

# UAE Cognitive Function Paper 2

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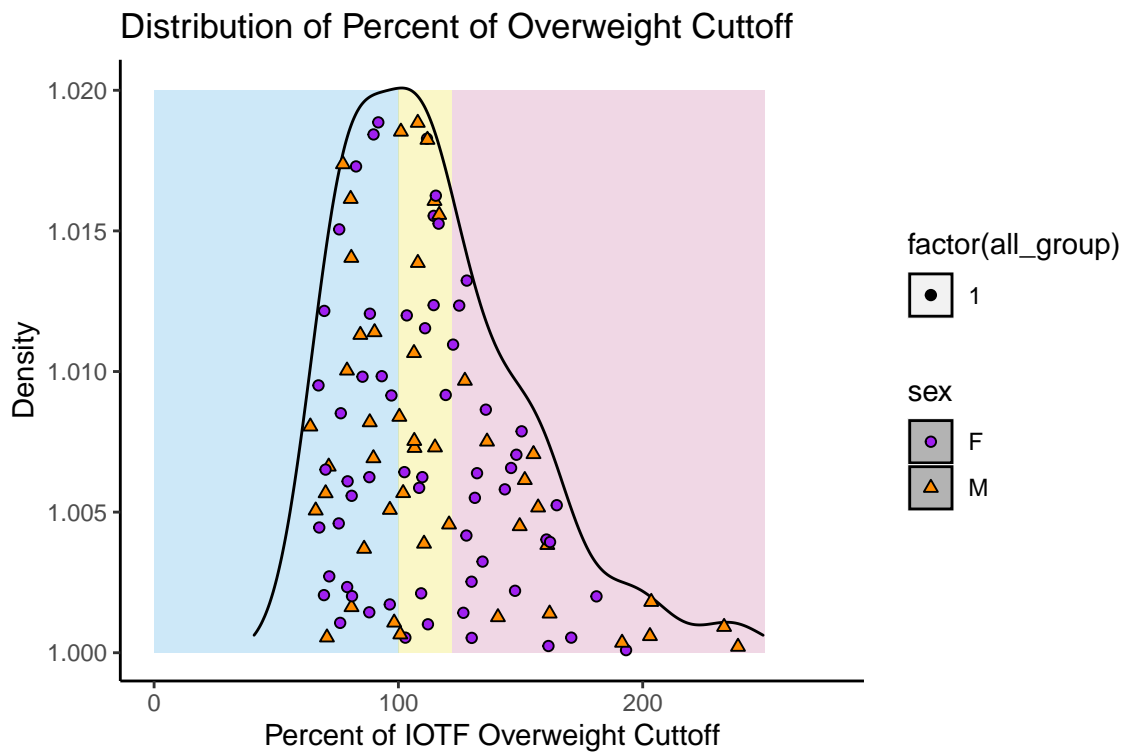
# 1 Measurement of Weight Status

We decided to use the International Obesity Task Force (IOTF) designation of weight status for the sample. They use smoothed, sex-specific BMI curves meant to match the the BMI cutoffs for overweight (OW;  $25 \text{ kg/m}^2$ ) and obesity (OB;  $30 \text{ kg/m}^2$ ) at age 18 yrs.

Rather than BMI-zscore or BMI-percentile, we chose to use percent of overweight cutoff because recent studies shows it has a tighter association with measured adiposity:

$$\text{BMI \% of overweight} = \frac{\text{childBMI}}{\text{BMI at age- and sex- adjusted overweight cutoff}} * 100$$

<100 % - indicates child BMI is below the overweight cutoff for age and sex (i.e., has healthy weight) 100 % - indicates child BMI is the same as the overweight cutoff for age and sex >100 % - indicates child BMI is above the overweight cutoff for age and sex (i.e., has overweight or obesity)



Density plot of percent of overweight by sex. The shaded regions indicated those with healthy weight (blue), overweight (yellow), and obesity (red). The points show density of participants by sex (purple circles = female, orange triangles = males).

## 2 Participant Characteristics

Table 1: Demographic Characteristics by Sex

Characteristic	All		Sex		
	N	N = 107	N	F, N = 61	M, N = 46
sex	107				
F		61 (57%)			
M		46 (43%)			
Age_yr	107	12.75 [7.31 - 17.84]	107	12.79 [7.31 - 17.84]	12.70 [8.04 - 17.54]
BMI	107	25.22 [12.71 - 55.52]	107	24.85 [12.71 - 47.60]	25.70 [13.60 - 55.52]
pOW	107	114.58 [63.95 - 239.00]	107	112.22 [67.29 - 193.18]	117.71 [63.95 - 239.00]
Father_ed	106	12.71 [0.00 - 18.00]	106	12.91 [0.00 - 18.00]	12.44 [6.00 - 18.00]
Unknown		1		0	1
Mother_ed	103	13.09 [0.00 - 18.00]	103	13.00 [3.00 - 18.00]	13.21 [0.00 - 18.00]
Unknown		4		1	3
Month_AED	103		103		
<25,000 AED		33 (32%)		17 (29%)	16 (36%)
25,000 - 55,000 AED		55 (53%)		33 (56%)	22 (50%)
55,000 - 75,000 AED		6 (5.8%)		4 (6.8%)	2 (4.5%)
> 75,000 AED		9 (8.7%)		5 (8.5%)	4 (9.1%)
Unknown		4		2	2
DadNationality	101		101		
Emirati		98 (97%)		58 (97%)	40 (98%)
Omani		1 (1.0%)		1 (1.7%)	0 (0%)
Yemeni		2 (2.0%)		1 (1.7%)	1 (2.4%)
Unknown		6		1	5
MomNationality	104		104		
Emirati		96 (92%)		55 (92%)	41 (93%)
Omani		1 (1.0%)		1 (1.7%)	0 (0%)
Yemeni		1 (1.0%)		0 (0%)	1 (2.3%)
Moroccan		2 (1.9%)		2 (3.3%)	0 (0%)
Egyptian		3 (2.9%)		2 (3.3%)	1 (2.3%)
Bahrani		1 (1.0%)		0 (0%)	1 (2.3%)
Unknown		3		1	2

<sup>1</sup> n (%); Mean [Range]

<sup>2</sup> Mean [Range]; n (%)

Table 2: Demographic Characteristics by Weight Status

Characteristic	N	HW	OW	OB	ANOVA	chi/fisher
sex	107					0.5111
F		24 (59%)	14 (48%)	23 (62%)		
M		17 (41%)	15 (52%)	14 (38%)		
Age_yr	107	11.85 [8.02 - 17.37]	12.84 [8.15 - 17.54]	13.69 [7.31 - 17.84]	0.01	
BMI	107	17.15 [12.71 - 22.72]	24.03 [18.70 - 28.86]	35.08 [21.87 - 55.52]	0	
pOW	107	80.86 [63.95 - 98.26]	109.66 [100.39 - 120.73]	155.80 [122.38 - 239.00]	0	
Father_ed	106	12.68 [6.00 - 18.00]	13.60 [6.00 - 18.00]	12.03 [0.00 - 18.00]	0.2014	
Unknown		0	0	1		
Mother_ed	103	13.28 [3.00 - 18.00]	13.93 [9.00 - 18.00]	12.25 [0.00 - 18.00]	0.1278	
Unknown		1	2	1		
Month_AED	103					0.8264
<25,000 AED		11 (28%)	10 (34%)	12 (35%)		
25,000 - 55,000 AED		23 (57%)	13 (45%)	19 (56%)		
55,000 - 75,000 AED		2 (5.0%)	3 (10%)	1 (2.9%)		
> 75,000 AED		4 (10%)	3 (10%)	2 (5.9%)		
Unknown		1	0	3		
DadNationality	101					0.0953
Emirati		40 (100%)	25 (96%)	33 (94%)		
Omani		0 (0%)	1 (3.8%)	0 (0%)		
Yemeni		0 (0%)	0 (0%)	2 (5.7%)		
Unknown		1	3	2		
MomNationality	104					0.6488
Emirati		38 (93%)	26 (93%)	32 (91%)		
Omani		0 (0%)	1 (3.6%)	0 (0%)		
Yemeni		0 (0%)	0 (0%)	1 (2.9%)		
Moroccan		1 (2.4%)	0 (0%)	1 (2.9%)		
Egyptian		2 (4.9%)	0 (0%)	1 (2.9%)		
Bahrani		0 (0%)	1 (3.6%)	0 (0%)		
Unknown		0	1	2		

<sup>1</sup> n (%); Mean [Range]

## 2.1 Associations between Demographics and Percent of Overweight Cutoff

### 2.1.1 t-test for sex

Welch Two Sample t-test

```
data:  pOW by sex
t = -0.72449, df = 78.92, p-value = 0.4709
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -20.558399  9.586342
sample estimates:
mean in group F mean in group M
      112.2213      117.7073
```

### 2.1.2 Correlation Matrix

Table 3: Correlations between percent of overweight cutoff and demographic characteristics

	Age_yr	Father_ed	Mother_ed	pOW
Age_yr				
Father_ed	0.03			
Mother_ed	-0.14	0.53*		
pOW	0.26*	-0.06	-0.14	

Table 4: P-values for the correlations between percent of overweight cutoff and demographic characteristics

	Age_yr	Father_ed	Mother_ed	pOW
Age_yr				
Father_ed	0.795			
Mother_ed	0.15	0		
pOW	0.006	0.544	0.154	

Only child age was associated with percent of overweight cutoff - older children tended to have higher percent of overweight cutoff indicating older children were more likely to have overweight or obesity. There was no association with father or mother education level, which differs from finding in the US. Hip to waist ratio was also not associated with percent of overweight cutoff.

