participants could only enter the cohort if they survived to study baseline without dementia/MCI). Log-rank tests were used for the statistical comparison of survival curves. In calculating adjusted mean ages at dementia/MCI across social activity tertiles, the AFT models included covariates for sex, years of education, race/ethnicity, and marital status. Model specification and distribution are described elsewhere.[26] We also assessed social network size, social support, and loneliness in these AFT models: Since model estimates for social activity were similar with and without these variables, we did not include them in the results presented.

3 | RESULTS

3.1 | Sample characteristics

During a mean follow-up of 6.7 (SD = 4.7) years, 545 (28%) participants developed dementia (Table 1), and 695 (49% of those without MCI at baseline) developed MCI (Table S2). Among those in the analytic population for dementia analyses, at baseline, mean age was 80.4 (SD = 6.6), and participants on average completed 15 (SD = 3.2) years of education. One quarter were male and 91% were non-Latino Whites. Mean social activity score was 2.6 (SD = 0.6), indicating the frequency of participation was approximately "several times in a month" (score = 3). Participants reported a mean of 7.1 (SD = 5.6) social contacts they had seen at least once a month. Mean social support and loneliness scores were 4.4 (SD = 0.7) and 2.2 (SD = 0.6), respectively. As revealed by Spearman correlation coefficients, these social engagement constructs were not highly correlated (Table S3). The study population was relatively healthy according to the self-reported number of vascular risk factors (mean = 1.1, SD = 0.8), number of vascular diseases (mean = 0.3, SD = 0.6), Katz ADL scale (mean = 0.2, SD = 0.6), and number of depressive symptoms (mean = 1.1, SD = 1.6). On average, participants reported 3.4 (SD = 3.6) hours of physical activity per week. Characteristics were similar in the somewhat smaller sample used to examine incident MCI (Table S2).

TABLE 1 Baseline characteristics of participants.

Characteristic	Sample for incident dementia analysis
N	1923
Developed dementia during follow-up	545
Age (years), mean (SD)	80.4 (6.6)
Years of education, mean (SD)	15.0 (3.2)
Male	25.3%
Non-Latino White	90.8%
MMSE score (score 0 to 30), mean (SD)	28.0 (2.0)
Social activity (score 1 to 5), mean (SD)	2.6 (0.6)
Social network size (score ≥0), mean (SD)	7.1 (5.6)
Social support (score 1 to 5), mean (SD)	4.4 (0.7)
Loneliness (score 1 to 5), mean (SD)	2.2 (0.6)
Vascular risk factor (score 0 to 3), mean (SD)	1.1 (0.8)
Vascular disease burden (score 0 to 4), mean (SD)	0.3 (0.6)
Katz disability (score 0 to 6), mean (SD)	0.2 (0.6)
Physical activity (hours/week), mean (SD)	3.4 (3.6)
Depressive symptoms (score 0 to 10), mean (SD)	1.1 (1.6)

Note: Table provides data for analytic cohort used in analyses of incident dementia. During the follow-up, 545 participants developed dementia. Social activity was measured as the frequency of participating in six common social activities. Social network size was measured as the number of children, family members, and friends each participant had seen at least once a month. Social support was the average of four items from the Multidimensional Scale of Perceived Social Support. Loneliness was evaluated with five items from a modified version of the De Jong Gierveld Loneliness Scale. Vascular risk factor was defined as the sum of self-reported hypertension, diabetes, and cigarette smoking (one point for each). Vascular disease burden was the sum of self-reported claudication, heart conditions, congestive heart failure, and stroke (one point for each). Disability was assessed by the Katz ADL Scale and was the number of ADLs that a participant was unable to perform without help. Physical activity was measured as the total hours per week that a participant reported engaging in five common exercises. Depressive symptoms were measured using the Center for Epidemiological Studies Depression Scale.
Abbreviations: ADL, activities of daily living; MCI, mild cognitive impairment; MMSE, Mini-Mental State Examination.

