Art Attendance and Change in Cognitive Function Among US Community-Dwelling Chinese Older Adults

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Abstract

Engaging in leisure activities that are cognitively-simulating and enjoyable may be protective against cognitive decline in older adults; yet, few studies have examined this topic. We used two waves of data from the Population Study of Chinese Elderly and ran mixed-effects regression models to examine the relationship between baseline art activity attendance (including attending museum, musical arts or both) and change in cognitive function (global, episodic memory, working memory and executive function) among 2,703 older U.S. Chinese adults. We found that compared to older adults who did not attend any art activities, those who reported attending both art activities experienced a slower rate of change in episodic memory (estimate = -0.07; SE = 0.03; p = 0.01) and executive function (estimate = -0.06; SE = 0.03; p = 0.04). Our study findings point to the importance of attending art-based culture events among US Chinese older adults.

Keywords

music; art; cognition; older adults; Chinese

INTRODUCTION

Participation in leisure activities is an important part of well-being for older adults. Leisure activities can be defined as, "uncoerced activity undertaken during free time where such

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activity is something people want to do and, at a personally satisfying level using their abilities and resources, they succeed in doing" (Stebbins, 2005, p. 350). Leisure activities can include participating in physical, cognitive or social activities (Blasko et al., 2014). Older adults who frequently engage in leisure activities are less likely to report feeling depressed (Chao, 2016; Lu, 2011) and lonely (Teh & Tey, 2019). Decreased participation in leisure activities has been linked to lower level of cognition and faster rates of cognitive decline (Iwasa et al., 2012; Kim, Arai, & Kim, 2017). Furthermore, increased participation in leisure activities has been associated with lower risk of dementia (Eriksson Sörman, Sundström, Rönnlund, Adolfsson, & Nilsson, 2014; Sanders & Verghese, 2007; Verghese et al., 2003).

Attending visual and musical arts is a common form of leisure activity among older adults which is attributed to their overall well-being and psychological health. For example, increased art attendance in older adults has been found to be associated with lower rates of depression (Cross, Flores, Butterfield, Blackman, & Lee, 2012), mortality (Fancourt & Steptoe, 2019) and frailty (Rogers & Fancourt, 2020). Furthermore, sustained art attendance in adulthood has been associated with increased overall wellbeing among older adults (Tymoszuk, Perkins, Spiro, Williamon, & Fancourt, 2019) as well as improved self-reported health (Johannson, Konlaan, & Bygren, 2001). However, there is a paucity of research examining the relationship between participation in the specific forms of art and cognitive outcomes in older adults. Recent research suggests that engaging in art activities that are cognitively-simulating, culturally appropriate and enjoyable may lower risk of dementia in older adults. For example, in one study using the data from the English Longitudinal Study of Ageing, Fancourt and colleagues have shown that participants who visited museums every few months or more were less likely to be diagnosed with dementia over the next 10 years (Fancourt, Steptoe, & Cadar, 2018). In a recent study of 200 Swiss community-dwelling older adults, the researchers found that compared to adults who never played a musical instrument, those who played a musical instrument showed a significant improvement in their cognition over a 12-month period (Mansky et al. 2020)." In a cross-sectional study of 1,399 racially and ethnically diverse cohort of older adults in the U.S., a higher level of leisure activity participation (which included going to cultural events) was associated with better cognition across cognitive domains and varied by race/ethnicity (Peterson et al. 2020). Attending art activities that are cognitively simulating and enjoyable may be protective against cognitive decline in older adults; yet, few studies have examined this topic. Previous studies clustered leisure activities according to the assumed level of cognitive effort and social interaction, which is often arbitrary since several activities, such as music may contain elements of social interaction while requiring cognitive effort at the same time. In addition, previous studies have examined the effect of art attendance on overall cognition with very few studies examining the impact of art activities on specific cognitive domains. Examining the impact of attending art activities across specific cognitive domains is important given the rates of decline across multiple cognitive domains vary according to the nature of cognitive impairment (Albert et al., 2011).