### 2.1.3 One-Way ANOVA for Income Categories

Anova Table (Type III tests)

```
Response: pOW
      Sum Sq Df F value Pr(>F)
(Intercept) 424771  1 298.8582 <2e-16 ***
Month_AED    932  3  0.2185 0.8833
```

Residuals 140710 99

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

There was no difference in percent of overweight by monthly income category.

#### 2.1.4 Sensitivity Tests

Table 5: Linear Model: pOWcutoff - SES category + Maternal Education + Age + Sex

	b	se	t	p	
(Intercept)	76.737	25.597	2.998	0.003	**
Month_AED25,000 - 55,000 AED	9.493	8.401	1.130	0.261	
Month_AED55,000 - 75,000 AED	19.745	16.570	1.192	0.236	
Month_AED> 75,000 AED	3.696	15.678	0.236	0.814	
Mother_ed	-1.826	1.220	-1.497	0.138	
Age_yr	3.934	1.363	2.887	0.005	**
sexM	10.466	7.425	1.409	0.162	

After controlling for family income, mother education, and child sex, child age was significantly associated with percent of overweight such that for each year older, the expected percent of overweight is predicted to increase 4.24% points.

### 3 Neuropsychological Assessments

Table 6: Neuropsychological Performance by Sex Status

Characteristic	All		Sex			ANOVA
	N	N = 107	N	F	M	
WASI-Block, T	107	45.04 (8.75) [22.00 - 75.00]	107	46.00 (7.98) [28.00 - 70.00]	43.76 (9.62) [22.00 - 75.00]	0.1914
WASI-Matrix, T	107	46.05 (9.56) [23.00 - 75.00]	107	47.69 (8.81) [25.00 - 67.00]	43.87 (10.17) [23.00 - 75.00]	0.0403
WASI-PRI, T	107	90.23 (15.55) [49.00 - 130.00]	107	93.36 (13.87) [53.00 - 128.00]	86.09 (16.80) [49.00 - 130.00]	0.0159
WASI-PRI, IQ	107	91.72 (12.94) [56.00 - 126.00]	107	94.30 (11.53) [60.00 - 124.00]	88.30 (14.01) [56.00 - 126.00]	0.017
Digit Forward, raw	107	8.62 (2.12) [4.00 - 15.00]	107	8.69 (2.27) [5.00 - 15.00]	8.52 (1.92) [4.00 - 12.00]	0.6887
Digit Forward, SS	107	9.24 (2.85) [2.00 - 16.00]	107	9.38 (2.82) [4.00 - 16.00]	9.07 (2.92) [2.00 - 15.00]	0.5783
Digit Backward, raw	107	6.24 (1.68) [3.00 - 11.00]	107	6.51 (1.86) [3.00 - 11.00]	5.89 (1.35) [4.00 - 10.00]	0.0599
Digit Backward, SS	107	8.17 (2.85) [3.00 - 16.00]	107	8.61 (2.94) [3.00 - 15.00]	7.59 (2.65) [3.00 - 16.00]	0.067
Digit Total, raw	107	14.87 (3.09) [8.00 - 23.00]	107	15.21 (3.44) [8.00 - 23.00]	14.41 (2.53) [9.00 - 21.00]	0.1866
Digit Total, SS	107	9.72 (2.86) [4.00 - 18.00]	107	10.03 (2.89) [4.00 - 16.00]	9.30 (2.81) [4.00 - 18.00]	0.1942
Coding, raw	107	44.84 (13.98) [14.00 - 80.00]	107	46.82 (13.75) [18.00 - 75.00]	42.22 (14.01) [14.00 - 80.00]	0.092
Digit Total, SS	107	7.35 (3.43) [1.00 - 19.00]	107	7.72 (2.99) [1.00 - 19.00]	6.85 (3.91) [1.00 - 17.00]	0.193

<sup>1</sup> Mean (SD) [Range]

Percent of overweight and height:weight ratio were not associated with any of the neuropsychological assessments. Number of comorbidities was associated with total digit span SS such that the higher number of comorbidities the lower the standard score.

Table 7: Neuropsychological Performance by Weight Status

Characteristic	N	HW	OW	OB	ANOVA
WASI-Block, T	107	45.10 (9.17) [22.00 - 75.00]	46.90 (8.17) [30.00 - 63.00]	43.51 (8.66) [27.00 - 64.00]	0.2989
WASI-Matrix, T	107	45.59 (9.75) [23.00 - 63.00]	46.66 (9.01) [28.00 - 67.00]	46.08 (10.00) [25.00 - 75.00]	0.9006
WASI-PRI, T	107	89.15 (16.06) [49.00 - 130.00]	92.76 (14.78) [58.00 - 121.00]	89.46 (15.76) [53.00 - 124.00]	0.5939
WASI-PRI, IQ	107	90.85 (13.47) [56.00 - 126.00]	93.79 (12.27) [65.00 - 118.00]	91.05 (13.01) [60.00 - 120.00]	0.6029
Digit Forward, raw	107	8.24 (1.88) [5.00 - 13.00]	8.45 (2.21) [4.00 - 13.00]	9.16 (2.23) [5.00 - 15.00]	0.1417
Digit Forward, SS	107	9.05 (2.57) [4.00 - 15.00]	9.07 (3.20) [2.00 - 14.00]	9.59 (2.92) [4.00 - 16.00]	0.655
Digit Backward, raw	107	6.12 (1.60) [4.00 - 10.00]	6.52 (1.86) [4.00 - 11.00]	6.16 (1.64) [3.00 - 11.00]	0.5902
Digit Backward, SS	107	8.27 (2.89) [3.00 - 15.00]	8.55 (3.01) [3.00 - 16.00]	7.76 (2.71) [3.00 - 14.00]	0.5151
Digit Total, raw	107	14.39 (2.85) [9.00 - 23.00]	14.97 (3.63) [9.00 - 23.00]	15.32 (2.90) [8.00 - 22.00]	0.4079
Digit Total, SS	107	9.78 (2.84) [4.00 - 16.00]	9.76 (3.35) [4.00 - 18.00]	9.62 (2.54) [4.00 - 15.00]	0.9676
Coding, raw	107	41.83 (14.27) [14.00 - 69.00]	45.93 (14.20) [23.00 - 80.00]	47.32 (13.23) [18.00 - 75.00]	0.1986
Digit Total, SS	107	7.83 (3.37) [1.00 - 17.00]	7.55 (3.43) [1.00 - 17.00]	6.65 (3.47) [1.00 - 19.00]	0.2959

<sup>1</sup> Mean (SD) [Range]

Performance on neuropsychological assessments did not differ by weight status. There were 5 people who had Performance IQ < 70 so all results are presented with and without those 5. Likely the PRI < 70 was due in part to attention/engagement and may not accurately reflect PRI.