3.2 | Social activity and risk of incident dementia

After adjusting for age, sex, years of education, race/ethnicity, and marital status (Table 2), each one-unit increment in social activity score was associated with 38% lower dementia risk (HR = 0.62, 95% CI: 0.53 to 0.74). To test whether social activity was independently related to dementia above and beyond other constructs of social engagement, we added social network size, social support, and loneliness to the model (Table 2). With these covariates, social activity remained associated with 38% lower risk for dementia (HR = 0.62, 95% CI: 0.51 to 0.75). Of these added variables, loneliness was significantly associated with incident dementia: Each one-unit increment in loneliness score was associated with a 40% higher risk of developing dementia (HR = 1.40, 95% CI: 1.18 to 1.66). Social network size (HR = 1.02, 95% CI: 1.00

TABLE 2 Multivariate Cox proportional hazards models of incident dementia.

	Model 1		Model 2	
Parameter	HR	95% CI	HR	95% CI
Social Activity (score 1 to 5)	0.62	[0.53, 0.74]	0.62	[0.51, 0.75]
Age (years)	1.16	[1.10, 1.14]	1.12	[1.10, 1.14]
Male	1.12	[0.90, 1.40]	0.99	[0.78, 1.27]
Years of education	1.00	[0.97, 1.03]	1.02	[0.98, 1.05]
Non-Hispanic White	0.73	[0.52, 1.03]	0.68	[0.48, 0.97]
Widowed (r.t. married)	1.21	[0.96, 1.54]	1.14	[0.89, 1.44]
Divorced/unmarried (r.t. married)	1.13	[0.83, 1.53]	1.00	[0.73, 1.37]
Social Network Size (score ≥ 0)			1.02	[1.00, 1.03]
Social Support (score 1 to 5)			0.92	[0.79, 1.06]
Loneliness (score 1 to 5)			1.40	[1.18, 1.66]

Note: Model 1 included full analytical sample ($N = 1923$). Model 2 dropped 197 persons due to missing values of social network size, social support, or loneliness at baseline ($N = 1726$).
Abbreviations: CI, confidence interval; r.t., relative to.

to 1.03) or social support (HR = 0.92, 95% CI: 0.79 to 1.06) were not related to incident dementia.

To address concerns of reverse causation, we conducted a sensitivity analysis that excluded 365 persons who developed MCI or dementia within 2 years after baseline and hazard ratios for social activity were not changed (HR = 0.63, 95% CI: 0.48 to 0.81; Table S4).

3.3 | Social activity and age at dementia diagnosis

Figure 1 shows the survival curves according to tertiles of social activity. The probability of remaining dementia-free was significantly lower for the least socially active than the more socially active ($p < .001$). The median age at dementia diagnosis was 88.5 years for participants in the bottom tertile of social activity score compared to 90.7 years in the middle tertile and 93.2 years in the top tertile of social activity.

We controlled for sex, years of education, race/ethnicity, and marital status using AFT models and estimated mean ages at dementia diagnosis across tertiles of social activity (Table 3). In predicting the mean age at diagnosis, we set sex as female, years of education as median in the study population (ie, 15 years), race/ethnicity as non-Latino White, and marital status as widowed. There was a strong association of social activity with age at diagnosis: predicted mean age of dementia onset for the least socially active was 87.7 years, which was 4.5 years earlier than the most socially active (mean $age_{top\ tertile} = 92.2$, $p < .01$ relative to lowest). Similarly, we found a 2-year difference in mean age of dementia diagnosis between the lowest and middle tertiles (mean $age_{middle\ tertile} = 89.8$, $p = .02$ relative to lowest).

The patterns were similar when using quartiles instead of tertiles of social activity (Figure S1).