Older Chinese adults are the fastest and largest growing group of older Asian Americans in the United States with approximately 14.3% of 4.4 million Chinese Americans being over the age of 65 (U.S. Census Bureau, 2018). Previous studies have reported relatively low

levels of participation in leisure activities among US Chinese older adults (Dong & Simon, 2014). The most common leisure activities among this population included watching TV and reading (Dong & Simon, 2014). Participation in activities across the lifespan may have protective effects against cognitive decline in older Chinese adults. For instance, late-life active participation in intellectual activities among older Chinese adults was associated with lower risk of incident dementia (Lee et al., 2018) and lower incidence of global cognitive decline (Leung et al., 2011). Furthermore, older Chinese adults who frequently participated in intrapersonal and interpersonal cognitive leisure activities had a lower risk of cognitive impairment (Qiu et al., 2019). Recent evidence points to the importance of mid-life and late-life protective factors against cognitive decline among older Chinese adults.

There are several possible mechanisms that could account for the protective effect of art attendance and cognition in older adults. The cognitive reserve theory outlines factors, such as higher levels of education, occupational complexity, and engagement in physical, cognitive and social activities that may increase cognitive reserve, making older adults less susceptible to the underlying Alzheimer's disease (AD) pathology (Stern, 2002, 2012; Stern, Albert, Tang, & Tsai, 1999). For example, older adults with higher levels of education were less likely to show progression to mild cognitive impairment/dementia even with presence of cortical thinning in AD-vulnerable brain regions (Pettigrew et al., 2017). Alternatively, older adults who engage in art activities may have personality traits that include empathy, compassion, and openness to experience and diverse perspectives. For instance, being open to experiences is correlated with higher activity levels and, in turn, better cognitive performance in older adults in select cognitive domains, such as reading ability (Hogan, Staff, Bunting, Deary, & Whalley, 2012). Another possible explanation of the effect is that participation in the arts is often a multisensory experience that may increase brain plasticity. For example, music training which often requires a coordinated effort and communication between different areas of the brain and the hemispheres may increase older adults' brain plasticity and protect against age-related cognitive decline (Sutcliffe, Du, & Ruffman, 2020). Older adults who visit a museum may engage in curator tours or read the history information associated with the piece of art. When attending a musical event, older adults may read the program book and learn new information about the piece of music or the performer. In turn, these activities may bolster adult learning and provide opportunities for personal growth and self-expression, thus enhancing brain plasticity.

The purpose of this study was to examine the relationship between baseline frequency of attending art activities (including visiting museums, attending concerts or both) and rates of change in global cognitive function and across three cognitive domains (i.e., episodic memory, working memory and executive function) in the two-year follow up among 2,713 older Chinese adults age 60+ in the U.S. enrolled in the Population Study of Chinese Elderly (PINE) study. The purpose of this study was to compare the rate of change in cognitive function between older adults who never attended art activities to those who only attended one form of art activity and those who attended both art activities.

METHOD

Study Design

We used two waves of data from the Population Study of Chinese Elderly (PINE) (Dong, Wong, & Simon, 2014; Dong, Bergren, & Simon, 2017). The PINE study is a population-based epidemiological study of older United States Chinese adults in the Chicago area. The baseline data was collected between 2011 and 2013 using in-home interviews. The interviews for the second wave were completed between 2013 and 2015. Details description of the PINE data collection can be found elsewhere (Dong, Wong, & Simon, 2014). Out of 3,159 respondents at baseline, 2,713 finished both waves of the study. Compared with those who participated in Wave 2, those who did not complete Wave 2 assessments were older, more cognitively impaired according to the global cognition scores and were more physically impaired. The Institutional Review Board of the Rush University Medical Center approved all study.

Measures

<u>Art attendance:</u> The independent variable of art attendance included frequency of museum and musical art attendance. The two questions were selected from the Social Engagement Scale (Dong & Simon, 2014). During the interview, participants were asked in the past five years how many times they have, "Visited a museum" and "Attended a concert, play, or a musical." Participants' responses were coded using a 4-point scale (0 = never, 1 = 1 to 2 times, 2 = 3 to 9 times, 3 = 10 to 19 times, and 4 = 20 or more times). For the purpose of this study, we created a new variable of art attendance with four categories: "Never attending any art activities", "Attending museums only", "Attending musical activities only" and "Attending both museums and musical activities" since 69.9% and 74.4% of older adults at baseline reported never attending museums or musical arts, respectively (Dong & Simon, 2014).