### 3.1 Correlation Matrix

Table 8: Correlations between neuropsychological performance and percent of overweight

	blockT	matrixT	PRI	ds_fSS	ds_bSS	ds_SS	codingSS	age	pOW	hw_ratio	nComorbid
blockT											
matrixT	0.39*										
PRI	0.82*	0.83*									
ds_fSS	-0.03	0.15	0.07								
ds_bSS	0.15	0.16	0.21*	0.27*							
ds_SS	0.1	0.25*	0.21*	0.75*	0.74*						
codingSS	0.34*	0.26*	0.33*	0.11	0.23*	0.32*					
age	-0.13	0.06	-0.05	0.03	-0.33*	-0.22*	-0.25*				
pOW	-0.06	0	0	0.03	-0.16	-0.1	-0.15	0.26*			
hw_ratio	-0.02	0.1	0.06	-0.05	-0.01	-0.05	0.11	0.19	0.02		
nComorbid	-0.12	-0.02	-0.05	-0.15	-0.16	-0.21*	-0.12	0.02	0.05	0.16	

Table 9: Correlation p values between neuropsychological performance and percent of overweight

	blockT	matrixT	PRI	ds_fSS	ds_bSS	ds_SS	codingSS	age	pOW	hw_ratio	nComorbid
blockT											
matrixT	0										
PRI	0	0									
ds_fSS	0.76	0.113	0.446								
ds_bSS	0.112	0.096	0.032	0.005							
ds_SS	0.299	0.01	0.033	0	0						
codingSS	0	0.007	0.001	0.277	0.018	0.001					
age	0.176	0.529	0.597	0.755	0.001	0.02	0.008				
pOW	0.561	0.983	0.998	0.768	0.106	0.287	0.135	0.006			
hw_ratio	0.877	0.351	0.582	0.635	0.923	0.672	0.328	0.094	0.835		
nComorbid	0.238	0.868	0.584	0.128	0.093	0.031	0.211	0.82	0.62	0.143	

Percent of overweight and height:weight ratio were not associated with any of the neuropsychological assessments. Number of comorbidities was associated with total digit span SS such that the higher number of comorbidities the lower the standard score.

### 3.2 Correlation Matrix - IQ $\geq$ 70

Table 10: Correlations between neuropsychological performance and percent of overweight

	blockT	matrixT	PRI	ds_fSS	ds_bSS	ds_SS	codingSS	age	pOW	hw_ratio	nComorbid
blockT											
matrixT	0.27*										
PRI	0.78*	0.8*									
ds_fSS	-0.03	0.19	0.1								
ds_bSS	0.09	0.09	0.13	0.28*							
ds_SS	0.07	0.24*	0.19	0.75*	0.74*						
codingSS	0.32*	0.26*	0.32*	0.1	0.23*	0.32*					
age	-0.03	0.17	0.09	0.05	-0.3*	-0.2*	-0.23*				
pOW	-0.11	-0.03	-0.05	0.03	-0.19	-0.12	-0.16	0.3*			
hw_ratio	-0.03	0.1	0.06	-0.05	-0.02	-0.05	0.11	0.19	0.02		
nComorbid	-0.22*	-0.09	-0.17	-0.15	-0.21*	-0.24*	-0.16	0.06	0.03	0.16	

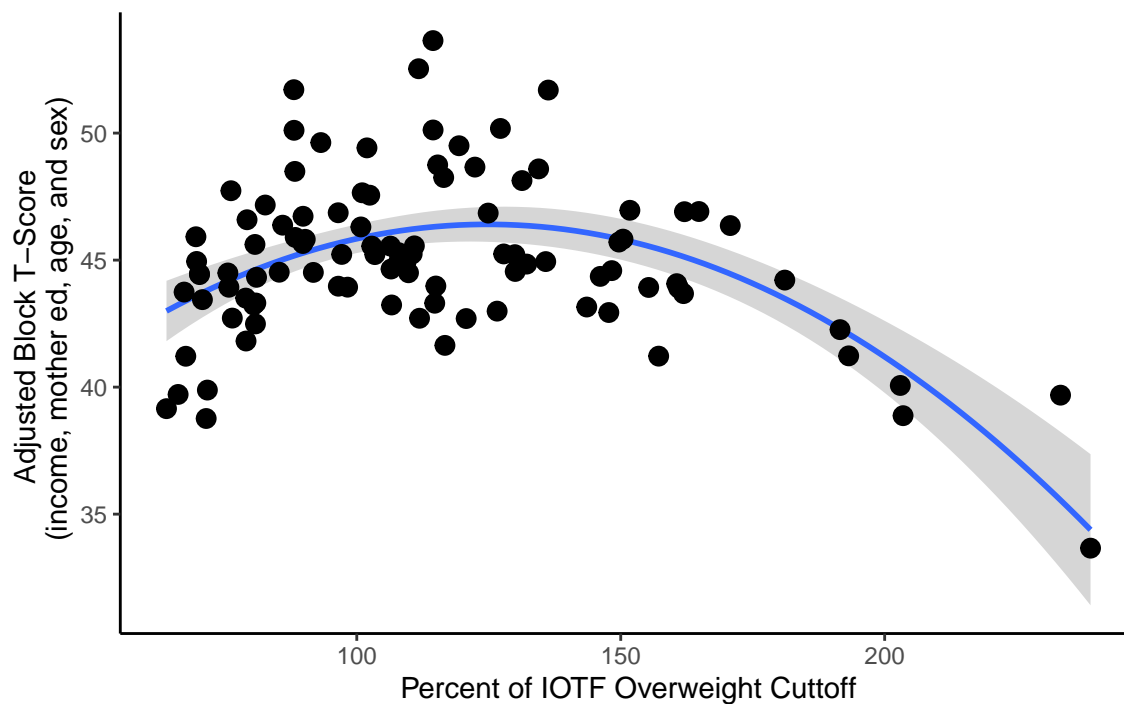
Table 11: Correlation p values between neuropsychological performance and percent of overweight

	blockT	matrixT	PRI	ds_fSS	ds_bSS	ds_SS	codingSS	age	pOW	hw_ratio	nComorbid
blockT											
matrixT	0.005										
PRI	0	0									
ds_fSS	0.794	0.06	0.313								
ds_bSS	0.385	0.388	0.205	0.004							
ds_SS	0.455	0.016	0.054	0	0						
codingSS	0.001	0.008	0.001	0.321	0.019	0.001					
age	0.803	0.081	0.365	0.639	0.002	0.045	0.021				
pOW	0.281	0.791	0.619	0.743	0.062	0.233	0.101	0.002			
hw_ratio	0.805	0.368	0.61	0.67	0.89	0.684	0.332	0.097	0.858		
nComorbid	0.028	0.387	0.096	0.125	0.035	0.016	0.111	0.53	0.75	0.163	

After exculding the 5 participants with  $IQ < 70$ , percent of overweight and height:weight ratio were not associated with any of the neuropsychological assessments. Number of comorbidities was still associated with total digit span SS such that the higher number of comorbidities the lower the standard score. After excluding the 5 participants, greater number of comorbidities was also associated with lower Block T-scores and backward digit span SS.

### 3.3 WASI - Block

Association between Percent of Overweight Cutoff and WASI Block



#### Analysis of Variance Table

Model 1: WASI\_BlockT ~ Month\_AED + Mother\_ed + Age\_yr + sex + pOW\_c100  
 Model 2: WASI\_BlockT ~ Month\_AED + Mother\_ed + Age\_yr + sex + pOW\_c100 +  
 pOW\_c100\_sq

	Res.Df	RSS	Df	Sum of Sq	F	Pr(>F)
1	92	7056.8				
2	91	6752.6	1	304.16	4.0989	0.04584 *

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

After looking at the association between Block T-score and percent of overweight, a non-linear association was suspected. Adding a quadratic term to the model significantly improved model fit.

Table 12: WASI Block model

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	52.475	6.166	8.510	0.000
Month_AED25,000 - 55,000 AED	1.843	2.040	0.903	0.369
Month_AED55,000 - 75,000 AED	4.830	4.062	1.189	0.237
Month_AED> 75,000 AED	8.068	3.727	2.165	0.033
Mother_ed	-0.129	0.299	-0.433	0.666
Age_yr	-0.515	0.338	-1.520	0.132
sexM	-0.984	1.821	-0.540	0.590
pOW_c100	0.060	0.040	1.489	0.140
pOW_c100_sq	-0.001	0.000	-2.025	0.046

