Risk of Cardiovascular Disease and Cognitive Status in Middle-aged Adults:
The Gray Matters Study

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Abstract

Objective: To investigate the relationship between cardiovascular disease (CVD) risk and cognitive decline in middle-aged adults.

Participants & Methods: 146 persons (66% female) who volunteered for a randomized controlled pilot study of a healthy lifestyle application were studied for 6 months. Mean (sd) age was 54.2 (6.9), with 77% completing a bachelor's degree or higher. All measures were administered at baseline and 6-months. Ten-year risk of experiencing a CVD event was determined using a risk calculator based on demographic and health indicators from the 2013 guidelines of the American College of Cardiology (ACC) and American Heart Association (AHA) Task Force. A score >= 7.5% was considered higher risk. Cognitive status was assessed by the Montreal Cognitive Assessment (MOCA), Rey Auditory Verbal Learning Test (RAVLT), Controlled Oral Word Association Test (COWA), and the following NIH toolbox measures: List Sorting Working Memory, Flanker Inhibitory Control, and Picture Vocabulary. Linear mixed effects models examined the association between CVD score (time-varying) and cognitive measures. Covariates tested were age, sex, education, and body mass index (BMI).

Results: Baseline CVD score [Mean (sd)] = 3.3% (3.1); CVD risk scores increased by an average of .3% ($p < .01$) for all subjects over 6 months. Low CVD score (< 7.5%) was associated with higher scores on the MOCA (β=.7, p=.06) and RAVLT sum of trials 1-5 (β=3.7), recognition errors (β=-3.0), & interference (β=0.8), all p<.05, with the inclusion of covariates. CVD risk score was not significantly associated with other test scores nor rate of change on any tests.

Conclusions: Individuals at greater risk of cardiovascular disease had, on average, worse scores on tests of global cognitive functioning and episodic (verbal) memory. Modifiable lifestyle factors that reduce CVD risk may be a target for intervention to promote cognitive functioning in mid-to-late life.

Introduction

- The prevalence of cognitive impairment without dementia increases with age.[9]
- Many cardiovascular factors, including diabetes, mid-life obesity, mid-life hypertension, and hyperlipidemia, have been associated with increased risk for cognitive decline and dementia in late life.[1,4]
- The ACC and AHA promote the use of a CVD risk calculator in predicting 10-year and lifetime risk of a first hard Atherosclerotic Cardiovascular Disease (ASCVD) as a preventative and health management tool.[3]
- This study examined whether cardiovascular risk was associated with cognitive performance in a sample of middle-aged adults.

Methods

Participants:

- Persons enrolled in Gray Matters, a randomized controlled pilot study that investigated the adoption & utility of a smart phone application to promote healthy lifestyles with may reduce risk for for cognitive decline and/or dementia in late life.[6]

Procedures:

- Participants completed health screenings (e.g. weight, height, blood pressure, blood & urine testing, medical history) and cognitive testing at baseline and approximately six-months later.

Measures:

•Risk for Cardiovascular Disease:

- Cardiovascular Disease (CVD) score: an objective estimation of risk for CVD based on an evidence-based algorithm that includes the following factors: age, race, sex, smoking status, blood pressure, use of hypertension medication, cholesterol, and diabetes diagnosis. A score >= 7.5% is considered higher risk.[3]

•Cognitive Tests:

- Montreal Cognitive Assessment (MoCA): a brief, 30-pt cognitive screener with documented sensitivity and specificity in detecting Mild Cognitive Impairment.[5]
- Rey Auditory Verbal Learning Test (RAVLT): a standardized list-learning task that measures episodic memory and includes 5 immediate recall/learning trials, an interference trial, a delayed recall trial, and a recognition trial.[8]
- Controlled Oral Word Association Test (COWA): a well-validated, timed measure of verbal fluency.[2]
- National Institute of Health (NIH) Toolbox - Cognition Battery: a computerized battery of brief assessments of several neuropsychological domains. In order to assess vocabulary, executive functioning, working memory, and processing speed, the following tests were administered: Picture Vocabulary, Flanker Inhibitory Control and Attention Test, List Sorting Working Memory Test, and Oral Symbol Digit Test.[10]

Statistical Modeling:

- Linear mixed effects models were used to examine the association between cardiovascular risk and cognition over the six month interval.
- Covariates tested: age, sex, education, and Body Mass Index (BMI).