<u>Rate of change in cognitive function:</u> For dependent variable, we examined rates of change across four cognitive function tests, which measured executive function, episodic memory and working memory (Chang & Dong, 2014; Li et al., 2017). Executive function was measured using the Symbol Digit Modalities Test (SDMT). This 11-item test examined rapid perceptual comparisons of numbers and symptoms in 90 seconds (Smith & Services, 2002). The composite score of the East Boston Memory Test (Immediate and Delayed Recall of brief stories) was used to measure episodic memory (Wechsler, 1987). Working memory was assessed using the Digit Span Backwards (Wechsler, 1987). We also used a previously constructed measure of global cognition, which included five cognitive tests (SDMT, East Boston Memory Test Immediate and Delayed Recall, Digit Span Backwards, and Mini-Mental State Examination) (Chang & Dong, 2014). We created composite scores by transforming participants' scores on individual cognitive function tests to a z score based on the mean and standard deviation of the distribution of the scores of all respondents. We then averaged z scores across all cognitive tests. We measured time as the difference between Wave 2 and baseline participant interviews. The mean was 1.92 years (SD = 0.3; range; 1.8–3.7 years) (Li et al., 2017).

Covariates: We selected covariates previously shown to be associated with activities participation (Dong & Simon, 2014) and cognition in this population of Chinese older adults (Li et al., 2017). Sociodemographic variables included age (years and centered at 72), sex (male: 0; female: 1), education (years), annual personal income ($9,999 or >$10,000), marital status (not married: 0; married: 1), living arrangement (includes number of household members), number of children, language preference (English/Mandarin: 0; Cantonese/Taishanese: 1) (Dong & Jiang, 2018), years in the US, and years in the community. Health-related variables included general health (poor or fair: 0; good or very good: 1), change in health compared to one year ago (worsened or same: 0; improved: 1), physical function (total score on the Katz Activities of Daily Living measure) (Katz & Akpom, 1976), depressive symptoms (total score on the PHQ-9) (Yeung et al., 2008), medical comorbidities (count of chronic conditions that a participant told he or she has by a doctor, nurse, or a therapist), and smoking status with never smoked as a reference category (current smoker or former smoker). Additionally, we controlled for baseline global cognition given the variation in cognitive function among participants at baseline.

Analysis—We used descriptive chi^2 statistics to examine any differences in sociodemographic and health-related variables between participants who never attended each activity, attended only one activity or attended both activities at least once. We examined the relationship between baseline art attendance and rates of change in cognitive function (global cognition, executive function, episodic memory and working memory) using mixed-effect regression models. We used both fixed and random effects. In Model 1, we tested the main effect of time. In Model 2 we examined the main effect of art attendance adjusting for time, baseline art attendance, and baseline art attendance X time. In Model 3, we added sociodemographic variables. In Model 4, we included additional health-related variables. The analyses were completed using SAS software v.9.2 (SAS Institute Inc, Cary, NC, USA).

RESULTS

The sample size for descriptive purposes in Table 1 included 2,703 older adults after list-wise deletion of missing data for the independent variable. At baseline, 381 (14.1%) out of 2,703 participants reported attending museums, while 247 out of 2,703 (9.1%) reported attending a concert, play or a musical. When examining the combined art attendance, 440 out of 2,703 (16.3%) reported attending both art activities. There were statistically significant differences between participants who attended both art activities and those who did not for the following variables: age, education, annual income, number of children, language preference, years in the US, years in community, smoking status, overall health status, health status change, physical function, and depression (Table 1).