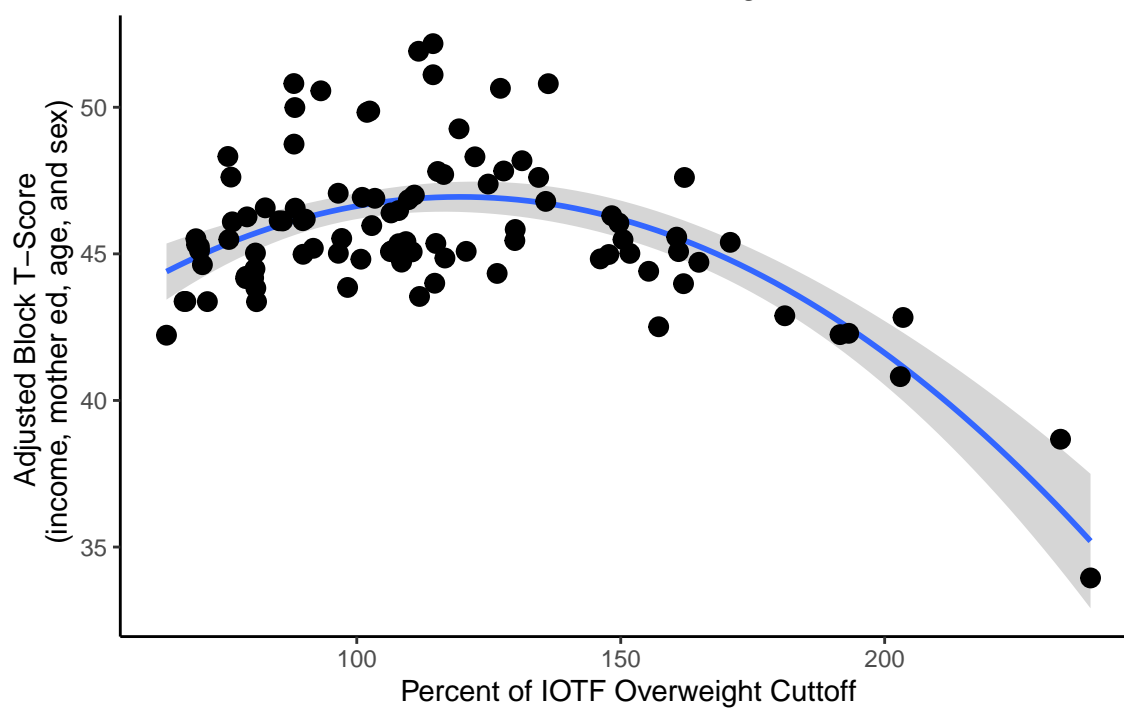
After controlling for income, maternal education, age, and sex, there was a significant quadratic effect of percent of overweight on Block performance. The linear association between percent of overweight and performance becomes less positive as percent of overweight increases such that the slope changes from positive to negative at 131% of overweight cutoff. This indicates that both performance is worse in those with both low and height weight for their age and sex. Additionally, those whose families made >\$75,000 AED had Block T-Scores that were 8 point higher than those whose families made between \$25,000-\$55,000 AED.

Table 13: WASI Block model - IQ  $\geq 70$ 

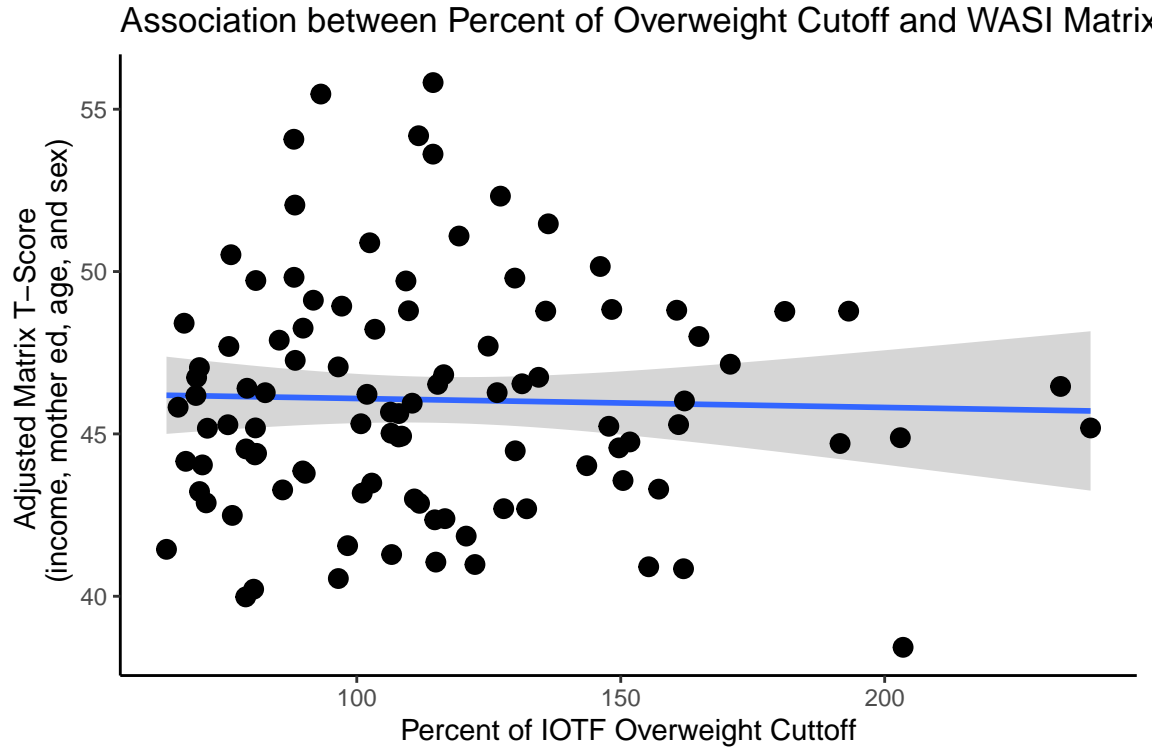
	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	51.016	6.047	8.436	0.000
Month_AED25,000 - 55,000 AED	1.387	1.960	0.708	0.481
Month_AED55,000 - 75,000 AED	4.526	3.820	1.185	0.239
Month_AED> 75,000 AED	7.249	3.520	2.059	0.042
Mother_ed	-0.330	0.293	-1.129	0.262
Age_yr	-0.111	0.337	-0.329	0.743
sexM	-0.648	1.742	-0.372	0.711
pOW_c100	0.039	0.040	0.977	0.331
pOW_c100_sq	-0.001	0.000	-1.974	0.052

Pattern of results remained unchanged when restricting to IQ  $\geq 70$  with just a little loss in significance due to lower participant numbers.

Association between Percent of Overweight Cutoff and WASI Block



### 3.4 WASI - Matrix



The model for Matrix performance was not improved by adding a quadratic term.

#### Analysis of Variance Table

```
Model 1: WASI_MatrixT ~ Month_AED + Mother_ed + Age_yr + sex + pOW_c100
Model 2: WASI_MatrixT ~ Month_AED + Mother_ed + Age_yr + sex + pOW_c100 +
pOW_c100_sq
  Res.Df  RSS Df Sum of Sq    F Pr(>F)
1     92 8000.5
2     91 7935.0  1    65.544 0.7517 0.3882
```

Table 14: WASI Matrix model

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	36.733	6.614	5.553	0.000
Month_AED25,000 - 55,000 AED	3.500	2.176	1.608	0.111
Month_AED55,000 - 75,000 AED	5.830	4.296	1.357	0.178
Month_AED> 75,000 AED	8.934	4.035	2.214	0.029
Mother_ed	0.304	0.318	0.957	0.341
Age_yr	0.288	0.366	0.788	0.433
sexM	-3.055	1.931	-1.582	0.117
pOW_c100	0.000	0.027	0.014	0.989

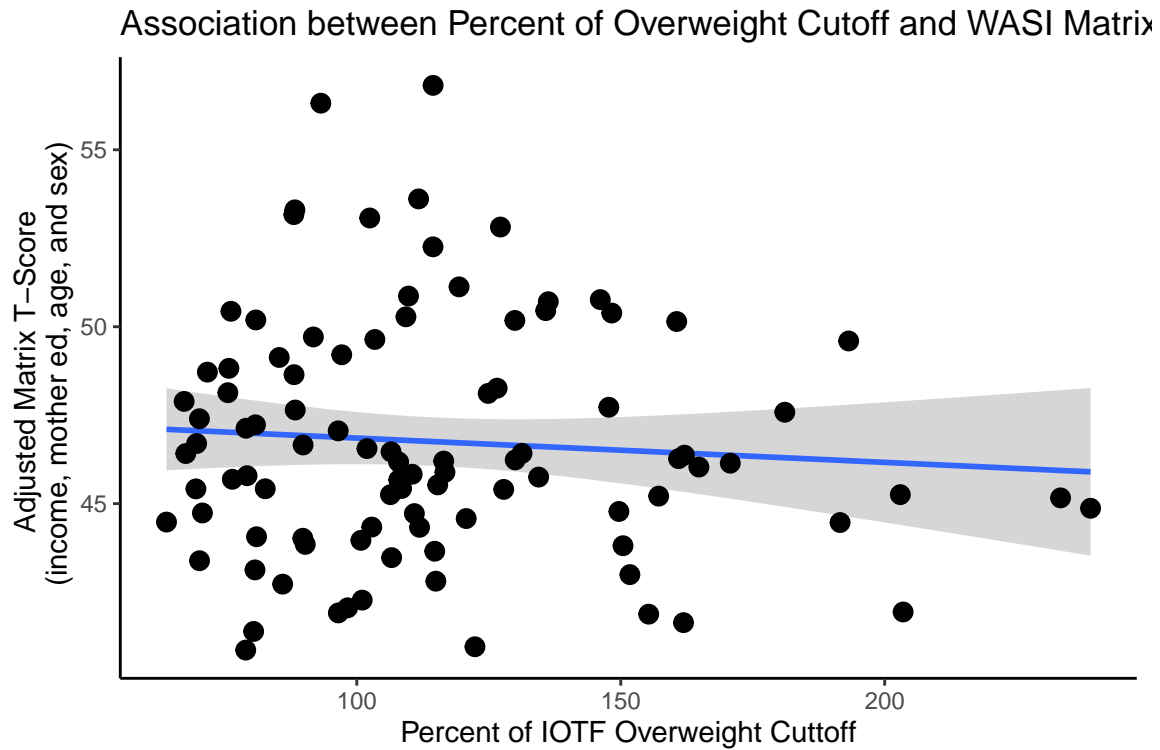
Matrix performance was not associated with percent of overweight. There was, however, a difference by

income such that those whose families made >\$75,000 AED had Matrix T-Scores that were 9 points higher than those whose families made between \$25,000-\$55,000 AED.

