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Current Physical Activity Levels may Not be a Protective Factor for Cognitive Decline in Women Ages 55 to 64

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Abstract

Purpose: Physical activity could help prevent or slow deficits in cognition as an individual age; however, little is known about this relationship in females ages 55 to 64. The purpose of this study was to assess the relationship between physical activity levels and cognitive decline in females ages 55 to 64.

Methods: This cross sectional analysis used 2015 data from the Behavioral Risk Factor Surveillance System (BRFSS) for females ages 55 to 64 in Connecticut, Montana, and Oregon. Logistic regression was used to assess the relationship between physical activity levels and cognitive decline while controlling for health and demographic factors.

Results: Across states, few participants reported cognitive decline (10-14%), and only one-fifth reported being inactive (18-29%), while twice as many reported being highly active (34-48%). Adjusted results indicated that cognitive decline was not found to be significantly related to physical activity levels in any state, but cognitive decline was significantly related to number of health conditions, mental health, and substance use (all with moderate to large effect sizes) in two or three of three states.

Conclusion: Across states, cognitive decline was not related to physical activity levels in females ages 55 to 64. The measurement for cognitive decline provided a limited scope of the condition and this study was unable to control for menopause and hormone replacement therapy, which may affect the outcome.

Primary providers should not screen for physical activity levels related to cognitive decline in this population, but should screen for cognitive decline, multiple health conditions, current mental health issues, and substance use, if symptoms present for any of these in this target population.

Providers should educate patients about the overall benefits of physical activity, but should focus on concurrently

managing health conditions and discontinuing tobacco use as related to cognitive decline in females ages 55 to 64.

Keywords Physical activity; Exercise; Cognitive decline; Cognitive function; Middle-aged

Introduction

As individuals age, neurodegenerative diseases become more extensive, which may lead to cognitive decline, which results in complex issues for individuals, families, and the healthcare system. Increasing age is known to be associated with cognitive decline through decreased neurotrophic factor expression and neurogenesis in the brain [1]. Substance use and current health status may also affect cognition over time [1-4].

For example, tobacco and alcohol use negatively impact many aspects of health, including brain function, which could contribute to cognitive decline and lower levels of cognitive function [3,5]. In addition, stress can counteract neuroprotective influences, leading greater risk for cognitive decline [1,4], and excess sleep could be a symptom of certain disorders, such as depression, that are associated with increased cognitive decline [6].

Indeed, lower levels of depressive symptoms are associated with greater neuroprotective effects [1], and the absence of diabetes, stroke, or heart attack tend to be associated with greater mental functioning in older adults [6]. Aside from age, inactivity is identified as the predominant risk factor for many disease processes [1], which include physical, as well as cognitive and neurologic decline. Deficits in cognitive and neurologic function could potentially be prevented or slowed with health promotion and physical activity [4].

Many studies have shown that those who are physically active experience lower rates of cognitive decline [2,7,8]. IGF-1, a factor associated with neurogenesis, presents with diminished levels in elderly with poor cognitive performance. Exercise is known to accelerate cognitive function and increase IGF-1 levels, which can subsequently improve cognitive performance. Exercise also increases VEGF, which is known to be neurogenic

and neuroprotective [1]. Both increased leisure-time activity and vigorous physical activity may help reduce the risk of cognitive decline in postmenopausal females [2,3].

While there is strong evidence supporting the beneficial effects of physical activity on cognition [1,4], there are limited findings for females ages 55 to 64 [9] and in postmenopausal women [2].

There are also inconsistent findings addressing the type and intensity of physical activity that would be most beneficial for cognitive decline [3,4,6,9]. This study aims to assess the relationship between varying levels of physical activity and cognitive decline for females ages 55 to 64.

Methods

Design

This cross-sectional analysis used 2015 data from the Behavioral Risk Factor Surveillance System (BRFSS) conducted by the Centers for Disease Control and Prevention (CDC) regarding health-related risk behaviors, chronic health conditions, and use of preventive services [10]. BRFSS collects data in all 50 states as well as the District of Columbia and three U.S. territories, and completes more than 400,000 interviews annually. This study was given exempt status by The University of North Texas Health Science Center.