Next, we examined the relationship between baseline art attendance and cognitive function, presented in Tables 2 through 5. Adjusting for all sociodemographic and health-related variables, compared to participants who did not attend any art activities, participants who attended musicals (Table 2 Model 4; estimate $_{musical}$ = 0.13, SE = 0.04; p = 0.001) or attended both art activities (Table 2 Model 4; estimate $_{both}$ = 0.16, SE = 0.03; p = 0.00) had higher levels of global cognition at baseline. Adjusting for all sociodemographic and

health-related variables, compared to participants who did not attend any art activities participants who attended museums had higher levels of episodic memory at baseline (Table 3 Model 4; estimate $_{museum}$ = 0.07, Standard Error [SE] = 0.03; p = 0.007). There was no association between art attendance in cognitive domains of working speed and executive function (Tables 4 and 5).

When we examined the relationship between baseline art activities and rates of change in cognitive function, we found that compared to older adults who did not attend any art activities, those who reported attending both art activities experienced a 0.07 standard score unit reduction in the rate of change in episodic memory (Table 3 Model 4, estimate $_{both}$ = -0.07; SE = 0.03; p = 0.01) and a 0.06 standard score unit reduction in the rate of change in executive function (Table 5 Model 4, estimate $_{both}$ = -0.06; SE = 0.03; p = 0.04). We found no relationship between attending individual art activities and rates of change in cognitive function.

DISCUSSION

In our study, we found that older Chinese Americans who reported attending art activities had higher levels of cognitive function at baseline and art attendance was associated with slower rates of change in cognitive function. Specifically, compared to older adults who never attended art activities, participants who reported attending art activities at least once in the past five years, had higher levels of global cognition and episodic memory at baseline. Additionally, compared to older adults who never attended art activities, those who reported attending both art activities experienced a reduction in the rate of change in episodic memory and executive function. These results point to the importance of art attendance and its relationship to rates of change in cognition among older Chinese Americans.

Our study findings are in line with previous work highlighting the relationship between attending museums and changes in cognition among older adults. For example, Fancourt et al. (2018) found a lowered risk of dementia occurrence for older adults (N=3,911) who attended museums every few months or more often. In addition, later study by Fancourt and Steptoe (2019) reported findings on the protective effect of art attendance (which included attending museums, art galleries, exhibitions, the theater, concert or the opera) on longevity in older adults (N=6,710). The relationship between attending museums and reduction in the rates of cognitive change may be partially explained by positive subjective experiences of older adults who attended museums. For instance, older adults with early-stage dementia reported several benefits of participating in the art, such as cognitive stimulation, social connections and positive self-esteem (Flatt et al., 2015). While these qualitative findings are associated with a structured art engagement program modeled after New York's "Meet Me at MoMA", the leisure activity question in our study asked a broad question about museum attendance, which is a multimodal activity. Multimodal activities such as attending museums may engage individuals cognitively, physically and socially. Similar to attending a concert, attending a museum requires older adults to leave their home and go outside, decreasing the frequency of sedentary behaviors. Our study provides empirical evidence of the association between attending art activities and reduction in the rates of cognitive function change for older Chinese Americans.

Other leisure activities have also been found to be associated with rates of change in cognition among Chinese older adults. For example, longitudinal research on Chinese older adults found late-life intellectual and social leisure activities were associated with slower cognitive decline (Leung et al., 2011; Wang et al., 2013). In addition, older Chinese adults with higher rates of participation in intrapersonal and interpersonal cognitive leisure activities (Qiu et al., 2019) and overall leisure activities (Zhu, Qiu, Zeng, & Li, 2017) had lower risk of cognitive impairment. Taken together, previous studies suggest a positive association between leisure activities and cognitive function in older Chinese adults.

In our study we found that baseline art attendance was associated with select cognitive domains. In our study, combined art attendance was associated with a reduction in the rate of change in episodic memory. Decline in episodic memory (i.e., the ability to learn and recall new material) in older adults often precede the onset of dementia by several years (Albert et al., 2011). Therefore, any lifestyle factor that is associated with a slower change in episodic memory should be viewed as an important part of everyday life for older adults. In addition, visual arts engagement can promote self-esteem and improve emotional well-being (Kim, 2013). Higher self-esteem and improved emotional well-being may be associated with better cognitive outcomes in older adults.