Table 15: WASI Matrix model - IQ  $\geq 70$

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	35.261	6.489	5.434	0.000
Month_AED25,000 - 55,000 AED	2.443	2.119	1.153	0.252
Month_AED55,000 - 75,000 AED	5.088	4.084	1.246	0.216
Month_AED> 75,000 AED	7.492	3.848	1.947	0.055
Mother_ed	0.161	0.312	0.515	0.608
Age_yr	0.668	0.367	1.822	0.072
sexM	-2.789	1.885	-1.479	0.143
pOW_c100	-0.014	0.026	-0.533	0.595

Pattern of results remained unchanged when restricting to IQ  $\geq 70$ .



### 3.5 WASI - PRI

#### Analysis of Variance Table

```

Model 1: WASI_PRI_IQ ~ Month_AED + Mother_ed + Age_yr + sex + pOW_c100
Model 2: WASI_PRI_IQ ~ Month_AED + Mother_ed + Age_yr + sex + pOW_c100 +
      pOW_c100_sq
      Res.Df  RSS Df Sum of Sq    F Pr(>F)
1         92 14046
2         91 13545  1    501.36 3.3684 0.06972 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

There is a trend for a quadratic term improving the model fit.

Table 16: WASI PRI model

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	91.710	8.733	10.501	0.000
Month_AED25,000 - 55,000 AED	5.426	2.889	1.878	0.064
Month_AED55,000 - 75,000 AED	10.346	5.753	1.798	0.075
Month_AED> 75,000 AED	15.416	5.279	2.920	0.004
Mother_ed	0.128	0.423	0.302	0.763
Age_yr	-0.319	0.479	-0.665	0.508
sexM	-3.806	2.579	-1.476	0.143
pOW_c100	0.093	0.057	1.643	0.104
pOW_c100_sq	-0.001	0.001	-1.835	0.070



### 3.6 Digit Span - Forward

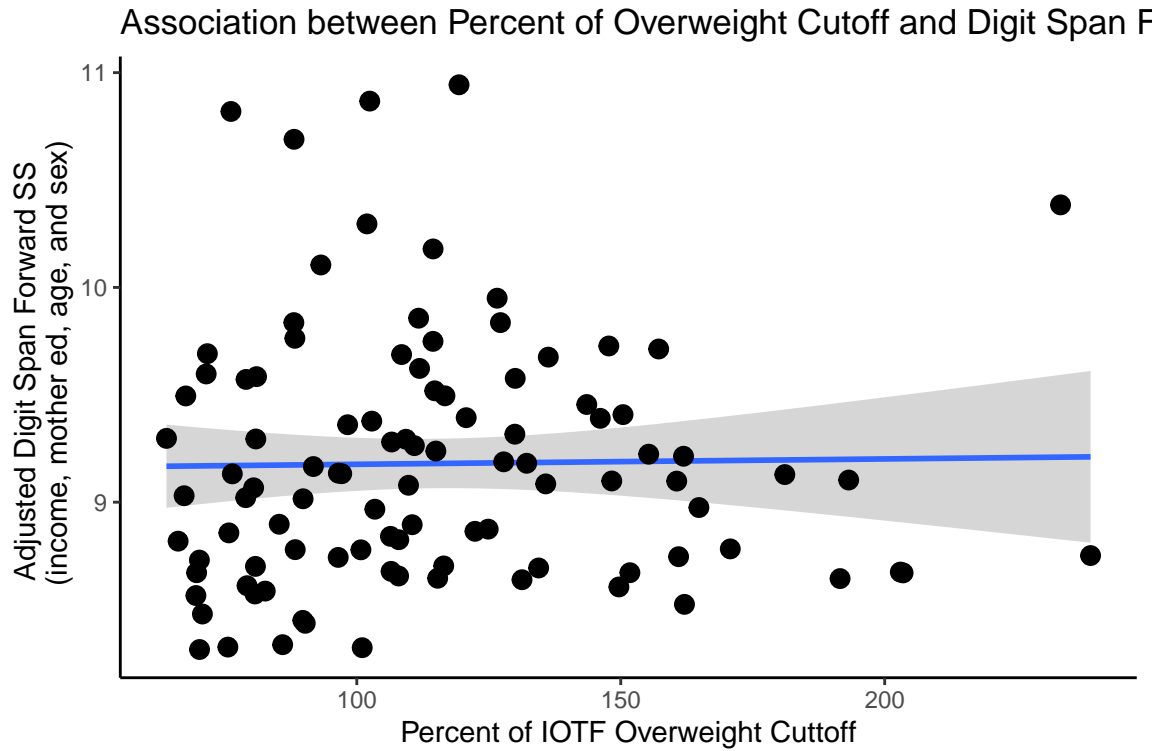


Table 17: Digist Span Forward SS model

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	7.989	2.078	3.844	0.000
Month_AED25,000 - 55,000 AED	-0.648	0.684	-0.947	0.346
Month_AED55,000 - 75,000 AED	1.189	1.350	0.881	0.381
Month_AED> 75,000 AED	0.107	1.268	0.085	0.933
Mother_ed	0.066	0.100	0.661	0.510
Age_yr	0.055	0.115	0.481	0.632
sexM	-0.262	0.607	-0.433	0.666
pOW_c100	0.000	0.008	0.047	0.963

There was no association with percent of overweight or any other demographic variable.

Table 18: Digist Span Forward SS model - IQ  $\geq 70$ 

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	7.870	2.198	3.581	0.001
Month_AED25,000 - 55,000 AED	-0.623	0.718	-0.868	0.388
Month_AED55,000 - 75,000 AED	1.212	1.383	0.876	0.383
Month_AED> 75,000 AED	0.105	1.303	0.081	0.936
Mother_ed	0.062	0.106	0.588	0.558
Age_yr	0.069	0.124	0.552	0.582
sexM	-0.254	0.638	-0.398	0.692
pOW_c100	0.000	0.009	0.005	0.996

Pattern of results remained unchanged when restricting to IQ  $\geq 70$ .

### 3.7 Digit Span - Backward

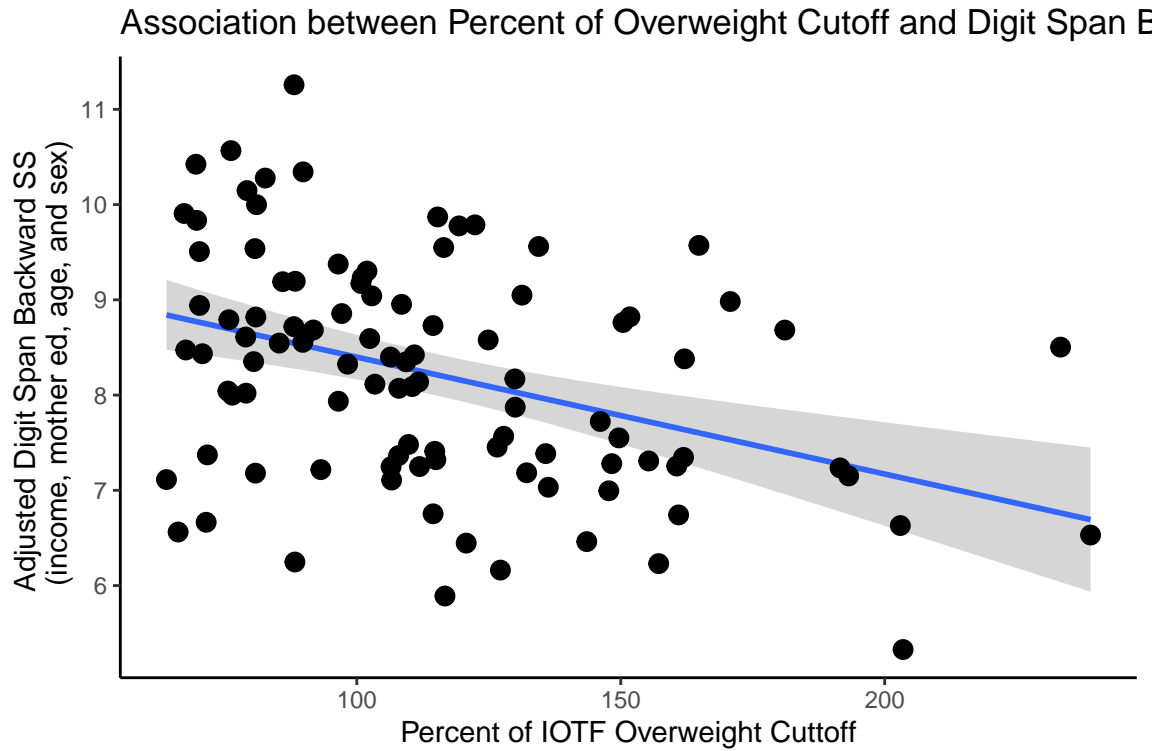


Table 19: Digist Span Backward SS model

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	11.817	1.953	6.049	0.000
Month_AED25,000 - 55,000 AED	0.392	0.643	0.610	0.544
Month_AED55,000 - 75,000 AED	1.222	1.269	0.964	0.338
Month_AED> 75,000 AED	-0.463	1.192	-0.388	0.699
Mother_ed	0.045	0.094	0.478	0.634
Age_yr	-0.307	0.108	-2.838	0.006
sexM	-1.009	0.570	-1.769	0.080
pOW_c100	-0.005	0.008	-0.573	0.568

There was no association with percent of overweight. There was, however, an association with age such that older children tended to have lower standard scores than younger children. Males also had a trend level lower performance than females.

Table 20: Digist Span Backward SS model - IQ  $\geq 70$ 

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	11.411	2.044	5.582	0.000
Month_AED25,000 - 55,000 AED	0.260	0.668	0.389	0.698
Month_AED55,000 - 75,000 AED	1.118	1.287	0.869	0.387
Month_AED> 75,000 AED	-0.689	1.212	-0.569	0.571
Mother_ed	0.056	0.098	0.575	0.567
Age_yr	-0.277	0.116	-2.394	0.019
sexM	-0.934	0.594	-1.573	0.119