Sample

The population included females ages 55 to 64 in Connecticut (N=1623), Montana (N=829), and Oregon (N=638). These states were chosen for their higher proportions of active females in the target age range based on prevalence data available through BRFSS [10].

Data

The outcome, cognitive decline, was measured as yes/no to having "serious difficulty concentrating, remembering, or making decisions." The factor of interest, physical activity levels, was measured in BRFSS with questions asking about weekly physical activities and time spent in activities.

Based on weekly minutes of moderate activity (or vigorous equivalent), BRFSS categories for levels of physical activity include the following: "inactive," defined as 0 minutes/week; "insufficiently active," defined as 11 to 149 minutes/week; "active," defined as 150 to 300 minutes/week; and "highly active," defined as greater than 300 minutes/week. Control variables included health and demographic factors.

Number of health conditions was measured as the number of lifetime diagnoses of any of the following: hypertension, hyperlipidemia, myocardial infarction, coronary heart disease, stroke, skin cancer, cancer, chronic obstructive pulmonary disease (COPD), arthritis, depression, renal disease, diabetes, and asthma. Numerical results were categorized as 0, 1, 2, or 3 or more. Due to low percentages in categories across states, health conditions was dichotomized as "0-2 health conditions" versus "3 or more health conditions" for adjusted analyses. Mental health was measured quantitatively as number of days of poor mental health attributed to "stress, depression, or problems with emotions" in the past 30 days. Due to severe skew across all states, this variable was then dichotomized at the mode in all states (mode=30) as "30 days of good mental health in the past 30 days" versus "less than 30 days of good mental health in the past 30 days." Tobacco use was categorized as "current smoker" versus "non-smoker." Alcohol use was measured as yes/no to any alcohol consumption in the past 30 days.

Due to small percentages in various categories across states, race/ethnicity was categorized as "White, non-Hispanic" versus "Other." Education level was measured as "graduated college or technical school" versus "did not graduate college or technical school." Marital status was categorized as "married" versus "not married." Variable categories and descriptive statistics by state are shown in Table 1.

Analysis

Frequency distributions by state were used to describe the sample and determine any issues with the distribution of variables. Multiple logistic regression analysis by state was used to assess the relationship between cognitive decline and levels of physical activity after controlling for health and demographic factors. We chose to analyze data separately by state to assess patterns in relations among variables across similar samples. As such, a similar result in two or three (out of three states) was considered reliable evidence for a relationship.

Any observations with missing data for any of the variables were excluded from the multivariable analysis. Adjusted results by state are shown in Table 2. All analyses were conducted in R (version 3.3.3, © 2017 The R Foundation for Statistical Computing).

Table 1: Descriptive statistics by state.

Variable	Connecticut N=1623		Montana N= 829		Oregon N = 638	
	n	%	n	%	n	%
Cognitive Decline						

Yes	165	11	78	10	86	14
No	1401	89	737	90	532	86
Total	1566	96	829	100	618	97
Physical Activity						
Inactive	355	25	227	29	97	18
Insufficiently active	283	20	137	18	78	14
Active	293	21	117	15	114	21
Highly active	474	34	293	38	264	48
Total	1405	87	774	93	553	87
Health Conditions						
0 health problems	219	15	144	19	85	15
1 health problem	379	25	170	23	119	20
2 health problems	348	23	182	25	137	23
3 or more health problems	563	37	244	33	244	42
Total	1509	93	740	89	585	92
Mental Health						
30 days of good mental health in the past 30 days	962	60	538	66	360	57
Less than 30 days	639	40	280	34	270	43
Total	1601	99	818	99	630	99
Tobacco Use						
Current smoker	202	13	156	19	96	16
Not a current smoker	1350	87	658	81	517	84
Total	1552	96	814	98	613	96
Alcohol Use						
Yes in the past 30 days	900	59	403	50	347	57
No	627	41	404	50	260	43
Total	1527	94	807	97	607	95
Ethnicity/Race						
White, non-Hispanic	1282	80	722	88	570	90
Other	316	20	98	12	61	10
Total	1598	98	820	99	631	99
Educational Level						
Graduated college/technical school	774	48	312	38	253	40
Did not graduate college/technical school	844	52	509	62	383	60
Total	1618	100	821	99	636	100
Marital Status						
Married	853	53	498	61	365	58
Not married	754	47	325	39	260	42
Total	1607	99	823	99	625	98

