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Engagement in Reading and Hobbies and Risk of Incident Dementia: The MoVIES Project

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Abstract

Objective: To examine whether there is an association between engagement in reading and hobbies and dementia risk in late life. **Methods**: A total of 942 members of a population-based, prospective cohort study were followed biennially to identify incident dementia cases. Cox proportional hazards models were used to estimate the risk of dementia in relation to baseline total number of activities and time commitment to reading and hobbies. **Results:** A lower risk for dementia was found for a greater number of activities and for a high (about 1 hour each day) compared with low (less than 30 minutes each day) weekly time commitment to hobbies, independent of covariates. Only the protective effect of hobbies remained after methods were used to minimize bias due to potential preclinical dementia. **Conclusion:** Engaging in hobbies for 1 or more hours every day might be protective against dementia in late life.

Keywords

dementia, cognitive activity, leisure activity, hobbies

Introduction

Dementia is one of the most dreaded conditions of older age. Approximately 35.6 million are expected to be affected worldwide in 2010, with the prevalence expected to double every 20 years to over 100 million in 2050.[1] Dementia is now recognized as a chronic disease with both genetic and environmental factors contributing to the risk. Because at present, only environmental factors are potentially amenable to change they are the focus of most efforts to delay or prevent dementia.

There is both scientific and popular interest in the idea that older adults may alter their risk for dementia by keeping their brains active. Higher levels of engagement in cognitively stimulating leisure activities in late life have been linked to lower risk of dementia in observational studies.[2-7] However, interpretation of this association is bedeviled by the problem of reverse causality. The underlying pathology of degenerative dementias starts many years earlier before symptom onset.[8] When a risk factor is identified more proximal to the onset of dementia, it cannot be determined whether it is a true causal factor or an early marker of disease.[9] As a result, a negative association between late-life leisure activity and dementia risk could indicate that either a higher level of engagement provides protection against dementia or a lower level of engagement is an effect of early dementia. Both explanations have important implications for the cognitive health of older adults and should be equally considered when interpreting the results of studies with relatively short follow-up periods (ie, less than 10 years).

We used data from a population-based cohort of older adults to examine whether the number of reading and hobby activities in which an older person engages, and the time commitment to reading and hobbies in general, are associated with the risk of incident dementia over a period of approximately 6 years. Given this relatively short follow-up period, we also evaluated whether preclinical dementia could confound the findings.

Methods

Study Site and Population

Participants were from the Monongahela Valley Independent Elders Survey (MoVIES) project, a prospective epidemiologic

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study in a predominately blue collar, rural area of southwestern Pennsylvania that has been previously described.[10] Briefly, the study enrolled 1681 participants who were at least 65 years, fluent in English, had at least a sixth grade education, and were living in the community at the time of recruitment, beginning in 1987. Of them, 1422 were recruited through random sampling of voter registration lists considered comprehensive for the area and 259 participants were volunteers from the same area (hereafter referred to as "recruitment status") that has been previously described.[11] Written informed consent was obtained according to procedures annually approved by the University of Pittsburgh Institutional Review Board.

MoVIES participants were followed at 2-year intervals through 2002. The assessment comprised a cognitive battery[12] and demographics, health, medication, health service utilization, and lifestyle variables. Information related to reading and hobby activities was first collected at wave 3 (1991-1993), the baseline for the current study, at which time 1165 (69.3%) of the 1681 participants were assessed, with the remainder being lost due to death (273[16.2%]), dropout (81[4.8%]), relocation (21[1.4%]), poor health/untestable status (4[0.2%]), or request to delay participation to a future wave (137[8.1%]). They had a mean (SD) age of 76.44 (5.36) years, 63.09% were women, and 60.60% had a high school or higher education. After excluding 81 participants with dementia onset prior to baseline, 44 participants who reported difficulty reading the newspaper even with corrective lenses, and 98 participants with missing data on any of the relevant study variables, 942 participants were available for the current analyses.