Results

Sample Characteristics

- 146 persons (66% female) from Cache County, UT with a mean (sd) age of 54.2 (6.9) and majority (77%) education level of 4-year college degree or higher.

Cardiovascular Risk & Cognitive Decline

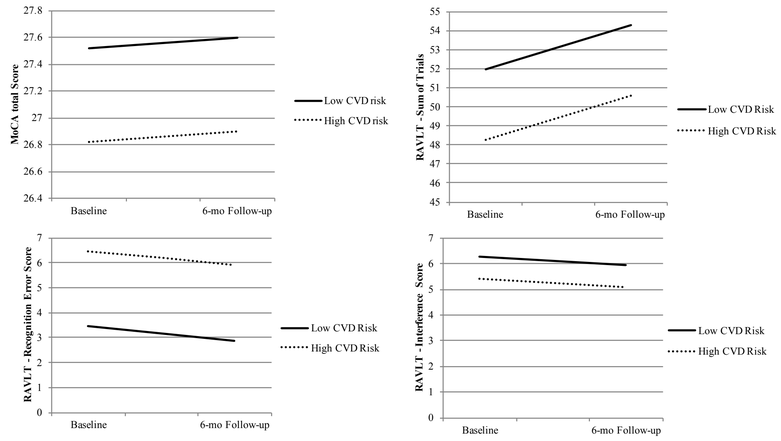
- CVD score was generally low at baseline [Mean (sd) = 3.3% (3.1)] and increased by an average of 0.3% over the course of 6 months.
- Low CVD score (< 7.5%) was associated with better global cognitive functioning and verbal memory after controlling for covariates.
- CVD score was not associated with rate of cognitive decline.

Table: Linear Mixed Effects Models of CVD Risk and Cognitive Decline

Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
MoCA							
Intercept	26.82	0.40	230.33	66.97	.000	26.03	27.60
Time	0.15	0.33	141.60	0.46	.644	-0.50	0.81
Low CVD Risk[a]	0.70	0.37	226.16	1.89	.061	-0.03	1.42
Male[b]	-0.63	0.28	152.56	-2.28	.024	-1.18	-0.09
RAVLT - sum of trials							
Intercept	61.82	5.58	194.00	11.09	.000	50.82	72.82
Time	4.67	1.18	138.60	3.97	.000	2.35	7.00
Low CVD Risk[a]	3.67	1.68	268.39	2.18	.030	0.36	6.98
Age	-0.25	0.09	161.56	-2.78	.006	-0.42	-0.07
Male[b]	-4.73	1.30	159.98	-3.64	.000	-7.30	-2.16
RAVLT – recognition errors							
Intercept	6.47	0.61	245.77	10.59	.000	5.26	7.67
Time	-1.15	0.49	137.90	-2.36	.019	-2.11	-0.19
Low CVD Risk[a]	-3.03	0.62	251.09	-4.88	.000	-4.26	-1.81
RAVLT – interference							
Intercept	5.43	0.34	223.10	15.81	.000	4.76	6.11
Time	-0.65	0.34	142.81	-1.89	.061	-1.33	0.03
Low CVD Risk[a]	0.83	0.35	209.87	2.39	.018	0.15	1.51

[a]Reference group: High CVD Risk; [b]Reference group: Female

Plots: Linear Mixed Models of CVD Risk and Cognitive Decline



Conclusions

- Our findings suggest that middle-aged adults at lower risk of cardiovascular disease performed better on global cognitive and verbal episodic memory measures than those at higher risk of cardiovascular disease.
- Therefore, screening for cardiovascular disease risk may be useful in predicting cognitive functioning in middle-aged adults.
- Information on cardiovascular risk factors may be an area of intervention to promote cognitive functioning in mid-life and potentially reduce the risk for dementia later in life.[7]
- Further research is suggested to examine whether cardiovascular risk factors predict *change* in cognition over a longer time period and whether life-style interventions targeting cardiovascular risk factors also reduce risk of cognitive decline.

Citations

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