



# SENSITIVITY AND SPECIFICITY OF THE MMSE AND MoCA IN SCREENING FOR MILD AND SEVERE COGNITIVE IMPAIRMENT RELATED TO DEMENTIA



Katie McCulloch, M.A.<sup>1, 2</sup> & Robert L. Collins, Ph.D. ABPP-CN<sup>1, 3</sup>

<sup>1</sup>Michael E. DeBakey Veteran's Affairs Medical Center, <sup>2</sup>University of Houston, <sup>3</sup>Baylor College of Medicine

### Introduction

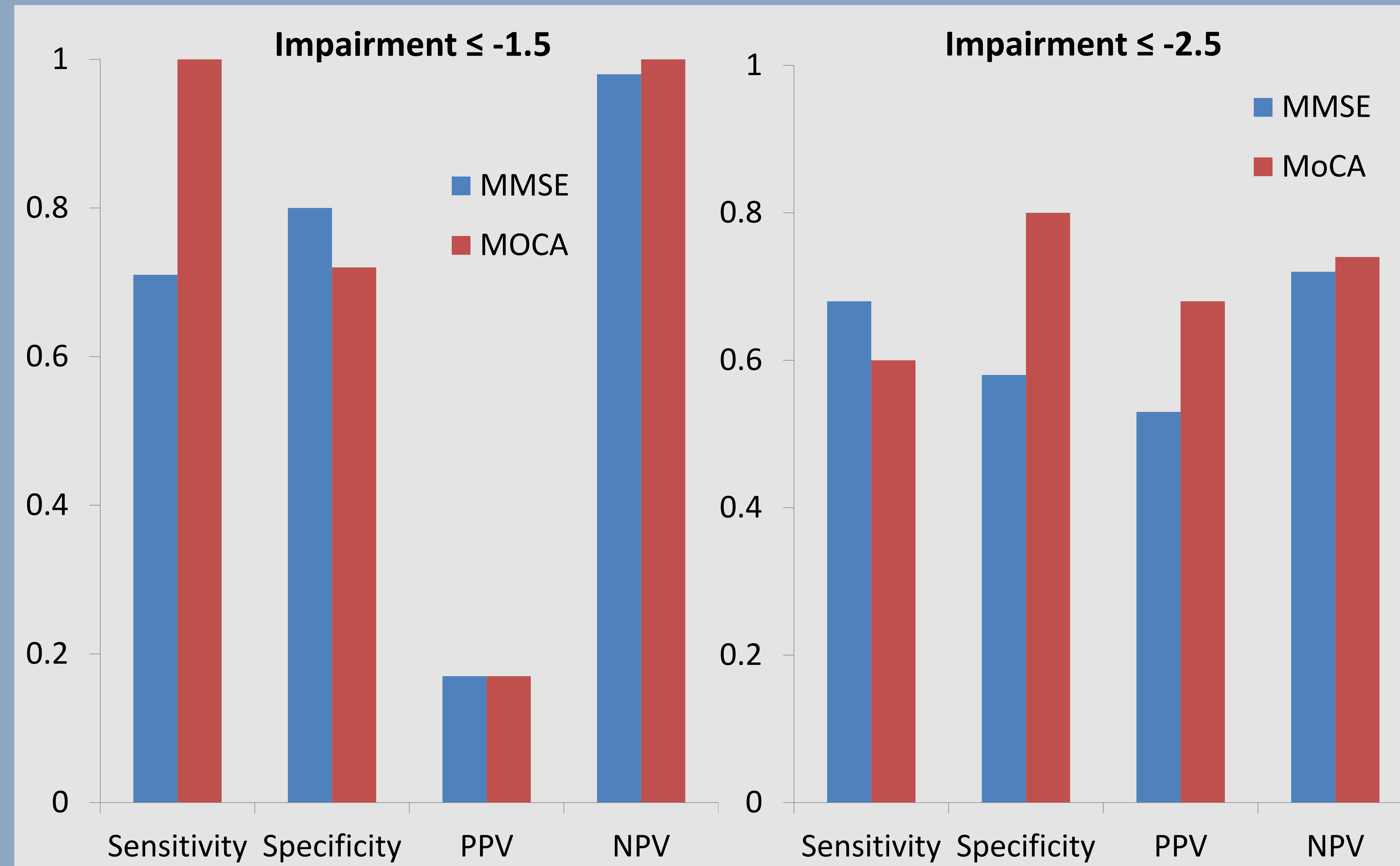
The Mini-Mental Status Examination (MMSE), developed by Folstein, Folstein and McHugh (1975), is a frequently utilized cognitive screening measure for detecting Alzheimer's disease and related dementias (ADRD). The Montreal Cognitive Assessment (MoCA) was developed in an attempt to increase detection of milder symptoms of ADRD (Nasreddine et al., 2005). The goal of the present study was to determine which cognitive screener has greater diagnostic utility within a clinical sample.

### Methods

- 167 Veterans referred by Neurological services completed an MMSE and MoCA.
- Participants ( $n=49$ ) had been removed for suboptimal effort, as demonstrated on the Word Memory Test ( $<82.5$ ), the Test of Memory Malingering ( $<45$ ), or the California Verbal Learning Test-II Forced Choice ( $<14$ ).
- Sensitivity (SE), specificity (SP), negative predictive value (NPV), and positive predictive values (PPV) were calculated at each level of screener cut-off.
- Neuropsychological testing, as the "gold standard", was set to at multiple levels of impairment:  $\leq -1.5$  SD on at least two cognitive domains and  $\leq -2.5$  SD on at least two cognitive domains.
- At  $-1.5SD$ , the base rate of impairment was 41% and at  $-2.5SD$  the base rate was 5%.