Results

Descriptive statistics

Table 1 lists descriptive statistics for females age 55-64 in Connecticut, Montana, and Oregon. Across states, few participants reported cognitive decline (10-14%), and only one-fifth reported being inactive (18-29%), while twice as many reported being highly active (34-48%).

For current health status, about one-third of participants reported having three or more health conditions (33-42%) and

the majority reported 30 days of good mental health in the past 30 days (57-66%).

For substance use, most participants were nonsmokers (81-87%) and about half reported consuming alcohol in the past 30 days (50-59%). For demographic factors, most participants reported their ethnicity/race as White (80-90%); almost half reported graduating college or technical school (38-48%); and the majorities were married (53-61%).

Table 2: Results of logistic regression analysis by state, ref =referent group; AOR= adjusted odds ratio; 95% CI= 95% confidence interval; Bolded results are significant (AORs with 95% CI that do NOT include 1.0 are significant).

Cognitive Decline (yes vs. no)	Connecticut N=1623			Montana N=829			Oregon N=638		
	AOR	95% CI		AOR	95% CI		AOR	95% CI	
Physical Activity	-	-	-	-	-	-	-	-	-
Inactive	ref	-	-	ref	-	-	ref	-	-
Insufficiently active	0.83	0.46	1.5	1.13	0.46	2.79	0.42	0.15	1.17
Active	0.75	0.4	1.4	1.61	0.64	4.02	0.38	0.13	1.07
Highly active	0.65	0.36	1.18	0.96	0.44	2.11	0.55	0.24	1.25
Health Conditions	-	-	-	-	-	-	-	-	-
3 or more health problems	3.86	2.32	6.42	5.48	2.73	11	5.19	2.37	11.4
Mental Health	-	-	-	-	-	-	-	-	-
30 days of good mental health in the past 30 days	0.14	0.08	0.24	0.09	0.04	0.2	0.1	0.04	0.24
Tobacco Use									
Current smoker	1.04	0.61	1.77	2.79	1.41	5.51	3.5	1.67	7.36
Alcohol Use	-	-	-	-	-	-	-	-	-
Yes in the past 30 days	0.53	0.34	0.83	0.3	0.15	0.61	0.68	0.35	1.31
Ethnicity/Race	-	-	-	-	-	-	-	-	-
White, non-Hispanic	0.68	0.42	1.1	1.08	0.46	2.56	1.64	0.52	5.12
Educational Level	-	-	-	-	-	-	-	-	-
Graduated college/technical school	0.57	0.35	0.93	0.66	0.31	1.37	0.64	0.3	1.35
Marital Status	-	-	-	-	-	-	-	-	-
Married	0.5	0.31	0.8	1.06	0.56	2.01	0.27	0.14	0.54

Adjusted statistics

The results of multiple logistic regression analysis by state for females ages 55 to 64 showed that after controlling for all other variables in the model, cognitive decline was not significantly related to levels of physical activity in any of the three states. However, cognitive decline was highly related to health conditions and mental health in all three states.

Across states, participants that reported 3 or more health conditions were about 4 to 5.5 times more likely to report cognitive decline, while those who reported having 30 days of

good mental health in the past 30 days were about 7 to 11 times less likely to report cognitive decline. In addition, cognitive decline was related to substance use in two of three states. Those who reported consuming alcohol in the past 30 days were about 2 to 3 times less likely to report cognitive decline, while current smokers were about 3 to 3.5 times more likely to report cognitive decline.