In our study attending visual and musical arts was associated with a reduction in the rate of change in a non-memory domain - executive function. Executive function is often referred to a complex set of behaviors responsible for a response to novel situations (Lezak, 2004). Similar art-making activities have been associated with cognitive benefits in executive function. For example, singing and/or playing a musical instrument by itself (Mansens, Deeg, & Comijs, 2017) or categorized as a mental activity (Wang et al., 2013) was associated with better executive function. When attending a musical performance, participants engage their senses of vision and hearing. In addition, musical stimuli are often filled with emotions. These emotions can mirror one's own emotions or bring a listener to experience a different emotion. In addition, those who liked listening to music may have been more likely to engage in other cognitive, physical and social activities and, therefore, exhibited slower rate of cognitive decline (Kaufmann, Montross-Thomas, & Griser, 2018). Furthermore, older adults who liked listening to music may have been more likely to engage in activities, such as singing or playing a musical instrument either in their childhood/adolescence or mid-life. In addition, older adults who may have been more open to experience were more likely to participate in stimulating activities in early and mid-life (Ihle, Oris, Fagot, Maggiori, & Kliegel, 2016).

Our study has several limitations. First, the social engagement scale contains self-report items asking participants to recall attendance at these activities in the past five years which may be subject to recall bias. In addition, the phrasing of the survey questions makes it harder to distinguish cognitive changes between older adults who attended one play over the past five years versus those who had attended many plays, musicals, or concerts over the same period. Second, we were not able to examine the impact of participatory arts, which may have a larger effect of cognition given the increased cognitive demands of participatory arts as opposed to attending art activities. Furthermore, information on participants' occupation was not available in the data; thus, we were not able to assess

whether participants worked in an art-related occupation during their adulthood, which would have made them more likely to attend art activities. Third, the average follow-up of two years may not have been long enough to detect additional cognitive domain changes in our sample. Fourth, there are many unmeasured factors in this secondary analysis that could have contributed to older Chinese Americans attending art activities, such as early life family socioeconomic status, family environment, growing up in a family environment which valued art, family members' art-related hobbies, occupation, and availability of transportation. Despite these limitations, our study brings forth important policy and research implications.

Our study findings point to the potential importance of attending art-based culture events among U.S. Chinese older adults. Policies aimed at maintaining funding for art activities for older adults are greatly needed. Doing so will ensure that these activities are available for this high-risk rapidly-growing population. In addition, high quality safe transportation is needed to allow older Chinese Americans to attend these activities.

Our study highlighted important directions for future research. Future research should assess the timing and the monthly frequency of art attendance and the individual impact of timing and the frequency on cognition in this population. Future studies should also examine the specific mechanism of the effect of arts on cognitive function. Additionally, future studies should include a longer follow-up period between observation to obtain changes in cognition that are more meaningful clinically.

Funding:

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Table 1:

Baseline characteristics and their association with attending museums or musical arts (N=2,703)

