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Project Title: Cognitive impairment in advanced CKD: The Canadian Observation and Interventions Trial (CanFIT)

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SUMMARY: (no more than 250 words single spaced)

Background and Objectives: Chronic kidney disease (CKD) affects more than one third of adults over 65 years, and there appears to be a strong correlation between cognitive impairment and decreasing kidney function. Most studies examining cognitive impairment in kidney disease have focused on hemodialysis populations; thus, the aim of this study is to determine the prevalence and risk factors for cognitive impairment in patients with advanced CKD (stages 4-5), not on dialysis.
Methods: Cognitive function was assessed using the Montreal Cognitive Assessment (MoCA) in patients enrolled in the Canadian Frailty Observation and Interventions Trial. This study is a longitudinal study designed to collect data over a 2-year period from patients attending CKD clinics in 4 Canadian sites.
Results: Baseline cognitive assessments were completed on 385 patients with a median age of 68 and eGFR of 19 ml/min/1.73m2. The prevalence of cognitive decline in advanced CKD was 61% as defined by a MoCA score ≤24. Older age, history of recent falls, and stroke were associated with an increased risk of cognitive impairment.
Conclusions: Cognitive decline is common and underrecognized in advanced CKD and is associated with vascular risk factors. Regular screening, aggressive vascular protection, and practical changes in patient care are needed to ameliorate the effects of cognitive impairment on patient management and outcomes.

Student Signature **Supervisor Signature**

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Cognitive Impairment in Advanced CKD: The Canadian Frailty Observation and Interventions Trial (CanFIT)

Background

Chronic kidney disease (CKD) affects one eighth of the general adult population and more than one third of adults over the age of 65 [1–4]. There are clear associations between CKD and adverse clinical outcomes including cardiovascular and cerebrovascular disease, progression to end-stage renal disease (ESRD), and early mortality [1,2,5–9]. Both CKD and its two most common underlying conditions, diabetes and hypertension, are strong risk factors for vascular disease, dementia, and milder forms of cognitive impairment [10].

Mild cognitive impairment (MCI) is clinically defined as a concern for a change in cognition, impairment in one or more domains of cognition, preservation of functional abilities and independence, and the absence of dementia [11]. There is growing evidence that the processes leading to MCI and clinical dementia begin in the early stages of CKD and that there maybe a strong relationship between impaired cognition and decreasing kidney function [12–17]. However, MCI is underrecognized in CKD, particularly in older patients, and in those with multiple chronic diseases [13,18,19]. Early identification of cognitive impairment is important as it is associated with decreased adherence to medications and treatment, poor nutrition, decreased quality of life, increased mortality and increased cost of care [20–22]. To date, studies examining the association of kidney function and cognition have largely focused on patients on hemodialysis, and little is known about the prevalence and risk factors for MCI in earlier stages of CKD [6,10,18,23,24].

In order to address this evidence gap, we conducted a prospective cohort study to determine the prevalence and risk factors for MCI in patients with CKD Stages 4-5 (Table 1), not on dialysis. We hypothesized that the degree and nature of cognitive impairment in this population would be similar to those going renal replacement therapy and far greater than comparative populations of healthy older adults or those with earlier stages of CKD.

METHODS

Study population

The Canadian Frailty Observation and Interventions Trial (CanFIT) is a multicenter prospective cohort study of adults with Stages 4-5 CKD, not on dialysis. The aim of the study is to delineate the perceived and measured prevalence of frailty in advanced CKD, and to understand its association with dialysis treatment modality decisions and adverse outcomes. The study began enrolling participants in 2012 at 4 Canadian multidisciplinary renal health clinics, including Seven Oaks General Hospital, St. Boniface General Hospital, and the Health Sciences Centre in Winnipeg, MB as well as the Kidney Health Centre in Regina General Hospital in Regina, SK. The study is designed to collect data from 600 patients over 2 years with a baseline assessment followed by annual assessments. Individuals included in the study are patients with CKD Stages 4-5 attending one of the above renal health clinics. Exclusion criteria include inability to provide informed consent, inability to speak English, blindness, overt dementia and previous dialysis treatment. Ethics approval was obtained from the University of Manitoba Health Research Board as well as the St. Boniface General Hospital Research Review Committee and the Regina Qu'Appelle Health Region Research Ethics Board. Informed consent was obtained from each study participant.