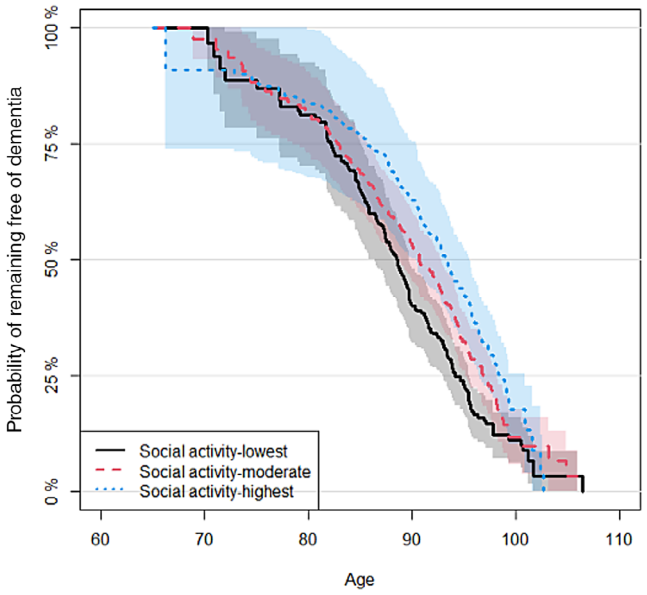

FIGURE 1 Kaplan–Meier curves of probability of remaining free of dementia, by level of social activity. Kaplan–Meier curves considered left truncation. Shaded areas indicated 95% confidence intervals. Tertile cut points were <2.4 in bottom (638 participants), 2.4 to 2.8 in middle (452 participants), and >2.8 in top tertile (833 participants) in this dementia population. We identified 211 cases of incident dementia among those in the lowest tertile of social activity (or 33% of participants in this tertile), 146 cases in the middle tertile (or 32% of participants in this tertile), and 188 cases in the highest tertile (or 23% of participants in this tertile).

3.4 | Social activity and risk of incident MCI

Analysis of incident MCI was restricted to 1425 participants free of MCI at baseline. After controlling for age, sex, education, race/ethnicity, and marital status (Table 4), social activity was related to a lower risk of MCI (HR = 0.76, 95% CI: 0.65 to 0.89). When we added other social engagement domains (Table 4), each one-unit increase in social activity score was associated with a 21% lower MCI risk (HR = 0.79, 95% CI: 0.66 to 0.94). Associations remained similar with the exclusion of participants who developed MCI or dementia in the first 2 years after baseline (HR = 0.82, 95% CI: 0.65 to 1.03; Table S4), although results were not statistically significant with the smaller sample size.

3.5 | Social activity and age at MCI diagnosis

Figure 2 shows the survival curves for MCI by level of social activity. The probability of remaining free of MCI was significantly different across tertiles of social activity ($p < .01$). The median age at MCI diagnosis was 78.4 years for the least socially active, approximately 1 year earlier than those in the middle tertile (median age = 79.7) and 3 years earlier than that for the most socially active (median age = 81.2).

The pattern held after adjusting for sex, education, race/ethnicity, and marital status in AFT models (Table 5). With covariate values

TABLE 3 Estimated age at diagnosis of dementia.

Baseline	*N*	Mean [95% CI]	25th Percentile	Median	75th Percentile
Lowest tertile/least socially active	638	87.7 [85.3, 89.7]	82.2	89.0	94.6
Middle tertile	452	89.8 [87.6, 91.8]	84.2	91.2	96.9
Highest tertile/most socially active	833	92.2 [90.2, 94.0]	86.4	93.6	99.4

Note: Tertile cut points were <2.4 in bottom (638 participants), 2.4 to 2.8 in middle (452 participants), and >2.8 in top tertile (833 participants) in this dementia population. Age at diagnosis was estimated using mean parameters from extended AFT model, with covariates for sex (set as female), years of education (set as median in the study population, ie, 15 years), race/ethnicity (set as non-Latino White), and marital status (set as widowed). *P* value is from coefficient comparing each tertile group to lowest tertile (ie, reference group).
Abbreviations: AFT, accelerated failure time; CI, confidence interval.

TABLE 4 Multivariate cox proportional hazard models of incident MCI.

Parameters	Model 1		Model 2	
	HR	95% CI	HR	95% CI
Social activity (score 1 to 5)	0.76	[0.65, 0.89]	0.79	[0.66, 0.94]
Age (years)	1.07	[1.06, 1.09]	1.08	[1.06, 1.09]
Male	1.30	[1.06, 1.59]	1.28	[1.02, 1.60]
Years of education	1.01	[0.98, 1.04]	1.02	[0.99, 1.05]
Non-Hispanic Whites	0.66	[0.48, 0.89]	0.63	[0.46, 0.87]
Widowed (r.t. married)	1.28	[1.04, 1.58]	1.24	[1.00, 1.54]
Divorced/unmarried (r.t. married)	1.13	[0.87, 1.47]	1.05	[0.80, 1.38]
Social Network Size (score ≥0)			1.00	[0.99, 1.02]
Social Support (score 1 to 5)			0.97	[0.84, 1.11]
Loneliness (score 1 to 5)			1.25	[1.07, 1.47]

Note: Model 1 included all participants free of MCI at baseline ($N = 1425$). Model 2 dropped 136 persons due to missing values of social network size, social support, or loneliness at baseline ($N = 1289$).
Abbreviations: CI, confidence interval; MCI, mild cognitive impairment; r.t., relative to.

