Summary of Christie Gardens data collection so far (June 12, 2018)
52 collected – 50 full datasets, 51 usable datasets
42 F, 9 M
-one participant only completed 7 CBS tasks, one participant with dementia only complete 2 tasks

	age	MoCA	MMSE	DT	OOO	SP	GR	DS	TS	PA	SS	FM	R	P	ML
min	62	12	16	-7	3	1	-1	0	0	2	0	2	-11	-5	0
max	97	30	30	39	19	30	22	7	10	6	7	110	98	66	8
mean	80.7	24.6	27.8	9.4	11.4	12.4	10.4	4.8	5.8	3.5	4.3	68.3	32.4	17.7	5.7
SD	8.8	4.0	2.8	11.9	3.5	7.1	5.9	1.8	1.8	0.9	1.2	25.6	26.1	16.8	1.8

Replication of Brenkel et al 2017
First, I split the participants into three groups based on their MoCA scores:

- Unimpaired: 27-30 (17 participants)
- Borderline: 23-26 (21 participants)
- Impaired: <22 (12 participants)

Second, I looked into further categorizing the borderline group based on their scores in each CBS task. I calculated the mean score for the Impaired and Unimpaired groups and compared each borderline score against those means. This comparison allowed me to determine whether, based on that task alone, the borderline participant could be categorized into the impaired or unimpaired groups.
Some tasks were more useful for further categorizing the borderline groups than others.

	OOO	DS	SS	GR	FM	ML	P	R	TS	DT	PA	SP
% left in Borderline	0.71 (15)	0.71	0.71	0.67	0.67	0.57	0.52	0.48	0.43	0.38 (8)	0.33 (7)	0.24 (5)
% moved to Unimpaired	0.14	0.10	0	0.10	0.10	0.19	0.14	0.14	0.10	0.14	0	0.14
% moved to Impaired	0.14	0.19	0.29	0.24	0.24	0.24	0.33	0.38	0.48	0.48	0.67	0.62

Brenkel et al, 2017
individually (one test at a time)

- OOO and DT categorized borderline participants best (sig t tests between impaired and unimpaired groups)
- PA and FM categorized borderline participants worst (PA was deemed too difficult for older adults)
- SP – no differences between three categories of participants

Using Brenkel et al method:
MoCA, on it's own, categorizes 59% of participants

Individually (one test at a time)

- SP, PA, DT were the top three at categorizing borderline participants
  90% 86% 85% of total participants (51) categorized
- OOO, DS, SS were the worst three at categorizing borderline participants
  70% 70% 70% of total participants (51) categorized

Which combination of tests best categorizes borderline participants? (i.e. using more than one test – categorizing in the same direction)

- SP & PA together leave the fewest participants in the borderline condition
  80% of total participants (51) categorized
- These two tests do better on their own

Which combination of tests best categorizes ALL participants (i.e. set cut offs, but then recategorize all)

- DT & SP; SP & TS; TS & PA were equally successful
  37% of total participants (51) categorized (**worse than MoCA on its own)**

T-tests: impaired vs unimpaired

Welch Two Sample t-test – takes into account variance within the groups (changes df)

Double Trouble	t(23)=-3.98,p<0.001
Odd One Out	t(17)=-5.08, p<0.001
Spatial Planning	t(24)=-2.64, p=0.014
Grammatical Reasoning	t(19)=-4.34, p<0.001
Digit span	t(13)=-4.53, p<0.001
Token Search	t(14)=-2.72, p=0.017
Paired Associates	t(21)=-4.51, p<0.001
Spatial Span	t(19)=-3.73, p=0.001
Feature Match	t(15)=-5.52, p<0.001
Rotations	t(24)=-3.17, p=0.004
Polygons	t(26)=-2.56, p=0.017
Monkey Ladder	t(14)=-3.79, p=0.002

Third, I looked into whether I could perform the same analysis on the MMSE scores.
I could not.
When the scores were divided up according the MMSE guidelines I was left with very uneven groups

- No cognitive impairment 24-30 (48 participants)
- Mild cognitive impairment 18-23 (2 participants)
- Severe cognitive impairment <17 (1 participant)

Regression analysis
In R, I performed a step-wise multiple regression analysis to determine which combination of CBS tasks best predicted both MoCA and MMSE scores.