Data collection

Frailty assessments were performed as described in detail in our previous manuscript. (Walker et al. Submitted to CJKHD). This study describes cognitive status at baseline.

Assessment of Cognitive Function

Cognitive function was measured at each study visit using the Montreal Cognitive Assessment (MoCA, English version 7.1 available at www.mocatest.org). The MoCA is a 30-point screening tool that takes approximately 10-minutes to complete and is highly sensitive in detecting MCI [25,26]. The MoCA encompasses multiple domains of cognition including short-term memory, visuospatial abilities and executive function, language, attention, concentration, and working memory, and finally orientation to time and place. The tasks include delayed recall of 5 nouns after 2 learning trials, a clock-drawing and 3 dimensional cube copy test, the Trail Making B test, a phonemic fluency task, a verbal abstraction task, a sustained attention task, serial subtraction and digits forward and backward tasks, a naming task, repetition of complex sentences, and a fluency task. Level of education is adjusted for by adding one point to the total score for participants with ≤12 years of formal education. The maximum score possible on the MoCA is 31 and we defined MCI as a score ≤24 in this study. The MoCA is administered and scored by a research coordinator in accordance with the English Version 7.1 instructions.

Baseline Demographics and Comorbid Conditions

We collected demographic information such as age, gender, and race at the initial assessment, while self-reported outcomes associated with frailty including weight loss, recent falls, hospitalizations, and the use of mobility aids was recorded at each study visit. Comorbid conditions, such as diabetes, depression, cardiovascular disease, cerebrovascular disease, and depression were also self-reported, while chart reviews were conducted to identify further comorbidities and record laboratory data.

Statistical Analysis

We tested for differences between the patient population as stratified by their MoCA score using the T-test and Mann-Whitney U test when appropriate for continuous variables and the Chi-squared test for categorical variables. Variables with face validity and a p-value < 0.10 between the two comparator groups in the univariate analysis were included in a stepwise multivariate logistic regression model predicting cognitive impairment as determined by a MoCA score ≤24. All statistical analyses were performed using SAS Version 9.3.

RESULTS

Three hundred and eighty-five participants in the CanFIT study completed the baseline cognitive assessments included in this analysis. The median age of the study cohort was 68 years, 39% were female, and 57% had diabetes. In addition, 12% of the participants had overt peripheral vascular disease and 9% had a self-reported history of stroke. The median eGFR was 19 ml/min/1.73m^2 (Table 2).

At baseline 237/385 (61%) of participants were cognitively impaired as defined by a MoCA score ≤24 (Table 3). Notably, the prevalence of MCI increased to 289/385 (75%) when a cutoff of <26 was used in scoring the MoCA (data not shown).

Comparison of MoCA scores with the general population

We compared the MoCA scores of our CKD cohort to a control group of elderly community dwelling adults with an average age of 73 years and without any history or complaints of MCI or dementia [25]. The study participants scored lower than the control group across all domains of cognition (Figure 1). The mean total score for the normal control group was 27.37 while the CKD group had a mean score of 22.75 ($p< 0.01$). When compared with the control population, composite scores identified the most pronounced deficits in the CKD population in recall, attention, and visuospatial/executive function with mean differences of -1.66 ($p< 0.01$), -0.76 ($p<0.01$) and -0.71 ($p<0.01$), respectively. Language deficits were also marked at -0.68 ($p<0.01$). Declines in naming, abstraction and orientation were more subtle but also statistically significant (Table 4).

Factors associated with Cognitive Impairment

In univariate analysis, older age, a history of falls, lower hemoglobin, higher pulse pressure, and the presence of peripheral vascular disease, congestive heart failure, and previous stroke were associated with cognitive decline (Table 3). Most of these associations, however, were not statistically significant when analyzed in the multivariate models. In these models, only older age (OR of 1.04 (95% CI 1.02-1.05)), recent falls (OR of 1.94 (95% CI: 1.12-3.35)), and a history of recent stroke (OR 4.71 (95% CI: 1.37-16.21)) were associated with cognitive impairment (Table 5).