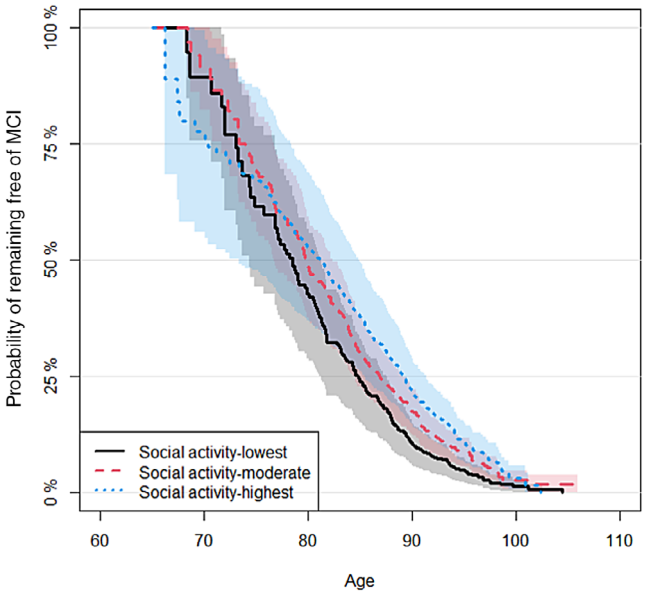

FIGURE 2 Kaplan–Meier curves of probability of remaining free of MCI, by level of social activity. Kaplan–Meier curves considered left truncation. Shaded areas indicated 95% confidence intervals. Tertile cut points were <2.4 in bottom (398 participants), 2.4 to 2.8 in middle (356 participants), and >2.8 in top tertile (671 participants) in this MCI analytical population. We identified 201 cases of incident MCI among those in lowest tertile of social activity (or 51% of participants in this tertile), 195 cases in middle tertile (or 55% of participants in this tertile), and 299 cases in highest tertile (or 45% of participants in this tertile). MCI, mild cognitive impairment.

specified in Section 3.3, those with the lowest tertile of social activity had mean age at MCI diagnosis of 74.2; the middle tertile had a mean of 76.9 ($p = .05$ relative to lowest), and the highest had a mean age of 79.1 ($p < .01$ relative to lowest).

Results were similar when using quartiles of social activity (Figure S1).

4 | DISCUSSION

We found that higher social activity was associated with a 5-year older age at dementia onset, compared to the least socially active. We also observed a 5-year difference in the age of MCI onset between these two groups. For the first time, by quantifying the association of social activity to age at dementia/MCI onset, our findings provide important public health metrics for understanding relations of social activity to cognitive health. The large difference in age at dementia onset at differing levels of social activity provides motivation for testing social activity–based interventions.

Estimating differences in age of dementia/MCI onset allows us to more directly link greater social activity to potential health and economic benefits. For example, a 5-year delay in dementia onset has been estimated to yield an additional 3 years of life and over US$500,000 of lifetime healthcare savings for each person who would eventually develop dementia.[21] In combination with the epidemiologic studies that consistently report a lower risk of dementia associated with more frequent social activity[3,4,7,13,14,16,20] – including our findings here that greater social activity was related to a 38% reduction in dementia risk and a 21% reduction in MCI risk – there is powerful evidence of the

TABLE 5 Estimated age at diagnosis of MCI.