Dementia Assessment

A 2-stage assessment procedure was used at each wave. First, all participants were screened with the cognitive test battery previously referenced.[12] Those meeting operational criteria for "cognitive impairment" or "cognitive decline,"[13] and a subsample of matched cognitively intact individuals, were then clinically evaluated for dementia based on modified consortium to establish a registry for Alzheimer disease (CERAD)[14] and Pittsburgh Alzheimer Disease Research Center assessment protocols. Participants were assigned a Clinical Dementia Rating (CDR)[15] score of 0, 0.5, 1, 2, or 3 indicating *no, possible/questionable, mild, moderate*, or *severe dementia*,[15,16] respectively, with date of onset estimated based on all available data. For the current analyses, those receiving a CDR score of 1 or greater were classified as having dementia.

Engagement in Reading and Hobbies

MoVIES participants were asked to self-report whether they engaged in 10 leisure activities chosen by the study investigators based on their knowledge of the community and experience with the cohort. These activities included reading books, magazines, and newspapers, and engaging in hobbies including board games, crafts, crossword puzzles, jigsaw puzzles, musical instruments, bridge, and other card games. The participants also had the opportunity to report any other hobbies they engaged in, such as gardening, word-find puzzles, baking, and painting. Frequency of engagement in reading and hobbies in general, but not for each specific reading or hobby type, was based on hours of participation each week. For the current analyses, this time commitment to reading and hobbies was categorized into 3 levels: low (0-3 h/week, approximating less than 30 minutes per day; reference group), medium (4-6 h/week, approximating 30 to 60 minutes per day), and high (> 6 h/week, approximating 1 or more hours per day). Each individual activity, total number of activities (range 0-10; Cronbach $\alpha = .45$), and time commitment level for reading and hobbies were the main predictor measures.

Covariates

Baseline age, gender, and education (<high school, ≥high school), and recruitment status were included as covariates. Depressive symptoms were measured using the modified Center for Epidemiological Studies−Depression Scale[17] (range 0-20), with those scoring greater than 5 being classified as having substantial depressive symptoms based on the cutoff score at the MoVIES cohort 90th percentile.[18] Using the older Americans resources and services questionnaire[19] assessment of instrumental activities of daily living, individuals were classified as functionally not impaired (0 impairments), mildly impaired (1-4 impairments), and moderately to severely impaired (5-7 impairments). Physical exercise level (no or low/high effort) was measured based on a previously derived composite measure from the MoVIES cohort.[20] Overall health was measured by the number of prescription drugs regularly taken and by self-rated health (poor or fair/good or excellent).

Data Analyses

All data analyses were carried out using statistical analysis software (SAS) version 9[21] with P values less than .05 (2-tailed) interpreted as being statistically significant.

Crude comparisons between those who remained nondemented and those who developed dementia during the study period were made for each covariate and measures of engagement in reading and hobby activities using independent sample t tests for continuous measures, and Pearson χ^2 test for categorical variables. Separate Cox proportional hazard regression models[22] were used to examine the associations of time to dementia onset with the following predictors: (1) all individual activities, (2) the total number of activities, (3) the time spent participating in reading, and (4) the time spent participating in hobbies. For each of these predictors, the crude HR (hazard ratio) and 95% CI (confidence interval) were estimated in model 1; followed by adjustment for age, gender, and education in model 2; plus baseline depressive symptoms, functional impairment, physical exercise level, prescription medication use, self-rated health, and recruitment status in model 3.

To further examine whether any associations found could be confounded by preclinical dementia, we fit all models again

Table 1. Baseline Characteristics of Participants Who Did and Did Not Develop Dementia During the Follow-Up Period[a]