DISCUSSION

In our study of 385 patients with advanced CKD, we found that cognitive impairment was highly prevalent. Moreover, cognitive impairment is extremely underrecognized in this cohort since patients with overt dementia were excluded from the study and cognitive decline is not regularly screened for in the CKD clinic. When compared to a control group of healthy older adults, patients with CKD Stages 4-5 had higher prevalence of deficits in all aspects of cognition, with the largest deficiencies found in recall, attention and executive function. In multivariate analysis, older age, a history of falls, and previous strokes were strongly associated with impaired cognition. We found that MCI increased by 40% over ten years in patients with advanced CKD, which is expected because both cognitive decline and CKD increase in prevalence with advancing age [27–31]. In addition, gait disturbances are a common clinical finding in patients with vascular MCI [32,33], which may account for the association of recent falls with an increased risk of impaired cognition. These findings suggest that the cognitive impairments found in patients with CKD are likely vascular in origin.

When compared to other observational studies, our findings indicate that the prevalence of cognitive decline in late-stage CKD is much higher than that of healthy older adults. As part of the Cardiovascular Health Study, the prevalence of MCI in community dwelling adults over the age of 65 was found to be 19% overall, and 29% in those over 75 years [27], while another population-based study of older adults between 75-95 years estimated the prevalence of MCI as 15% [34]. These studies included a neuropsychological examination as part of the assessment, increasing the detection of MCI significantly [27].

When compared to populations of older adults with other chronic diseases, we again found the prevalence of impaired cognition to be higher in our CKD cohort. Cognitive impairment was found in 30% of breast cancer patients prior to chemotherapy and 35% after treatment [35]. Similarly, other studies also assessing cognition with the MoCA found 40% of patients with HIV [36] and 45% with stroke history [37] had MCI. Studies in patients with type 2 diabetes detected MCI in about one third of participants when screening with either the MMSE or the MoCA, and assessing their activities of daily living (ADL) and instrumental activities of daily living (IADL) [38,39]. Finally, multiple studies have assessed cognition in patients with congestive heart failure (CHF). One

such study found that 73% of patients were cognitively impaired when screened with the MoCA. This study, however, used a cut-off score of <26 to define cognitive impairment, thus the prevalence of MCI may have been overestimated [40]. When compared to our secondary analysis using a MoCA score of <26 as a cut-off, the prevalence of MCI in advanced CKD is slightly higher at 75%. Cognitive decline may have been further exaggerated in this CHF cohort because the MoCA was administered in an acute setting - during hospital admission. Another study found that 60% of participants with serious CHF, and 43% with mild CHF (based on New York Heart Association Classification) had cognitive declines, based on the MMSE and 7 neuropsychological tests [41]. It should be noted that the average age of this study group was 75, which is much higher than our cohort (average age of 68 years). However, whether or not these studies overestimate MCI in CHF, they do indicate that rates of cognitive decline in CHF are approaching those found in advanced CKD, which is unsurprising since the etiology of CHF MCI may be largely vascular as well [41,42]. Furthermore, the prevalence of cardiovascular disease and CHF in CKD populations is high [43].

To the best of our knowledge, there has not been a study that utilized the MoCA to screen patients with mild CKD (stages 2-3), however, many studies have analyzed this population with other screening tools and neuropsychological examinations. It has been shown that there is a dose-response relationship between declining kidney function and cognition, and cognitive declines tend to be more focused on executive function tasks, which may be explained by subclinical vascular disease [12,14,15,30].