Baseline	*N*	Mean [95% CI]	25th Percentile	Median	75th Percentile
Lowest tertile/least socially active	398	74.2 [65.9, 80.4]	66.5	74.9	82.6
Middle tertile	356	76.9 [68.3, 83.2]	69.0	77.7	85.7
Highest tertile/most socially active	671	79.1 [70.3, 85.1]	70.9	79.8	88.0

Note: Tertile cut points were <2.4 in bottom (398 participants), 2.4 to 2.8 in middle (356 participants), and >2.8 in top tertile (671 participants) in this MCI analytical population. Age at diagnosis was estimated using mean parameters from extended AFT model, with covariates for sex (set as female), years of education (set as median in study population, ie, 15 years), race/ethnicity (set as non-Latino White), and marital status (set as widowed). *P* value is from coefficient comparing each tertile group to lowest tertile (ie, reference group).
Abbreviations: AFT, accelerated failure time; CI, confidence interval; MCI, mild cognitive impairment.

value of social activity as a possible community-level intervention for reducing dementia.

Indeed, several small-scale (<300 participants), short-term (3 to 10 months) randomized trials provided preliminary evidence regarding the efficacy of social activity for improving cognition.[29–31] These trials also demonstrate the feasibility of interventions, for example, group meetings facilitated by trained professionals as a candidate intervention. Together, these complementary lines of research support the need for large-scale, longer-term randomized trials testing social activity for preserving cognitive health.

This study was designed to describe the association between social activity and dementia/MCI from an epidemiological perspective and did not include biological data to directly assess mechanisms through which social activity or other domains of engagement may affect brain health. While the exact mechanisms are unknown, there are several commonly endorsed explanations for the observed relationship between social activity and dementia. The stimuli supplied by participating in social activity could lead to brain responses such as synaptogenesis or neurogenesis that could build cognitive resilience that buffers against the accumulation of Alzheimer's disease or other dementia-related neurodegenerative pathologies.[9,32–35] Social activity is also likely to reduce stress, which interferes with the hypothalamic pituitary–adrenal axis and leads to loss of hippocampal neurons.[32,36,37] Finally, social activity may be related to dementia through other overlapping domains of social life such as increased physical activity or alleviating loneliness[37]; however, the associations of social activity with dementia were independent of these related domains in time-to-event models here.

At the same time, limitations should be noted when interpreting our findings. In this observational study, we cannot rule out uncontrolled or residual confounding. To address confounding, we leveraged the richness of MAP cohort data and assessed a wide variety of potential confounders, including health and lifestyle. Adjustment for these variables did not alter the relationship between social activity and incident dementia/MCI. Reverse causation is also possible, where dementia leads to less social activity rather than in the opposite direction. To try to evaluate reverse causation, we conducted sensitivity analyses that excluded participants who developed MCI or dementia within 2 years after baseline. Results were consistent with our primary analyses, providing some reassurance. Additionally, this cohort consisted of mainly non-Latino White older adults residing in the Chicago area who volunteered for annual evaluation and *post mortem* organ donation and, thus, may be more socially engaged and health-conscious. While this would not affect internal validity, the findings should be confirmed in more diverse populations. Finally, our six-item scale of social activity may have missed activities that are of particular relevance to brain health in older adults or may be more or less relevant to certain diverse subsets of older adults. This scale was not intended to capture the full range of social activities that older adults participate in, but rather the latent construct of social activity. It is worth noting that this scale was developed in cohorts with diverse representation (19% Black older adults),[25] and studies using this scale in diverse cohorts generally have shown a relationship with cognition.[10,38,39] That being said, in the future, research utilizing scales that are more culturally relevant to different demographics of older adults may reveal even stronger associations.

The study has important strengths. Taking advantage of the established MAP cohort with detailed annual clinical assessment and high response rate, we identified dementia and MCI at their earliest clinical manifestation, thereby minimizing misclassification of onset timing. We examined the relationship of social activity above and beyond related constructs that may not be as readily amenable to intervention such as loneliness and number of social contacts. Most importantly, our estimates of the extent to which social activity relates to dementia onset age provides a unique lens for understanding the public health significance of social activity. Considering potential negative impacts of the COVID-19 pandemic on social engagement, it is now important to develop and test initiatives targeted at social activity among older adults.

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CONFLICT OF INTEREST STATEMENT

Bryan D. James is a consultant for the Alzheimer's Association and a reviewing editor for *Alzheimer's & Dementia*. Other authors have no

conflict of interest to declare. Author disclosures are available in the supporting information.

CONSENT STATEMENT

All MAP participants provided informed consent.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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