	Participants Who Remained Non Demented (n = 831)	Participants Who Developed Dementia (n = 111)	*P* Value
Age (years), mean (SD)	75.42 (4.87)	78.92 (5.40)	<.01
Gender (% women)	65.82	71.17	.26
Education (% ≥high school)	65.34	51.35	<.01
Self-rated health (% good or excellent)	80.39	74.77	.17
Physical exercise (% high)	19.01	10.81	.03
Depressive symptoms (% ≥5)	6.86	11.71	.07
Functional impairment			<.01
% no	70.40	49.55	.
% mild	28.28	45.05	.
% moderate/severe	1.32	5.41	.
Medication, mean (SD)	2.20 (2.22)	2.53 (2.22)	.14
Recruitment status (% random)	20.82	11.71	.02
MMSE, mean (SD)	27.49 (2.02)	25.35 (3.17)	<.01

Abbreviation: MMSE, Mini-Mental Status Examination.
[a] Comparisons based on *t* tests for continuous variables and and χ^2 tests for categorical variables.

after excluding those who received a CDR rating of 0.5 (possible dementia) at baseline, after controlling for baseline global cognitive ability measured by the Mini-Mental Status Examination (MMSE),[23] and sequentially excluding cases diagnosed at each of the follow-up waves.

Results

Sample Characteristics

At baseline, the mean (SD) age of the sample was 75.84 (5.10) years, 66.45% were women, and 63.69% had a high school or higher education. The majority reported good or excellent health (79.72%), 18.05% reported a high level of exercise, 7.43% had substantial depressive symptoms, 67.94% had no functional impairments, and 19.75% were volunteer participants for the study. The average (SD) number of medications was 2.24 (2.22) and the mean (SD) MMSE score was 27.24 (2.29). Among the 942 participants, 802, 676, 546, and 242 were followed through wave 4, wave 5, wave 6, and wave 7, respectively. The average (SD; range) length of follow-up was 6.07 (2.75; 0-10.48) years.

The baseline characteristics of the sample by final dementia status at the end of the study period are presented in Table 1. Compared to those who developed incident dementia (CDR ≥1) during follow-up, those who remained free of dementia were significantly younger, more likely to have completed at least high school education, to engage in a high level of exercise, to have been originally recruited as part of the volunteer (vs random) sample, to have no compared with mild or moderate/severe functional impairment, and to have better global cognitive ability based on the MMSE. Table 2 shows baseline engagement in reading and hobby activities among those who did and did not develop dementia during the study period. Compared to incident cases of dementia, those without dementia were more likely to read books, do crafts and crossword puzzles, engage in a greater number of reading and hobby activities, and to devote a medium or high amount of time to reading, and a high amount of time to hobbies.

Engagement in Reading and Hobbies

The percentages of the baseline sample (n = 942) engaging in each activity are as follow: 52.15% read books, 94.06% read newspapers, 69.85% read magazines, 3.50% played board games, 27.60% did crossword puzzles, 0.96% did jigsaw puzzles, 4.99% played musical instruments, 31.32% did crafts, 5.10% played bridge, 31.21% played other card games, and 28.98% engaged in other hobbies. On average, the participants engaged in 3.50 (SD = 1.59) types of reading and hobby activities. The majority of the sample had a low (35.56%) or high (44.16%) time commitment to reading with only 20.28% in the medium category. Similarly, 53.82% and 31.32% had low and high time commitments, respectively, to hobbies, with only 14.86% devoting a medium level of time. Having at least a high school education, good or excellent self-reported health, volunteer status, fewer depressive symptoms, and better functional ability were associated with greater engagement in total activities and time spent engaging in reading and hobbies. Being younger, female, and taking fewer prescription medications were also associated with engaging in more activities and with a higher time commitment to hobbies.

Engagement in Reading and Hobbies and Incident Dementia

During the follow-up period, 111 incident dementia cases with CDR ≥1 were documented for a crude overall incidence rate of 22.6 (95% CI: 18.4-26.8) per 1000 person years. Table 3 shows the results of the Cox proportional hazards models for each of the main predictors. Engaging in crafts (HR = 0.40, 95% CI:

Table 2. Baseline Engagement in Reading and Hobby Activities in Participants Who Did and Did Not Develop Dementia During the Follow-Up Period[a]