There are many studies that have identified a high rate of cognitive decline in hemodialysis patients[6,10,23,24]. Using a battery of neuropsychological tests to assess cognitive function, Murray et al found that 87% of the hemodialysis population suffered from some degree of cognitive impairment, ranging from mild to severe [18]. Importantly, this study included patients with overt cognitive impairment, and when the severe impairment group was excluded, the prevalence of mild and moderate cognitive impairment was 50%. Tiffin-Richards et al studied the MoCA as a screening tool for hemodialysis patients and found that 59% had MCI with a cut-off score of ≤24. As observed in the present study, there was decline in global cognition, with the most prominent declines in memory, language, executive function, and visuospatial abilities [44]. Additionally, imaging studies have found a similar pattern of white matter disease and cerebral atrophy in hemodialysis and CKD stages 4-5 patients. This damage may be due to the long-standing exposure to vascular risk factors in these two patient cohorts [45,46]. These results strongly support our hypothesis that CI in advanced CKD presents in a similar manner as in hemodialysis patients.

The most striking association in our model was history of stroke and MCI, with previous stroke increasing the risk of MCI almost fivefold. Strokes are commonly associated with cognitive decline, particularly in executive function, which is often observed in subcortical infarctions. Inn addition, CKD is itself a risk factor for stroke, white matter disease, and cerebral atrophy [24,29,30]. Together these finding reinforce the supposition that cognitive decline in CKD is mediated through vascular damage due to the high prevalence of both traditional and nontraditional vascular risk factors, such as hypertension, chronic inflammation and oxidative stress [30,47]. Many previous studies have found, however, that CKD is an independent risk factor for MCI when controlling for cardiovascular and cerebrovascular disease, suggesting that cognitive declines are, at least in part, a result of subclinical vascular damage or nonvascular causes, such as anemia or chronic inflammation. [24,30,45]. This hypothesis is supported by an observed association between elevated FGF-23 levels (which increase with decreasing kidney function) and cognitive impairment in hemodialysis patients [48]. It has also been shown that elevated inflammatory markers such as IL-6 and CRP are associated with cognitive decline [49].
This study contributes to the growing body of knowledge and awareness surrounding MCI in patients with kidney failure and our findings have important clinical implications. Although the

high prevalence of cognitive impairment in CKD and hemodialysis patients has been established, MCI is still clinically underdiagnosed, likely due to its subtle presentation and lack of routine screening in CKD patients [13,18]. In stages 4-5 CKD and ESRD, cognitive decline is more prevalent and at a more advanced stage than in milder CKD, however evidence supports the notion that MCI begins in early kidney failure. Thus, screening in early stages of disease would be beneficial to patients and decrease the cost of care that is associated with adverse outcomes [21,30]. Patients in the late stages of kidney disease must adhere to complex treatment plans and dietary restrictions, and many important and difficult decisions must be made regarding future care and renal replacement therapy. Screening and identifying MCI in these patients is important to optimize patient compliance, quality of life, and minimize premature death. This can be accomplished clinically by changing the approach to care in practical ways, such as encouraging the use of advance directives, involving family members in clinic appointments, utilizing proxy decision-makers, simplifying treatment regimens, and providing patients with lists and reminders to improve compliance. Furthermore, early identification will allow care teams to target MCI risk factors in order to slow the progression of cognitive decline. Such strategies should include more aggressive primary and secondary stroke prevention through improved diet and exercise, tight blood pressure control, optimal use of anti-platelet therapy and statins, as well as cognitive stimulation and retraining.

This study has some important limitations. First, the MoCA may be too sensitive in detecting MCI at the recommended normal range (score of 26-31), particularly in participants with lower levels of education [50]. This can lead to an overestimation of MCI, however we attenuated this by decreasing the cutoff score to ≤24, which has been shown to maximize the validity of the test [44,50]. Furthermore, the MoCA was the sole test used to identify CI; ideally a neuropsychiatric evaluation would have been conducted to correlate our findings. It is also important to note that although the present report is a cross-sectional study, the design of CanFIT is longitudinal and will allow us to follow this cohort over time, examining the long-term cognitive decline in advanced CKD.
A primary strength of this study is the large and unique study population. Research on the cognitive effects of advanced CKD is lacking, and we were able to study this cohort in a diverse patient population, representative of the Canadian CKD population. A further attribute is that the MoCA is much more sensitive in detecting declines in executive function than other more commonly used tools, such as the MMSE [40], and it is particularly sensitive in identifying MCI due to vascular causes [25,37,51]. Thus, the MoCA is well suited to our study population, increasing the accuracy of our measure of the prevalence of cognitive decline in advanced CKD.