### Results and Conclusions

- The optimal cut-off for the MMSE was  $<28$  for  $-1.5SD$  ( $SE=0.68$ ,  $SP=0.58$ ,  $PPV=0.53$ ,  $NPV=0.72$ ) and  $<26$  for  $-2.5SD$  impairment ( $SE=0.71$ ,  $SP=0.80$ ,  $PPV=0.17$ ,  $NPV=0.98$ ).
- For the MoCA, the optimal cut-off was  $<22$  for  $-1.5SD$  ( $SE=0.60$ ,  $SP=0.80$ ,  $PPV=0.68$ ,  $NPV=0.74$ ) and  $<21$  for  $-2.5SD$  ( $SE=1$ ,  $SP=0.72$ ,  $PPV=0.17$ ,  $NPV=1$ ).
- The optimal cut for each cognitive screener is dependent on the severity of cognitive impairment being screened.
- At milder levels of impairment, the MoCA has greater sensitivity, whereas the MMSE has favorable specificity. However, when detecting more severe levels of impairment, the MMSE has superior sensitivity while the MoCA has relatively greater specificity.



### MMSE – Impairment $\leq -1.5SD$

Cut (<)	Sensitivity	Specificity	PPV	NPV
30	0.94	0.20	0.45	0.82
29	0.79	0.42	0.49	0.74
28	0.68	0.58	0.53	0.72
27	0.43	0.78	0.58	0.66
26	0.35	0.87	0.65	0.65
25	0.27	0.93	0.74	0.64
24	0.17	0.97	0.79	0.62
23	0.14	0.98	0.82	0.62
22	0.10	0.99	0.86	0.61
21	0.05	0.99	0.75	0.60
20	0.05	0.99	0.75	0.60
19	0.05	0.99	0.75	0.60
18	0.02	1.00	1.00	0.59
17	0.02	1.00	1.00	0.59
16	0	1.00	1.00	0.59

### MMSE – Impairment $\leq -2.5SD$

Cut (<)	Sensitivity	Specificity	PPV	NPV
30	1.00	0.15	0.06	1.00
29	1.00	0.35	0.08	1.00
28	0.71	0.48	0.07	0.97
27	0.71	0.71	0.12	0.98
26	0.71	0.80	0.17	0.98
25	0.29	0.86	0.10	0.95
24	0.29	0.92	0.17	0.96
23	0.14	0.93	0.11	0.95
22	0.14	0.96	0.17	0.95
21	0.14	0.98	0.28	0.95
20	0.14	0.98	0.28	0.95
19	0.14	0.98	0.28	0.95
18	0	0.99	0	0.95
17	0	0.99	0	0.95
16	0	1.00	0	0.95

### MoCA – Impairment $\leq -1.5SD$

Cut (<)	Sensitivity	Specificity	PPV	NPV
30	1.00	0.02	0.42	1.00
29	1.00	0.05	0.42	1.00
28	1.00	0.12	0.44	1.00
27	0.95	0.26	0.47	0.87
26	0.89	0.36	0.50	0.83
25	0.78	0.44	0.50	0.74
24	0.73	0.61	0.57	0.76
23	0.60	0.70	0.58	0.71
22	0.60	0.80	0.68	0.74
21	0.51	0.85	0.70	0.71
20	0.35	0.89	0.70	0.66
19	0.29	0.91	0.69	0.65
18	0.24	0.94	0.72	0.64
17	0.18	0.95	0.74	0.62
16	0.12	0.97	0.75	0.61
15	0.11	1.00	1.00	0.61
14	0.07	1.00	1.00	0.61
13	0.07	1.00	1.00	0.61
12	0.05	1.00	1.00	0.60
11	0.05	1.00	1.00	0.60
10	0.05	1.00	1.00	0.60
9	0	1.00	1.00	0.59

### MoCA – Impairment $\leq -2.5SD$

Cut (<)	Sensitivity	Specificity	PPV	NPV
30	1.00	0.01	0.05	1.00
29	1.00	0.03	0.06	1.00
28	1.00	0.07	0.06	1.00
27	1.00	0.17	0.06	1.00
26	1.00	0.26	0.07	1.00
25	1.00	0.36	0.08	1.00
24	1.00	0.48	0.10	1.00
23	1.00	0.59	0.12	1.00
22	1.00	0.65	0.14	1.00
21	1.00	0.72	0.17	1.00
20	0.67	0.81	0.17	0.98
19	0.67	0.84	0.20	0.98
18	0.50	0.88	0.19	0.97
17	0.50	0.91	0.25	0.97
16	0.50	0.95	0.35	0.97
15	0.50	0.97	0.52	0.97
14	0.50	0.99	0.77	0.97
13	0.50	0.99	0.77	0.97
12	0.33	0.99	0.69	0.96
11	0.33	0.99	0.69	0.96
10	0.33	0.99	0.69	0.96
9	0	1.00	1.00	0.95