	Participants Who Remained Non Demented (n = 831)	Participants Who Developed Dementia (n = 111)	*P* Value
Individual activities			
Reading books (% yes)	53.91	38.74	<.01
Reading the newspaper (% yes)	93.98	94.59	.80
Reading magazines (% yes)	70.40	65.77	.32
Board games (% yes)	3.73	1.80	.30
Crossword puzzles (% yes)	29.00	17.12	.01
Jigsaw puzzles (% yes)	1.08	0.00	.27
Musical instrument (% yes)	5.29	2.70	.24
Crafts (% yes)	33.33	16.22	<.01
Bridge (% yes)	5.42	2.70	.22
Other card games (% yes)	32.01	25.23	.14
Other hobbies (% yes)	29.72	23.42	.17
Total no of activities, mean (SD)	3.58 (1.59)	2.88 (1.42)	<.01
Time commitment reading	.	.	<.01
(% 0-3 h/week)	33.81	48.65	.
(% 4-6 h/week)	20.70	17.12	.
(% >6 h/week)	45.49	34.23	.
Time commitment hobbies	.	.	<.01
(% 0-3 h/week)	51.50	71.17	.
(% 4-6 h/week)	15.16	12.61	.
(% >6 h/week)	33.33	16.22	.

[a] Comparisons based on *t* tests for continuous variables and χ^2 tests for categorical variables.

Table 3. The Association Between Engagement in Reading and Hobbies and the Risk of Developing Dementia

	HR for Dementia (95% CI)		
	Model 1	Model 2	Model 3
Individual activities[a]			
Reading books	0.68 (0.44-1.07)	0.77 (0.49-1.21)	0.86 (0.54-1.37)
Reading the newspaper	1.31 (0.56-3.08)	1.86 (0.78-4.45)	2.82 (1.14-7.18)
Reading magazines	1.29 (0.81-2.06)	0.93 (0.57-1.50)	0.98 (0.60-1.60)
Board games	0.98 (0.23-4.06)	0.82 (0.20-3.40)	0.65 (0.15-2.77)
Crossword puzzles	0.52 (0.31-0.87)	0.63 (0.37-1.06)	0.57 (0.33-0.97)
Jigsaw puzzles	.	.	.
Musical instrument	0.69 (0.21-2.21)	0.64 (0.20-2.11)	0.59 (0.18-1.98)
Crafts	0.38 (0.22-0.64)	0.37 (0.22-0.63)	0.40 (0.23-0.68)
Bridge	0.69 (0.21-2.19)	0.52 (0.16-1.69)	0.54 (0.16-1.74)
Other card games	0.73 (0.47-1.13)	0.85 (0.55-1.33)	0.91 (0.58-1.42)
Other hobbies	0.71 (0.45-1.10)	1.01 (0.63-1.61)	1.03 (0.64-1.66)
Total no of activities	0.76 (0.67-0.86)	0.81 (0.71-0.92)	0.86 (0.75-0.99)
Time commitment to reading			
0-3 h/week (low)	1.00 (ref)	1.00 (ref)	1.00 (ref)
4-6 h/week (medium)	0.64 (0.38-1.09)	0.80 (0.47-1.36)	0.94 (0.54-1.62)
>6 h/week (high)	0.62 (0.41-0.95)	0.67 (0.44-1.04)	0.81 (0.52-1.28)
Time commitment to hobbies			
0-3 h/week (low)	1.00 (ref)	1.00 (ref)	1.00 (ref)
4-6 h/week (medium)	0.56 (0.31-0.99)	0.68 (0.38-1.21)	0.72 (0.40-1.29)
>6 h/week (high)	0.32 (0.19-0.55)	0.40 (0.23-0.68)	0.43 (0.25-0.75)

Abbreviations: HR, hazard ratio; CI, confidence interval; Model 1, crude model; Model 2, Adjusted for age, gender, and education; Model 3, adjusted for age, gender, education, depressive symptoms, physical exercise, functional impairment, self-reported health, medication use, and recruitment status.
[a] No engagement in each individual activity served as the reference group.