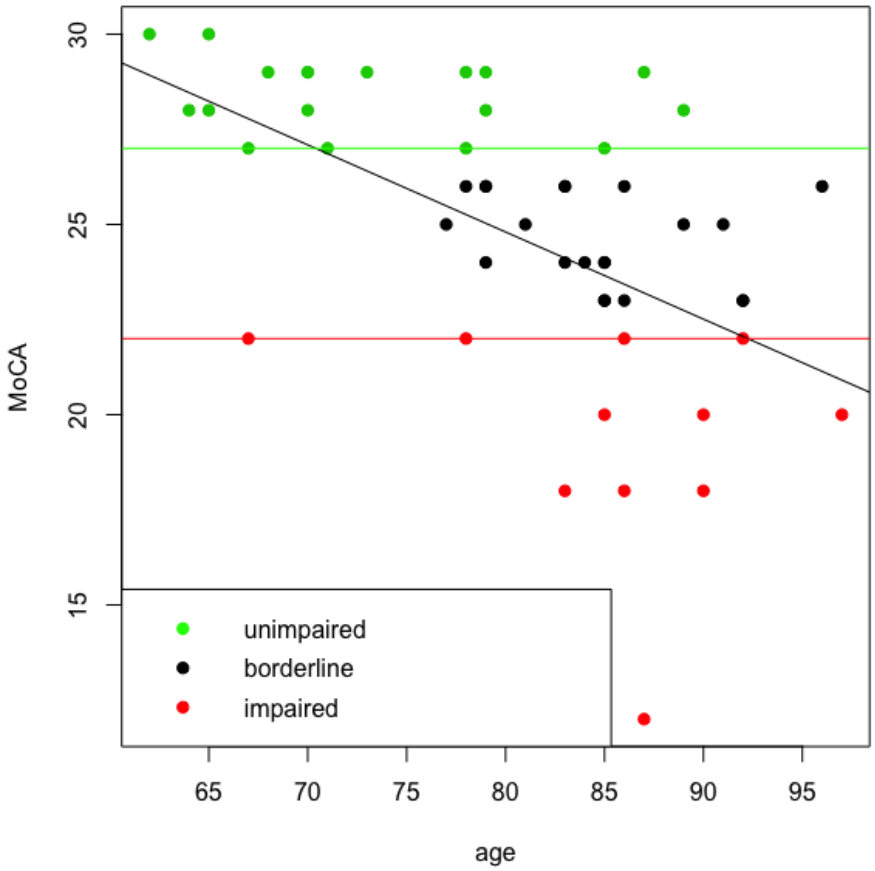
MoCA
MoCA scores are best predicted by: Feature Match and Odd One Out
Adjusted R^2 = 0.6483 = 0.65
Age was included as a factor and predicts 22% of the variance in MoCA scores (adjusted R^2 = 0.2216) on its own

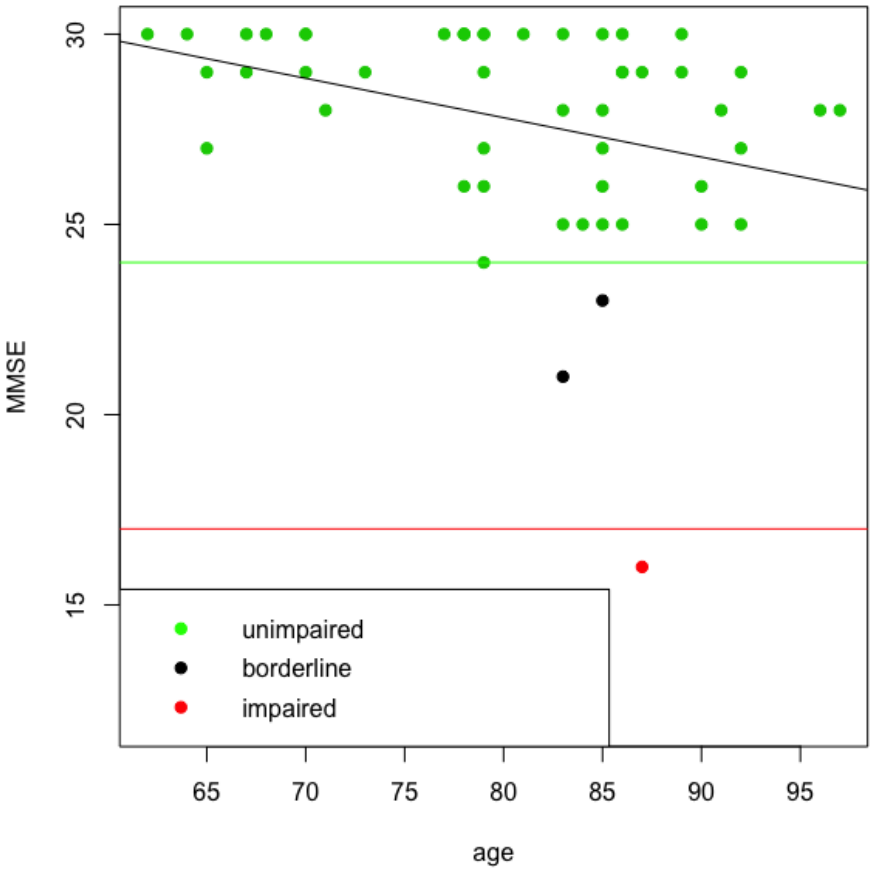
MMSE
MMSE scores are best predicted by: Grammatical Reasoning and Feature match
Adjusted R^2 = 0.3796 = 0.38
Age was included as a factor and predicts 8% of the variance in MMSE scores (adjusted R^2 = 0.0799) on its own