CONCLUSIONS

We found a high rate of previously unrecognized cognitive impairment in a population of advanced CKD patients, stages 4-5. Unfortunately, MCI in kidney failure is often overlooked, highlighting the need for a validated screening tool for this population and a screening protocol in CKD clinics. In addition, ongoing longitudinal research is needed to examine the effect MCI has on outcomes, such as quality of life, modality choice in renal replacement therapy, and mortality. While MCI in CKD is largely caused by vascular damage, CKD is also an independent risk factor for cognitive impairment, suggesting the involvement of subclinical vascular dysfunction and nonvascular mechanisms. Further research is warranted to delineate these mechanisms as possible targets for therapy and prevention. Finally, the prevalence and characteristics of cognitive decline mirror those previously found in hemodialysis populations. Thus, aggressive vascular protection and practical measures should be utilized to improve patient care and compliance.

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Table 1: Stages of chronic kidney disease based on GFR

CKD Stage	Description	GFR (mL/min/1.73m^2)
1	Kidney damage; normal GFR	> 90
2	Kidney damage; mildly decreased GFR	60-89
3	Kidney damage; moderately decreased GFR	30-59
4	Kidney damage; severely decreased GFR	15-29
5	Kidney failure; RRT needed	< 15 or dialysis

GFR, glomerular filtration rate; RRT, renal replacement therapy
Kidney damage is defined by proteinuria. Adapted from KDIGO Clinical Guidelines 2012 [52]

Table 2. Baseline demographic information of advanced CKD participants

Variable	Patients Enrolled in CKD Frailty Study (N=385)
Age	68.0 (56.0 - 78.0)
Gender (Female)	148 (39.4%)
Weight (KG)	84.0 (72.5 - 96.9)
Systolic Blood Pressure (mm Hg)	137 (124 - 149)
Diastolic Blood Pressure (mm Hg)	74 (67 - 82)
SPPB Score	9 (7 - 11)
SPPB Frail Score < 9	156 (40.5%)
SPPB Frail Score < 10	206 (53.5%)
Asthma	27 (7.2%)
Arthritis	165 (43.4%)
Malignancy	51 (13.5%)
Myocardial Infarction	61 (17.6%)
Stent	24 (6.9%)
Previous Cardiac Surgery	44 (12.6%)
Diabetes	196 (56.5%)
Hypertension	298 (85.9%)
Peripheral Vascular Disease	42 (12.1%)
Stroke	31 (8.9%)
Chronic Obstructive Pulmonary Disease	29 (8.4%)
Congestive Heart Failure	37 (10.7%)
Fall in Previous 12 Months	107 (28.2%)
Visual Impairment	151 (39.7%)
Hearing Impairment	78 (20.5%)
Depression	52 (13.7%)
Anxiety / Panic Attacks	47 (12.4%)
Urine ACR	48.5 (8.8 - 192.6)
Blood Glucose	6.4 (5.3 - 9.1)
Serum Albumin	36 (33 - 38)
AST (U/L)	18 (14 - 22)
ALT (U/L)	16 (12 - 22)
LDL (mmol/L)	1.9 (1.5 - 2.4)

HDL (mmol/L)	1.1 (0.9 - 1.4)
Triglycerides	1.7 (1.1 - 2.3)
eGFR (mL/min/1.73 m^2)	19 (14 - 25)
Creatinine (µmol/L)	260 (202 - 336)
Hemoglobin	115 (106 - 125)

Categorical variables expressed as N (%); continuous variables expressed as median (interquartile range)
Abbreviations: SPPB, short physical performance battery; ACR, albumin creatinine ratio; AST, aspartate aminotransferase; ALT, alanine aminotransferase; LDL, low density lipoprotein; HDL, high density lipoprotein; eGFR, estimated glomerular filtration rate