Table 4. The Association Between Engagement in Reading and Hobbies After Excluding Cases Diagnosed Within 2, 4, and 6 Years From Baseline

	Excluding Cases Diagnosed Within 2 years		Excluding Cases Diagnosed Within 4 years		Excluding Cases Diagnosed Within 6 years	
	Demented/ Nondemented	HR for Dementia (95% CI)[a]	Demented/ Nondemented	HR for Dementia (95% CI)[a]	Demented/ Nondemented	HR for Dementia (95% CI)[a]
Total no of activities	85/831	0.84 (0.71-0.98)	76/831	0.89 (0.75-1.06)	72/831	0.91 (0.76-1.09)
Time commitment to hobbies						
0-3 h/week (low)	56/428	1.00 (ref)	53/428	1.00 (ref)	52/428	1.00 (ref)
4-6 h/week (medium)	13/126	0.91 (0.49-1.69)	11/126	0.92 (0.47-1.81)	9/126	0.79 (0.38-1.66)
>6 h/week (high)	16/277	0.47 (0.26-0.85)	12/277	0.45 (0.23-0.89)	11/277	0.41 (0.20-0.84)

Abbreviations: HR, hazard ratio; CI, confidence interval.
[a] Adjusted for age, gender, education, depressive symptoms, physical exercise, functional impairment, self-reported health, medication use, and recruitment status.

0.23-0.68) and crossword puzzles (HR = 0.57, 95% CI: 0.34-0.97) were associated with a lower risk of incident dementia, whereas reading the newspaper (HR = 2.82, 95% CI: 1.14-7.18) was associated with a higher risk of dementia, independent of other activities and all covariates. Engaging in a greater number of activities (HR = 0.86, 95% CI: 0.75-0.99) and a high time commitment to hobbies (HR = 0.43, 95% CI: 0.25-0.75), compared to a low time commitment, were also associated with a reduced risk of incident dementia after adjusting for all covariates. Time commitment to reading activities was not associated with incident dementia risk.

To minimize potential bias due to preclinical dementia, we excluded 54 participants rated as possible/questionable dementia (CDR = 0.5), reducing our sample size to 888 participants. The association between time commitment level to hobbies and incident dementia remained significant, with a high level (HR = 0.46, 95% CI: 0.26-0.84) reducing risk. The association between total activities and incident dementia risk became only marginally significant (HR = 0.87, 95% CI: 0.74-1.01). We also further adjusted the models for baseline global cognitive status. Similarly, the association between high time commitment to hobbies and a reduced risk of incident dementia remained (HR = 0.50, 95% CI 0.29-0.86), but the association between total activities and dementia risk was only marginally significant (HR = 0.92, 95% CI: 0.80-1.05). Finally, sequential exclusion of those who would become demented at each subsequent follow-up demonstrated a similar pattern where a high time commitment to hobbies continued to be associated with a reduced risk of dementia, but that the association between total activities and dementia risk was attenuated (Table 4).

Discussion

Our study showed that being engaged in more reading and hobby activities and spending more time each week doing hobbies is associated with a lower subsequent risk of incident dementia. This finding is independent of many factors previously linked to both activity engagement and dementia that may confound the true association, including age, gender, education, health status, depressive symptoms, physical exercise level, functional impairment, and global cognitive functioning. This research suggests there may be potential benefits of leisure activities at the population level, because it was conducted using data from a large, representative, population-based study.

It is well established that temporal sequence cannot be established in cross-sectional studies and requires longitudinal studies such as the one reported here. However, the pathologies underlying dementia likely develop insidiously for decades before clinical onset. Because in our study, the onset of dementia occurred within 6 years (on average) after we measured engagement in reading and hobbies, an alternative interpretation of our findings could be that incipient dementia is associated with a lower level of engagement in reading and hobbies. We used several approaches to control for preclinical dementia to minimize the potential for reverse causality. The association between high time commitment to hobbies and a reduced risk of dementia remained when we restricted our sample to those who scored 0.5 on the CDR and adjusted for baseline global cognitive status. Sequential exclusion of incident cases at each follow-up wave also did not change this association, suggesting that this may be a true protective effect. Conversely, the protective effect of engaging in more types of activities was diminished when these methods to minimize misclassifying those with preclinical dementia as controls were used. Thus, it may be that a lower number of total activities is a preclinical marker of dementia. However, studies with even longer follow-up periods, as well as experimental trials, are needed to definitively establish causal relationships.