	Not attending any art activities (n=1635)	Attending museum only (n=381)	Attending musical arts only (n=247)	Attended both (n=440)	P-value
Age (yrs)	73.2(8.6)	72.4 (7.2)	71.2 (7.7)	71.5 (7.1)	<0.001
Sex					0.38
Male	683 (41.8)	160 (42.0)	112 (45.3)	170 (38.6)	
Female	952 (58.2)	221 (58.0)	135 (54.7)	270 (61.4)	
Education (yrs)	7.2 (4.7)	10.4 (4.9)	9.2 (4.2)	12.2 (4.7)	<0.001
Annual income (US$)					0.0002
$9,999	1419 (87.9)	322 (85.0)	193 (78.1)	364 (83.5)	
>$10,000	196 (12.1)	57 (15.0)	54 (21.9)	72 (16.5)	
Living arrangement					0.35
Living alone	357 (21.8)	82 (21.5)	43 (17.4)	102 (23.2)	
Living with others	1278 (78.2)	299 (78.5)	204 (82.6)	338 (76.8)	
Marital status					0.12
Not married	500 (30.6)	96 (25.2)	64 (25.9)	125 (28.5)	
Married	1134 (69.4)	285 (74.8)	183 (74.1)	314 (71.5)	
Number of children	3.1 (1.5)	2.7 (1.4)	2.7 (1.4)	2.5 (1.4)	<0.001
Language preference					<0.001
Cantonese or Taishanese	1448 (88.6)	242 (63.5)	194 (78.5)	210 (47.8)	
Mandarin or English	187 (11.4)	139 (36.5)	53 (21.5)	230 (52.3)	
Years in the US	20.0 (12.2)	19.5 (13.45)	21.7 (12.3)	17.8 (12.8)	0.0006
Years in the community	12.4 (10.7)	11.65 (10.7)	12.5 (10.6)	10.3 (10.6)	<0.001
Medical comorbidities	2.0 (1.5)	2.1 (1.5)	2.1 (1.5)	2.1 (1.4)	0.39
Smoking status					<0.001
Current smoker	233 (14.3)	15 (3.9)	28 (11.3)	22 (5.0)	
Former smoker	291 (17.8)	69 (18.1)	60 (24.3)	69 (15.7)	
Nonsmoker	1110 (67.9)	297 (78.0)	159 (64.4)	349 (79.3)	
Overall health status					<0.001

	Not attending any art activities (n=1635)	Attending museum only (n=381)	Attending musical arts only (n=247)	Attended both (n=440)	P-value
Poor	353 (21.6)	53 (13.9)	40 (16.2)	51 (11.6)	
Fair	690 (42.2)	153 (40.2)	108 (43.7)	206 (46.8)	
Good	542 (33.2)	154 (40.4)	88 (35.6)	155 (35.2)	
Very good	50 (3.1)	21 (5.5)	11 (4.5)	28 (6.4)	
Health status change					0.003
Worsened	707 (43.2)	144 (37.8)	107 (43.3)	188 (42.8)	
Same	809 (49.5)	196 (51.4)	105 (42.5)	206 (46.9)	
Improved	119 (7.3)	41 (10.8)	35 (14.2)	45 (10.3)	
Functional Status	0.2 (1.0)	0.04 (0.2)	0.1 (0.6)	0.06 (0.4)	<0.001
Depression	3.0 (4.5)	2.1 (3.3)	1.9 (3.2)	2.1 (3.4)	<0.001
Global cognition	−0.2 (0.8)	0.2 (0.7)	0.2 (0.6)	0.4 (0.7)	<0.001
Episodic memory	−0.2 (1.0)	0.2 (0.9)	0.2 (0.8)	0.4 (0.8)	<0.001
Working memory	−0.2 (0.9)	0.1 (1.0)	0.1 (1.0)	0.5 (1.0)	<0.001
Executive function	−0.3(0.8)	0.2 (0.9)	0.2(0.8)	0.5 (0.9)	<0.001

Table 2:

Association between Baseline Art Attendance and Changes in Global Cognition, Estimated from Mixed-Effects Models