pOW_c100	-0.006	0.008	-0.725	0.470

Pattern of results remained unchanged when restricting to IQ  $\geq 70$ .

### 3.8 Digit Span - Total

Table 21: Digist Span Total SS model

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	11.407	2.064	5.526	0.000
Month_AED25,000 - 55,000 AED	0.166	0.679	0.244	0.807
Month_AED55,000 - 75,000 AED	1.198	1.341	0.893	0.374
Month_AED> 75,000 AED	-0.552	1.259	-0.439	0.662
Mother_ed	0.048	0.099	0.485	0.629
Age_yr	-0.168	0.114	-1.473	0.144
sexM	-0.663	0.603	-1.100	0.274
pOW_c100	-0.005	0.008	-0.576	0.566

Table 22: Digist Span Total SS model - IQ >= 70

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	10.901	2.172	5.019	0.000
Month_AED25,000 - 55,000 AED	0.157	0.709	0.222	0.825
Month_AED55,000 - 75,000 AED	1.192	1.367	0.872	0.385
Month_AED> 75,000 AED	-0.679	1.288	-0.527	0.599
Mother_ed	0.061	0.104	0.589	0.558
Age_yr	-0.141	0.123	-1.146	0.255
sexM	-0.568	0.631	-0.900	0.371
pOW_c100	-0.006	0.009	-0.716	0.476

### 3.9 Coding

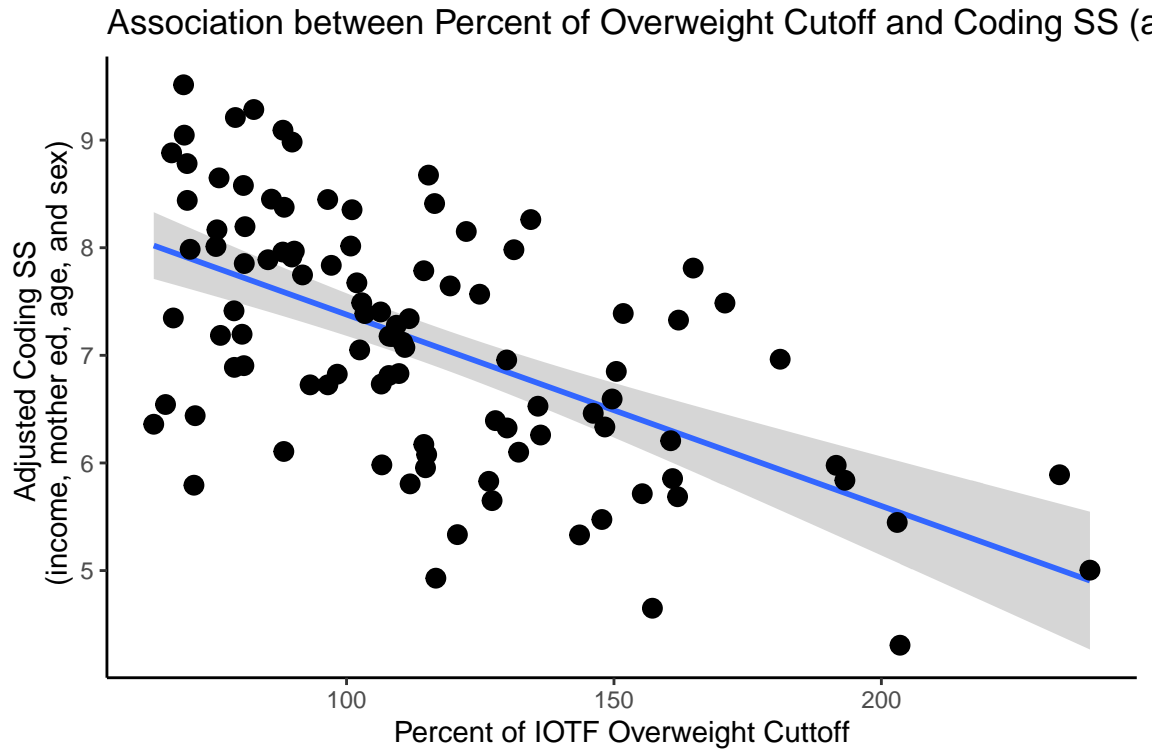


Table 23: Coding SS model

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	10.294	2.206	4.667	0.000
Month_AED25,000 - 55,000 AED	0.949	0.726	1.308	0.194
Month_AED55,000 - 75,000 AED	0.881	1.432	0.615	0.540
Month_AED> 75,000 AED	0.473	1.345	0.352	0.726
Mother_ed	-0.013	0.106	-0.123	0.903
Age_yr	-0.243	0.122	-1.991	0.049
sexM	-0.741	0.644	-1.151	0.253
pOW_c100	-0.012	0.009	-1.386	0.169

There was no association with percent of overweight. There was, however, an association with age such that older children had lower SS compared to younger children.

Table 24: Coding SS model - IQ  $\geq 70$ 

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	9.924	2.280	4.352	0.000
Month_AED25,000 - 55,000 AED	1.233	0.745	1.656	0.101
Month_AED55,000 - 75,000 AED	1.126	1.435	0.784	0.435
Month_AED> 75,000 AED	0.652	1.352	0.482	0.631
Mother_ed	-0.037	0.110	-0.338	0.736
Age_yr	-0.202	0.129	-1.571	0.120
sexM	-0.619	0.662	-0.934	0.353
pOW_c100	-0.015	0.009	-1.604	0.112

Pattern of results remained unchanged when restricting to IQ  $\geq 70$ .

## 4 Nback

Table 25: Nback Performance by Sex Status

Characteristic	N	N = 76
1-Back: Correct, %	76	0.83 (0.14) [0.33 - 0.93]
2-Back: Correct, %	76	0.52 (0.19) [0.00 - 0.87]
1-Back: False Alarm, %	76	0.03 (0.05) [0.00 - 0.40]
2-Back: False Alarm, %	76	0.05 (0.06) [0.00 - 0.36]
1-Back: Balanced Acc, %	76	0.90 (0.08) [0.59 - 0.97]
2-Back: Balanced Acc, %	76	0.73 (0.10) [0.44 - 0.91]
1-Back: d'	76	2.91 (0.64) [0.58 - 3.61]
2-Back: d'	76	1.67 (0.65) [-0.69 - 2.87]
1-Back: mean RT, ms	76	0.58 (0.11) [0.36 - 0.94]
2-Back: mean RT, ms	74	0.63 (0.11) [0.39 - 0.93]
Unknown		2
1-Back: median RT, ms	76	0.56 (0.13) [0.34 - 0.96]
2-Back: median RT, ms	74	0.61 (0.14) [0.39 - 0.93]
Unknown		2

<sup>1</sup> Mean (SD) [Range]



Table 26: Nback Performance by Weight Status

Characteristic	N	HW	OW	OB	ANOVA
1-Back: Correct, %	76	0.79 (0.17) [0.33 - 0.93]	0.87 (0.09) [0.67 - 0.93]	0.85 (0.13) [0.47 - 0.93]	0.0812
2-Back: Correct, %	76	0.49 (0.21) [0.00 - 0.87]	0.55 (0.14) [0.33 - 0.73]	0.54 (0.21) [0.00 - 0.87]	0.4948
1-Back: False Alarm, %	76	0.03 (0.04) [0.00 - 0.16]	0.02 (0.02) [0.00 - 0.07]	0.03 (0.08) [0.00 - 0.40]	0.4955
2-Back: False Alarm, %	76	0.06 (0.08) [0.00 - 0.36]	0.05 (0.03) [0.00 - 0.09]	0.06 (0.06) [0.00 - 0.33]	0.7077
1-Back: Balanced Acc, %	76	0.88 (0.09) [0.59 - 0.97]	0.93 (0.05) [0.80 - 0.97]	0.91 (0.07) [0.73 - 0.97]	0.0575
2-Back: Balanced Acc, %	76	0.71 (0.11) [0.48 - 0.91]	0.75 (0.07) [0.62 - 0.87]	0.74 (0.10) [0.44 - 0.89]	0.3805