Our findings are consistent with a growing body of evidence from observational studies suggesting that engaging in cognitively stimulating leisure activities in late life may reduce the risk of Alzheimer's disease[6,7] and overall dementia.[2-4] To our knowledge, no studies have reported negative associations of cognitive activity with the risk of dementia.

In our study, a significant reduction in dementia risk was only associated with a high, but not medium, time commitment to hobbies compared to low. Thus, it may be necessary to participant in cognitively stimulating leisure activities involving

hobbies for about 1 hour each day to benefit cognitive health. The fact that a medium level did not reach statistical significance suggests that committing less than 1 hour a day in later life may not be sufficient to reduce the risk of dementia. The lack of association with time commitment to reading may be related to heterogeneity in the cognitive demand of the reading material. This is supported by our unexpected finding that reading the newspaper was associated with an elevated risk of dementia. It is possible that the level of cognitive demand could depend on what sections of the newspaper were read (eg, obituaries vs business).

The degree of cognitive demand or novelty of activities is thought to be an important component of their potential benefit to cognitive health.[24] Our finding that engagement in a greater variety of activities reduced the risk of dementia might reflect greater opportunity for new and challenging activities. Because the various types of reading and hobby activities included in our analyses may influence dementia risk differently, we also examined the independent effect of each individual activity. We found that engagement in crossword puzzles and crafts reduced the risk of dementia, independent of other activities, perhaps, because these activities require more cognitive effort than other types of activities. Some of the activities (eg, bridge and board games) which require interaction with other people can be considered partly social activities, and social integration has been shown to be associated with dementia risk reduction.[2,5] In our cohort, activities with both cognitive and social components did not appear to offer more protection than those typically performed in isolation, such as crossword puzzles. Possibly, too few participants reported playing bridge or board games, or the board games they played did not require much cognitive effort.

Evidence from animal and human imaging studies offers potential explanations of the biological mechanisms underlying the link between cognitive activity and dementia. Animal studies show that enriched environments lead to structural and functional brain changes, including increased neurogenesis,[25] synaptogenesis,[26] and the release of nerve growth factor and brain-derived neurotrophic factor.[27] Alzheimer's disease pathology is also reduced in transgenic animal models living in an enriched environment versus standard housing.[28] Human studies demonstrate that cognitive activity may lead to a reorganization of neurocognitive networks,[29] attenuate the adverse effects of stress hormones on the brain,[30] and modify the association between white matter lesion density, reflective of small vessel disease, and cognitive performance.[31]

A major methodological issue surrounding the study of cognitive activity in relation to dementia and other cognitive outcomes is the measurement of activity. Studies vary considerably in the types of activities that are assessed. Similar to other cohort studies, our measure was based on self-reported engagement in activities, making it susceptible to measurement error. The reliability and validity of the measure also have not been established. We were also unable to examine the specific frequency, the real or perceived level of cognitive demand, or proficiency in each type of activity that would have provided more insight as to whether certain activities in specific quantities or of specific levels of cognitive challenge reduce risk more than others. The influence of cognitive activity across the life span, including activity related to occupation, could not be examined because data on cognitive activity were restricted to the study period after retirement. Understanding whether and how much cognitive activity level prior to older age modifies the relation between engagement in late life and dementia risk will have important implications for intervention development. Despite these limitations, the associations found in this study add to the growing body of evidence that engagement in activities in late life that require some degree of cognitive effort may offer protection against dementia. Controlled intervention trials of carefully selected activities may be the next step in elucidating these relationships and demonstrating their efficacy in maintaining cognitive health and preventing or delaying dementia.

Declaration of Conflicting Interests

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