Table 3. Baseline characteristics of CKD cohort stratified byMoCA score

Variable	MoCA Score Grouping		P-Value
	0 – 24 (N=237)	25 – 30 (N=148)	
Age	**72 (61 - 80)**	**64 (54 - 73)**	**<0.0001**
Gender (Female)	94 (40.9%)	54 (37.0%)	0.4526
Weight (KG)	82.4 (72.5 - 95.2)	87 (73.1 - 99.7)	0.1843
Systolic Blood Pressure (mmHg)	137.5 (125 - 149)	137 (124 - 149)	0.6886
Diastolic Blood Pressure (mmHg)	73 (66 - 80)	77 (69 - 85)	0.0027
Total SPPB Score	9 (6 - 10)	10 (8 - 12)	<0.0001
Asthma	19 (8.3%)	8 (5.4%)	0.2827
Arthritis	101 (43.5%)	64 (43.2%)	0.9555
Malignancy	33 (14.2%)	18 (12.2%)	0.5822
Myocardial Infarction	36 (17.4%)	25 (17.9%)	0.9109
Stent	13 (6.3%)	11 (7.9%)	0.5701
Previous Cardiac Surgery	29 (13.9%)	15 (10.7%)	0.3743
Diabetes	123 (59.4%)	73 (52.1%)	0.1798
Hypertension	180 (87.0%)	118 (84.3%)	0.4834
Peripheral Vascular Disease	**32 (15.4%)**	**10 (7.1%)**	**0.0207**
Stroke	**27 (13.0%)**	**4 (2.9%)**	**0.0011**
Chronic Obstructive Pulmonary Disease	19 (9.2%)	10 (7.1%)	0.5014
Congestive Heart Failure	**28 (13.5%)**	**9 (6.4%)**	**0.0356**
Fall in Previous 12 Months	**75 (32.2%)**	**32 (21.9%)**	**0.0306**
Visual Impairment	97 (41.8%)	54 (36.5%)	0.3011
Hearing Impairment	46 (19.8%)	32 (21.6%)	0.6729
Depression	29 (12.5%)	23 (15.5%)	0.4004
Anxiety / Panic Attacks	32 (13.8%)	15 (10.1%)	0.2909
Urine ACR	49.2 (7.4 - 193)	47.7 (9.1 - 189.7)	0.9649
Blood Glucose	6.3 (5.3 - 9.6)	6.6 (5.4 - 9.1)	0.7883
Serum Albumin	36 (33 - 38.5)	36 (34 - 38)	0.3899
AST (U/L)	17 (14 - 21)	19 (15 - 24)	0.0196
ALT (U/L)	14 (11 - 19)	18 (12 - 24)	0.0015
LDL (mmol/L)	1.8 (1.5 - 2.4)	1.9 (1.5 - 2.5)	0.2889
HDL (mmol/L)	1.1 (0.9 - 1.4)	1.1 (0.9 - 1.4)	0.4374
Triglycerides	1.7 (1.1 - 2.3)	1.6 (1.1 - 2.3)	0.4716

eGFR (mL/min/1.73m^2)	19 (14 - 24)	20 (14.5 - 26)	0.2342
Creatinine (µmol/L)	261 (205 - 333)	256 (194 - 343)	0.8649
Hemoglobin	**114 (106 - 123)**	**118 (106 - 127)**	**0.0357**
Pulse Pressure	**65.5 (54.0 - 76.0)**	**60.0 (49.0 - 73.0)**	**0.0145**
Depression / Anxiety	50 (21.1%)	33 (22.3%)	0.7806

Categorical variables expressed as N (%); continuous variables expressed as median (interquartile range)
Abbreviations: SPPB, short physical performance battery; ACR, albumin creatinine ratio; AST, aspartate aminotransferase; ALT, alanine aminotransferase; LDL, low density lipoprotein; HDL, high density lipoprotein; eGFR, estimated glomerular filtration rate

Table 4: Performance on MoCA Scores: Normal Control vs Advanced CKD Population

MoCA Subtest	Normal Control (N=90)		Advanced CKD (N=385)		T-Test
	Mean	SD	Mean	SD	P-Value
Visual/Executive (/5)	4.23	0.87	3.52	1.36	<0.0001
Naming (/3)	2.88	0.36	2.70	0.58	0.0050
Attention (/6)	5.68	0.63	4.92	1.31	<0.0001
Language (/3)	2.70	0.50	2.02	0.98	<0.0001
Abstraction (/2)	1.83	0.43	1.26	0.79	<0.0001
Recall (/5)	3.73	1.27	2.07	1.71	<0.0001
Orientation (/6)	5.99	0.11	5.75	0.77	<0.0001
Total Score	27.37	2.20	22.75	4.36	<0.0001