Variables	Model 1			Model 2			Model 3			Model 4		
	b	SE	p-value	b	SE	p-value	b	SE	p-value	b	SE	p-value
Intercept	-0.01	0.02	0.40	-0.20	0.02	0.00	0.005	0.05	0.92	0.05	0.05	0.34
Time	-0.04	0.01	0.00	-0.04	0.01	0.00	-0.03	0.007	0.00	-0.03	0.007	0.00
Museum only				0.36	0.04	0.00	0.10	0.03	0.004	0.06	0.03	0.06
Musical only				0.37	0.05	0.00	0.15	0.04	0.0002	0.13	0.04	0.001
Attending both				0.62	0.04	0.00	0.19	0.03	0.0000	0.16	0.03	0.00
Museum only X Time				-0.01	0.02	0.74	-0.01	0.02	0.60	-0.01	0.02	0.60
Musical only X Time				0.01	0.02	0.47	0.01	0.02	0.54	0.01	0.02	0.53
Attending both X Time				-0.02	0.02	0.28	-0.02	0.02	0.18	-0.02	0.02	0.20
Age							-0.03	0.002	0.00	-0.03	0.002	0.00
Sex							-0.08	0.02	0.0006	-0.07	0.03	0.03
Education							0.07	0.003	0.00	0.07	0.003	0.00
Income							0.09	0.03	0.005	0.08	0.03	0.006
Marital status							0.11	0.03	0.0006	0.09	0.03	0.007
Living arrangement							-0.11	0.03	0.001	-0.08	0.03	0.01
Language preference							-0.08	0.03	0.01	-0.09	0.03	0.003
Years in the US							0.003	0.001	0.02	0.003	0.001	0.03
Years in the community							0.0007	0.001	0.63	0.0004	0.001	0.74
Good general health										0.05	0.02	0.04
Physical function										-0.15	0.02	0.00
Change in health (improved)										-0.07	0.04	0.05
Depressive symptoms										-0.01	0.003	0.00
Medical comorbidities										0.01	0.008	0.27
Smoking status – current smoker										-0.03	0.04	0.46
Smoking status - Former smoker										0.01	0.04	0.72

Table 3:

Association between Baseline Art Attendance and Changes in Episodic Memory, Estimated from Mixed-Effects Models

Variables	Model 1			Model 2			Model 3			Model 4		
	b	SE	p-value	b	SE	p-value	b	SE	p-value	b	SE	p-value
Intercept	−0.02	0.02	0.28	−0.21	0.02	0.00	−0.13	0.06	0.02	−0.24	0.04	0.00
Time	−0.007	0.009	0.43	0.008	0.01	0.51	0.01	0.01	0.32	0.01	0.01	0.25
Museum only				0.40	0.05	0.00	0.17	0.05	0.0003	0.07	0.03	0.007
Musical only				0.42	0.06	0.00	0.23	0.06	0.0001	0.06	0.03	0.06
Attending both				0.61	0.05	0.00	0.24	0.05	0.00	0.04	0.03	0.18
Museum only X Time				−0.03	0.03	0.23	−0.04	0.03	0.18	−0.03	0.03	0.23
Musical only X Time				−0.01	0.03	0.67	−0.02	0.03	0.58	−0.02	0.03	0.55
Attending both X Time				−0.06	0.03	0.02	−0.06	0.03	0.01	−0.07	0.03	0.01
Age							−0.03	0.002	0.00	−0.002	0.001	0.05
Sex							0.03	0.03	0.37	0.13	0.02	0.00
Education							0.06	0.004	0.00	−0.009	0.002	0.0001
Income							0.10	0.04	0.01	0.02	0.02	0.41
Marital status							0.10	0.04	0.01	−0.03	0.02	0.16
Living arrangement							−0.09	0.04	0.03	0.05	0.02	0.03
Language preference							−0.02	0.04	0.64	0.08	0.02	0.002
Years in the US							0.004	0.002	0.007	0.002	0.0009	0.01
Years in the community							−0.003	0.002	0.13	−0.004	0.001	0.00
Good general health										0.04	0.02	0.01
Physical function										0.03	0.01	0.005
Change in health (improved)										0.03	0.03	0.33
Depressive symptoms										0.009	0.002	0.00
Medical comorbidities										0.003	0.006	0.58
Smoking status – current smoker										0.08	0.03	0.006
Smoking status - Former smoker										0.006	0.03	0.84
Baseline global cognition										1.04	0.01	0.00

Table 4:

Association between Baseline Art Attendance and Changes in Working Speed, Estimated from Mixed-Effects Models