1-Back: d'	76	2.65 (0.69) [0.58 - 3.61]	3.08 (0.49) [1.83 - 3.61]	3.08 (0.60) [1.26 - 3.61]	0.0145
2-Back: d'	76	1.58 (0.78) [-0.26 - 2.70]	1.78 (0.50) [0.89 - 2.87]	1.69 (0.62) [-0.69 - 2.62]	0.5659
1-Back: mean RT, ms	76	0.59 (0.12) [0.36 - 0.94]	0.56 (0.10) [0.41 - 0.80]	0.57 (0.12) [0.43 - 0.84]	0.6103
2-Back: mean RT, ms	74	0.64 (0.12) [0.39 - 0.85]	0.64 (0.09) [0.51 - 0.82]	0.62 (0.13) [0.41 - 0.93]	0.6846
Unknown		1	0	1	
1-Back: median RT, ms	76	0.58 (0.14) [0.34 - 0.96]	0.53 (0.11) [0.39 - 0.80]	0.55 (0.13) [0.40 - 0.86]	0.3768
2-Back: median RT, ms	74	0.62 (0.14) [0.39 - 0.91]	0.63 (0.12) [0.39 - 0.84]	0.60 (0.15) [0.39 - 0.93]	0.7519
Unknown		1	0	1	

<sup>1</sup> Mean (SD) [Range]

There was a trend for children with HW to have lower percent correct hits and ballanced accuracy during 1-back compared to those with overweight or obesity. There was a significant effect for 1-back d' such that those with HW showed lower sensitivity. May be due to those with lower weights being included in the HW category as <85th percentile.

#### 4.0.1 Correlation Matrix

Table 27: Correlations between Nback performance and percent of overweight

	Age_yr	pOW	hw_ratio	B1_pFA	B2_pFA	B1_BalAcc	B2_BalAcc	B1_dprime	B2_dprime
Age_yr									
pOW	0.28*								
hw_ratio	0.24*	0.04							
B1_pFA	-0.31*	0.01	0.02						
B2_pFA	-0.19	-0.03	0.01	0.52*					
B1_BalAcc	0.58*	0.22	0.03	-0.46*	-0.23*				
B2_BalAcc	0.45*	0.17	-0.01	-0.05	-0.21	0.53*			
B1_dprime	0.63*	0.27*	-0.01	-0.64*	-0.33*	0.91*	0.43*		
B2_dprime	0.44*	0.13	0	-0.17	-0.48*	0.54*	0.89*	0.48*	
B1_meanRTcor	-0.44*	-0.14	0.12	0.08	0.02	-0.61*	-0.53*	-0.48*	-0.46*
B2_meanRTcor	-0.18	-0.19	0.11	0.07	0.12	-0.4*	-0.26*	-0.3*	-0.24*

Table 28: Correlation p values between Nback performance and percent of overweight

	Age_yr	pOW	hw_ratio	B1_pFA	B2_pFA	B1_BalAcc	B2_BalAcc	B1_dprime	B2_dprime
Age_yr									
pOW	0.015								
hw_ratio	0.049	0.718							
B1_pFA	0.007	0.946	0.875						
B2_pFA	0.102	0.808	0.908	0					
B1_BalAcc	0	0.058	0.792	0	0.042				
B2_BalAcc	0	0.147	0.965	0.678	0.067	0			
B1_dprime	0	0.021	0.929	0	0.004	0	0		
B2_dprime	0	0.274	0.99	0.138	0	0	0	0	
B1_meanRTcor	0	0.225	0.31	0.516	0.856	0	0	0	0
B2_meanRTcor	0.124	0.109	0.386	0.532	0.316	0	0.024	0.01	0.044

Percent of overweight was positively correlated with 1-back d' sensitivity.

#### 4.0.2 Correlation Matrix - IQ $\geq 70$

Table 29: Correlations between neuropsychological performance and percent of overweight

	Age_yr	pOW	hw_ratio	B1_pFA	B2_pFA	B1_BalAcc	B2_BalAcc	B1_dprime	B2_dprime
Age_yr									
pOW	0.27*								
hw_ratio	0.24	0.04							
B1_pFA	-0.31*	0.01	0.02						
B2_pFA	-0.18	-0.02	0.02	0.52*					
B1_BalAcc	0.6*	0.23*	0.03	-0.47*	-0.24*				
B2_BalAcc	0.48*	0.18	0	-0.05	-0.22	0.52*			
B1_dprime	0.65*	0.28*	-0.01	-0.65*	-0.34*	0.91*	0.42*		
B2_dprime	0.45*	0.13	0	-0.17	-0.49*	0.53*	0.89*	0.48*	
B1_meanRTcor	-0.43*	-0.14	0.12	0.08	0.02	-0.63*	-0.55*	-0.5*	-0.48*
B2_meanRTcor	-0.16	-0.18	0.11	0.07	0.11	-0.44*	-0.31*	-0.33*	-0.27*

Table 30: Correlation p values between neuropsychological performance and percent of overweight

	Age_yr	pOW	hw_ratio	B1_pFA	B2_pFA	B1_BalAcc	B2_BalAcc	B1_dprime	B2_dprime
Age_yr									
pOW	0.018								
hw_ratio	0.051	0.725							
B1_pFA	0.007	0.943	0.877						
B2_pFA	0.115	0.834	0.902	0					
B1_BalAcc	0	0.048	0.78	0	0.036				
B2_BalAcc	0	0.118	0.981	0.666	0.053	0			
B1_dprime	0	0.017	0.941	0	0.003	0	0		
B2_dprime	0	0.248	0.98	0.137	0	0	0	0	
B1_meanRTcor	0	0.245	0.307	0.522	0.892	0	0	0	0
B2_meanRTcor	0.168	0.129	0.372	0.534	0.356	0	0.008	0.004	0.023