Table 5. Variables associated with cognitive impairment defined as MoCA score ≤ 24

Variable	OR	95% CI	P-Value
Age	1.04	1.02 – 1.05	<0.001
Stroke	4.71	1.37 – 16.21	0.014
Fall in past 12 months	1.94	1.12 – 3.35	0.018

Area under ROC curve: 0.683 (0.624 – 0.742)
Model 2: Multiple logistic regression model with stepwise selection for all variables. Model 1 variables included age, pulse pressure, peripheral vascular disease, stroke, congestive heart failure, recent falls and hemoglobin
OR, odds ratio; CI, confidence interval

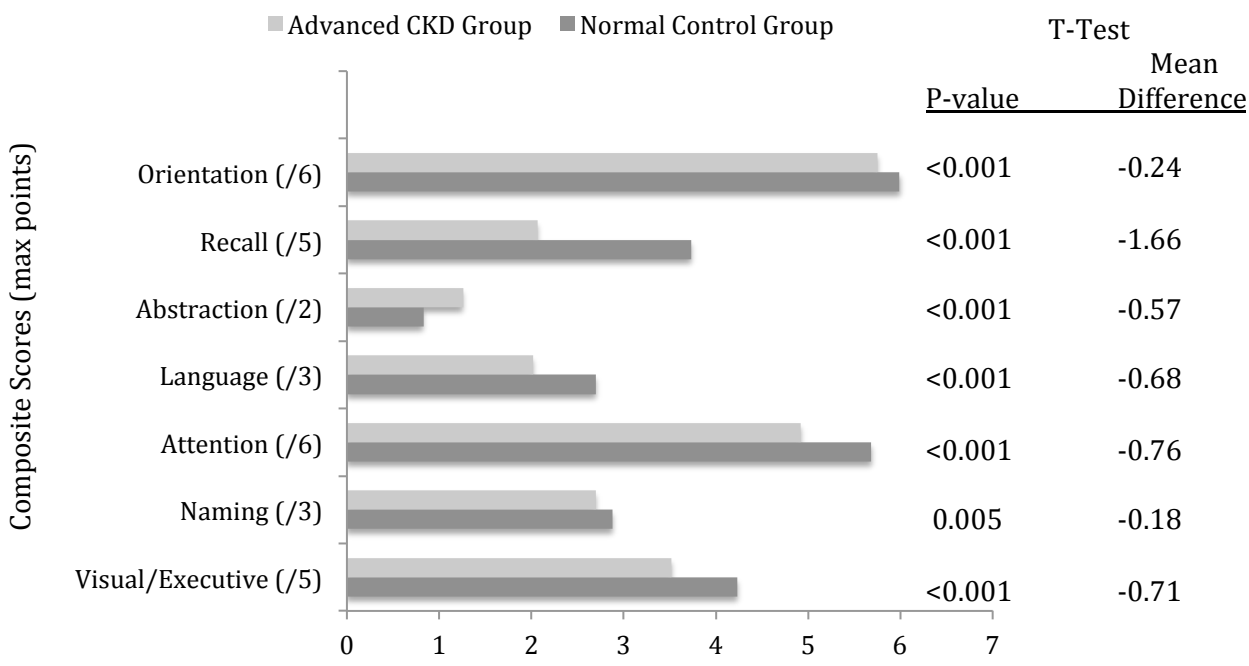

Figure 1. Group differences in cognitive domains of the Montreal Cognitive Assessment.
Bar graph shows the average scores of each group for the cognitive domains of the MoCA. Orientatation: temp oral and spatial; Recall: 5-item delayed recall; Abstraction: verbal abstraction; Language: sentance repitition, phonemic fluency; Attention: digit span forwards and backwards, sustained attention, serial subttraction, Naming: uncommon animals; Visual/Executive: Trail Making B task, cube and clock drawing