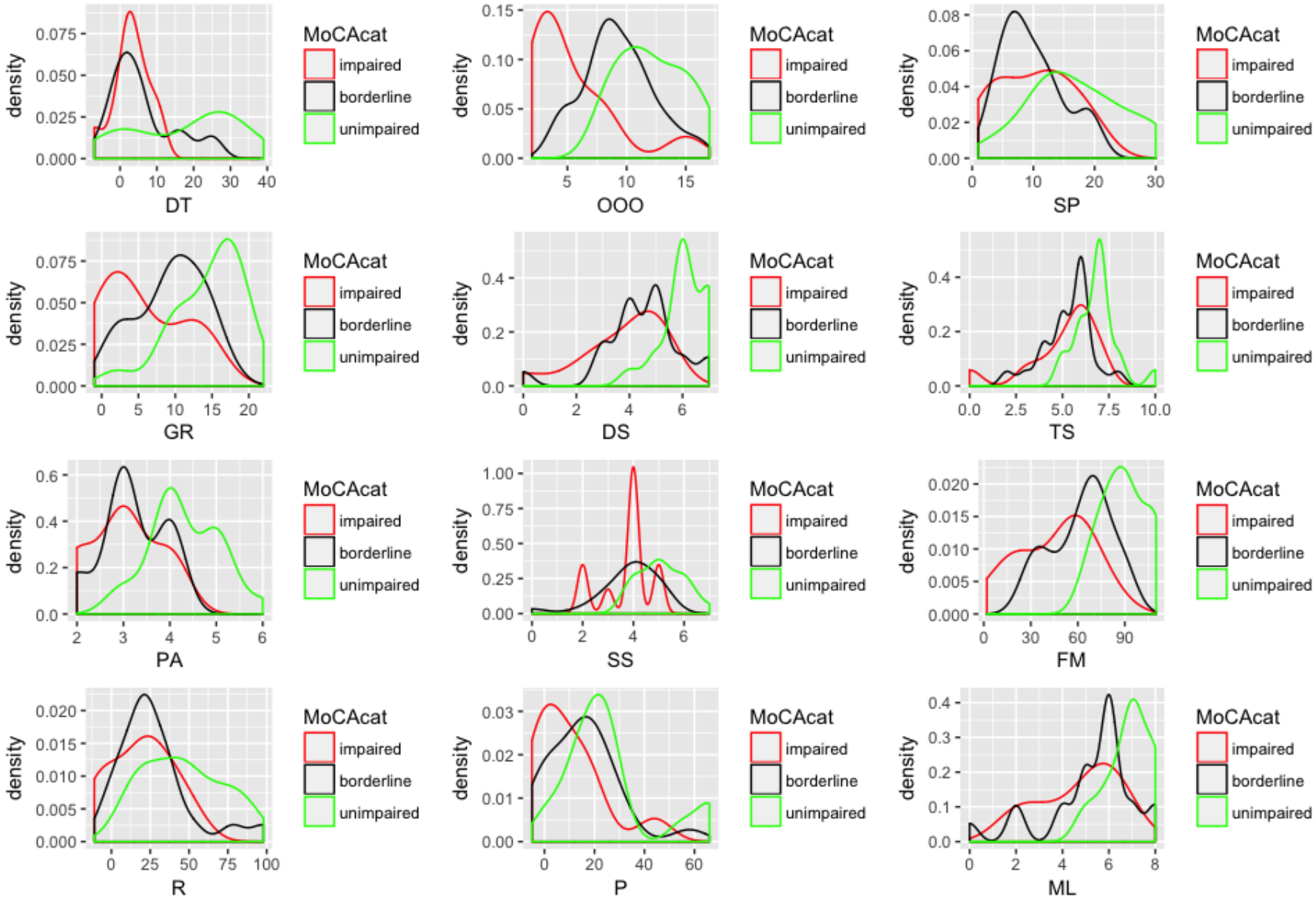
Conclusion:

- Using the MoCA and one additional test (Spatial Planning) 90% of participants can be categorized (more than 59% - MoCA on its own)
- Feature Match and Odd One Out best predict MoCA scores
- A MoCA ‘replacement’ test including only CBS tests would be a 3 test battery: FM, OO, and SP

Plots showing the relationship between MoCA/MMSE scores and age
The horizontal lines indicate the category cutoffs
The black line is the trend line






density
DT
OOO
SP
GR
DS
TS
PA
SS
FM
R
P
ML
MoCAcat
impaired
borderline
unimpaired