Discussion

The purpose of this study was to assess the relationship between physical activity levels and cognitive decline in female ages 55 to 64. Across states, few participants reported cognitive decline (10-14%), and only one-fifth reported being inactive (18-29%), while twice as many reported being highly active (34-48%). The results of adjusted analysis indicated that there were no significant patterns in relations between physical activity and cognitive decline in any of the three states. These findings differed from previous research that showed physical activity to be a neuroprotective factor [1-4,7-9].

This discrepancy could be due to differences in measures or target populations. Prior research examined the effects of physical activity on cognitive functioning using cognitive assessments [1,4,6,9,11], whereas this study defined cognitive decline as self-reported "difficulty concentrating, remembering, or making decisions."

In addition, this study examined females ages 55 to 64, whereas most previous research focused on the elderly [1,6-8,12]. The variables in this study were concurrent levels of cognitive decline and physical activity levels at one point in time; therefore, benefits of physical activity for cognitive decline may not be immediate.

The results of this study do, however, show that cognitive decline was consistently and moderately to highly rated to number of health conditions, mental health, and substance use in females ages 55 to 64. In this study, participants who reported having three or more conditions were more likely to report cognitive decline. Although prior research only examined the type of health condition as opposed to number of chronic conditions, the finding of cognitive decline being associated with chronic health conditions is consistent [1,3]. In addition, the results of this study indicated that women in the target population who reported good mental health were less likely to report cognitive decline, which is supported by prior research [1,6,12].

Interestingly for substance use, those who reported smoking were more likely to report cognitive decline, whereas those who reported alcohol consumption were less likely to report cognitive decline. The former finding for tobacco use is consistent with previous research, whereas the latter finding for alcohol use is not [2]. However, the variable for alcohol in this study simply measured any alcohol use in the past 30 days.

Limitations

Using 2015 data from the Behavioral Risk Factor Surveillance System (BRFSS) provided access to large sample sizes. However, the data is cross-sectional in nature so the results can only address concurrent relations and no temporal or casual relations can be determined from it.

In addition, the BRFSS data did not include certain variables that may be relevant to cognitive decline in this target population, including sleep [5] and onset of menopause and presence of Hormone Replacement Therapy (HRT) [4,11].

Because sleep and hormones may regulate the effect of physical activity on neurogenesis and, thus, on cognitive performance, future studies should include these variables as the findings related to them would be important in patient education and treatment.

Furthermore, the relationship between having multiple chronic health conditions and cognitive decline in this study could be related to participant medication use. Research shows that middle and older age adults tend to take multiple medications and many may take medications, such those with anticholinergic properties, that have adverse effects on cognitive functioning [13]. However, there was no data available for medication use in this study.

Conclusion

Because this was a population-based study, the findings may apply to females between the ages of 55 and 64 in primary care. For this target population, there may be a low prevalence of cognitive decline and moderate prevalence of physical activity. Although cognitive decline was not related to physical activity levels in this target population, providers should screen for cognitive decline in this target population when patients present with complaints or early signs of decreased cognitive functioning, and continue to educate patients on the benefits of physical activity, noting that any benefits may not be immediate for cognitive decline.

However, cognitive decline was consistently and moderately to highly related to number of health conditions, mental health status, and tobacco use. As such, females ages 55 to 64 presenting with cognitive decline symptoms should be screened for multiple health conditions, current mental health status, and tobacco use, and vice versa.

Providers should determine appropriate referrals for declining cognitive function; determine how well patients with multiple health conditions are managing them and help with management strategies; educate patients about the signs and symptoms of mental distress and provide resources for addressing mental health issues; and educate patients who smoke about the risks of tobacco use and encourage them to quit. Most importantly, primary care providers should concurrently monitor all comorbid conditions, including treatment regimens, compliance, and adverse medication side effects on cognitive functioning, to increase health outcomes for females ages 55 to 64.

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