Variables	Model 1			Model 2			Model 3			Model 4		
	b	SE	p-value	b	SE	p-value	b	SE	p-value	b	SE	p-value
Intercept	0.009	0.02	0.64	-0.17	0.02	0.00	0.21	0.06	0.0006	0.17	0.06	0.004
Time	-0.05	0.008	0.00	-0.06	0.01	0.00	-0.06	0.01	0.00	-0.06	0.01	0.00
Museum only				0.32	0.05	0.00	0.02	0.05	0.66	-0.05	0.04	0.20
Musical only				0.28	0.07	0.00	0.07	0.06	0.25	-0.06	0.05	0.21
Attending both				0.67	0.05	0.00	0.19	0.05	0.0001	0.06	0.04	0.13
Museum only X Time				-0.005	0.02	0.85	-0.007	0.02,	0.79	-0.007	0.02	0.78
Musical only X Time				0.02	0.03	0.56	0.02	0.03	0.54	0.02	0.03	0.55
Attending both X Time				0.01	0.02	0.53	0.01	0.02	0.65	0.01	0.02	0.65
Age							-0.02	0.002	0.00	0.002	0.002	0.21
Sex							-0.18	0.03	0.00	-0.13	0.04	0.0002
Education							0.08	0.004	0.00	0.02	0.003	0.00
Income							0.07	0.04	0.11	-0.001	0.03	0.98
Marital status							0.10	0.04	0.02	-0.002	0.03	0.97
Living arrangement							-0.09	0.05	0.04	0.01	0.04	0.82
Language preference							-0.20	0.04	0.00	-0.09	0.04	0.01
Years in the US							0.0005	0.002	0.74	-0.002	0.001	0.07
Years in the community							0.002	0.002	0.24	0.002	0.001	0.11
Good general health										-0.02	0.02	0.41
Physical function										0.005	0.02	0.77
Change in health (improved)										-0.006	0.04	0.88
Depressive symptoms										-0.003	0.003	0.32
Medical comorbidities										0.02	0.009	0.10
Smoking status – current smoker										-0.07	0.05	0.13
Smoking status - Former smoker										0.03	0.04	0.52
Baseline global cognition										0.76	0.02	0.00

Table 5:

Association between Baseline Art Attendance and Changes in Executive Function, Estimated from Mixed-Effects Models

Variables	Model 1			Model 2			Model 3			Model 4		
	b	SE	p-value	b	SE	p-value	b	SE	p-value	b	SE	p-value
Intercept	-0.03	0.02	0.09	-0.22	0.02	0.00	0.11	0.06	0.08	0.19	0.06	0.007
Time	-0.008	0.01	0.39	-0.006	0.01	0.63	-0.006	0.01,	0.62	-0.006	0.01	0.62
Museum only				0.38	0.05	0.00	0.05	0.05	0.26	-0.003	0.04	0.93
Musical only				0.37	0.07	0.00	0.08	0.06	0.16	-0.004	0.04	0.92
Attending both				0.72	0.05	0.00	0.19	0.05	0.00	0.07	0.04	0.05
Museum only X Time				0.04	0.03	0.17	0.04	0.03	0.17	0.04	0.03	0.17
Musical only X Time				0.01	0.03	0.77	0.01	0.03	0.77	0.01	0.03	0.77
Attending both X Time				-0.06	0.03	0.03	-0.06	0.03	0.03	-0.06	0.03	0.04
Age							-0.04	0.002	0.00	-0.02	0.002	0.00
Sex							-0.12	0.03	0.0002	-0.11	0.03	0.0008
Education							0.07	0.004	0.00	0.01	0.003	0.00
Income							0.14	0.04	0.0009	0.06	0.03	0.06
Marital status							0.054	0.04	0.23	-0.03	0.03	0.35
Living arrangement							-0.05	0.05	0.23	0.03	0.03	0.37
Language preference							-0.25	0.05	0.00	-0.18	0.03	0.00
Years in the US							0.004	0.002	0.03	0.0007	0.001	0.57
Years in the community							0.0004	0.002	0.81	0.0001	0.001	0.96
Good general health										-0.0001	0.02	0.998
Physical function										-0.02	0.02	0.13
Change in health (improved)										-0.03	0.04	0.50
Depressive symptoms										-0.007	0.003	0.03
Medical comorbidities										-0.005	0.008	0.51
Smoking status – current smoker										-0.12	0.04	0.003
Smoking status - Former smoker										-0.06	0.04	0.14
Baseline global cognition										0.74	0.02	0.00