After excluding those with performance IQ < 70, percent of overweight was positively correlated with both 1-back d' sensitivity and balanced accuracy.

## 4.1 Nback - percent of overweight models

### 4.1.1 Ballanced Accuracy

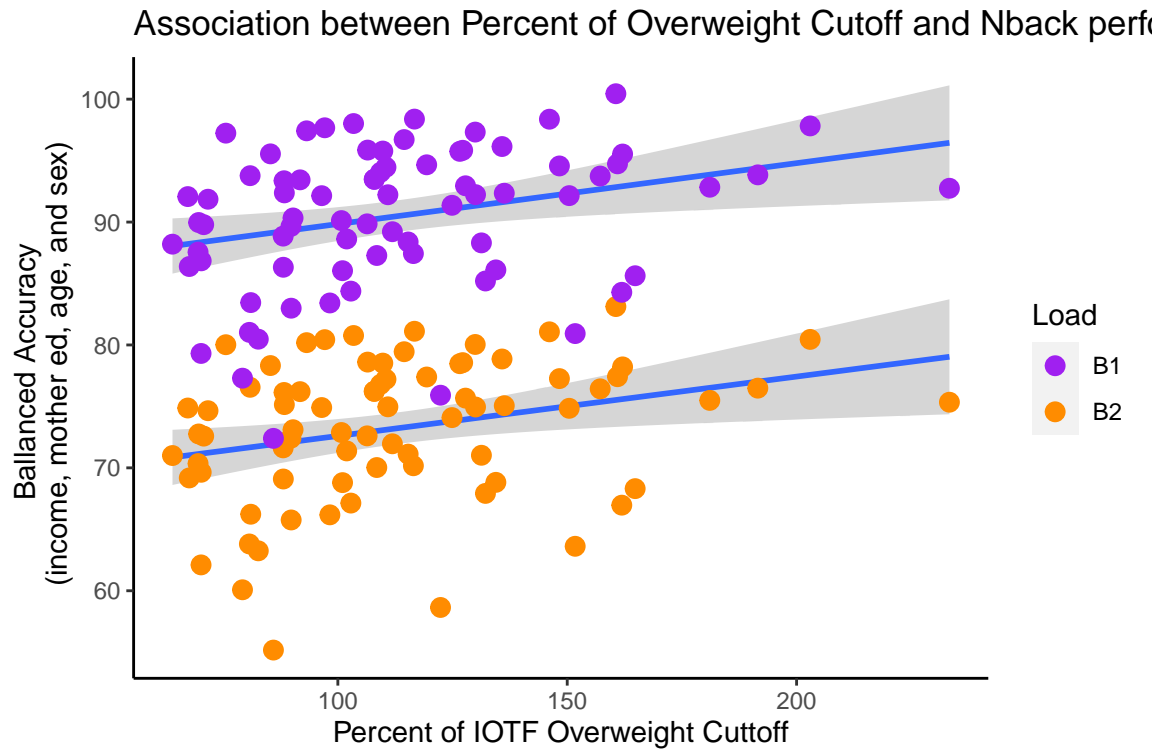


Table 31: Nback Load x Percent of Overweight: Ballanced Accuracy

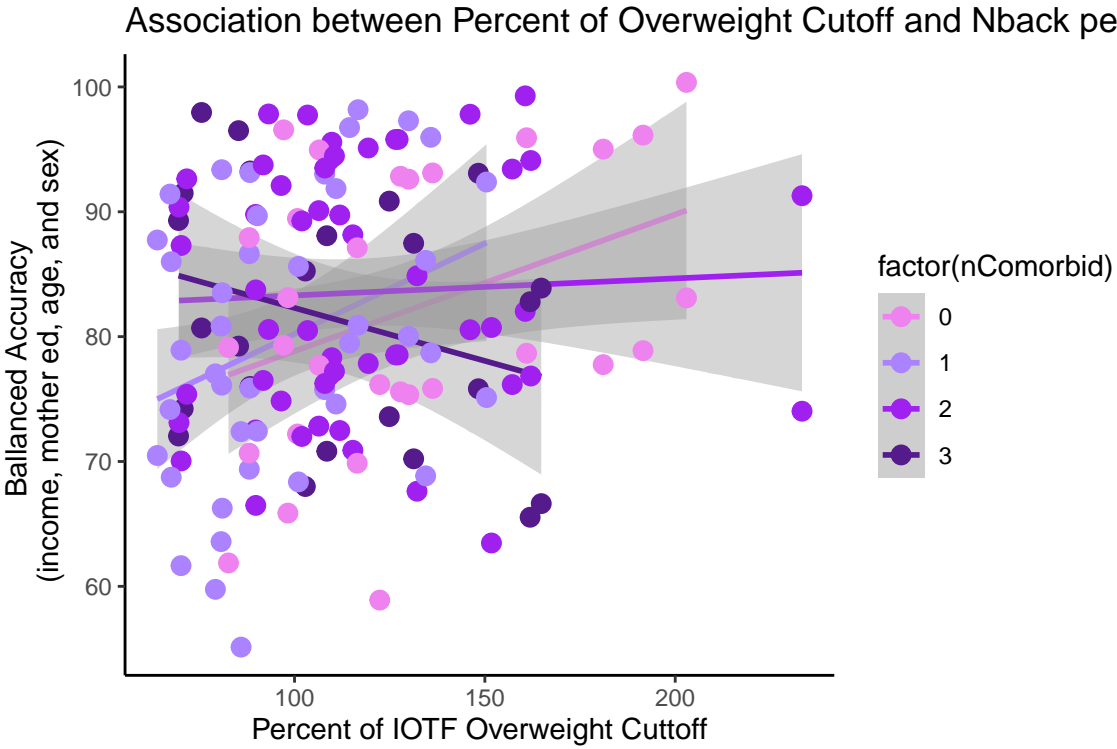
	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Month_AED	175.239	58.413	3	68	1.530	0.215
Mother_ed	5.737	5.737	1	68	0.150	0.699
Age_yr	1256.769	1256.769	1	68	32.921	0.000
pOW_c100	6.030	6.030	1	68	0.158	0.692
Load	9723.431	9723.431	1	73	254.708	0.000
pOW_c100:Load	0.068	0.068	1	73	0.002	0.966

There was no interaction and no main effect of percent of overweight. There was a significant effect of Load with better ballanced accuracy in 1- than 2-back. Age was positively associated with ballanced accuracy overall.

Table 32: Nback Load x Percent of Overweight: Ballanced Accuracy - IQ  $\geq 70$

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Month_AED	132.923	44.308	3	67	1.152	0.335
Mother_ed	2.565	2.565	1	67	0.067	0.797
Age_yr	1412.316	1412.316	1	67	36.735	0.000
pOW_c100	7.804	7.804	1	67	0.203	0.654
Load	9580.339	9580.339	1	72	249.187	0.000
pOW_c100:Load	0.000	0.000	1	72	0.000	0.998

Pattern of results remained unchanged when restricting to IQ  $\geq 70$ .



4.1.1.1 Comorbidity

Table 33: Nback nComorbid x Percent of Overweight: Ballanced Accuracy

	Estimate	Std. Error	df	t value	Pr(> t )
(Intercept)	63.578	5.117	67.278	12.424	0.000
Month_AED25,000 - 55,000 AED	2.726	1.795	66.000	1.519	0.134
Month_AED55,000 - 75,000 AED	5.785	3.614	66.000	1.601	0.114
Month_AED> 75,000 AED	1.681	3.190	66.000	0.527	0.600
Mother_ed	0.218	0.247	66.000	0.881	0.381
Age_yr	1.610	0.292	66.000	5.507	0.000
pOW_c100	0.085	0.038	66.000	2.234	0.029
nComorbid	1.018	0.867	66.000	1.175	0.244
LoadB2	-17.259	1.002	74.000	-17.223	0.000
pOW_c100:nComorbid	-0.053	0.021	66.000	-2.486	0.015

Table 34: Nback nComorbid x Percent of Overweight: Balanced Accuracy simple slopes

pOW_c100	nComorbid	pOW_c100.trend	SE	df	t.ratio	p.value
13.141	0	0.085	0.038	66	2.234	0.029
13.141	1	0.032	0.024	66	1.315	0.193
13.141	2	-0.021	0.026	66	-0.808	0.422
13.141	3	-0.073	0.040	66	-1.831	0.072

After controlling for Load, there was a significant interaction between percent of overweight and number of comorbidities such that the association between percent of overweight and balanced accuracy becomes more negative with increasing number of comorbidities. With zero comorbidities there was a significant positive association such that if percent of overweight increased by 10, ballanced accuracy is expected to increased by almost 1 percent (0.9). There was not a significant association for those with 1 or 2 comorbidities but a trend for a negative association for those with 3 comorbidities such that if percent of overweight increased by 10, balanced accuracy would be expected to decrease by almost 1 percent (0.7). There was a significant effect of Load with better balanced accuracy in 1- than 2-back. Age was positively associated with balanced accuracy overall.

Table 35: Nback nComorbid x Percent of Overweight: Ballanced Accuracy - IQ &gt;=70

	Estimate	Std. Error	df	t value	Pr(> t )
(Intercept)	65.545	5.086	66.301	12.886	0.000
Month_AED25,000 - 55,000 AED	2.195	1.769	65.000	1.241	0.219
Month_AED55,000 - 75,000 AED	5.301	3.534	65.000	1.500	0.138
Month_AED> 75,000 AED	1.589	3.113	65.000	0.510	0.611
Mother_ed	0.063	0.252	65.000	0.249	0.805
Age_yr	1.656	0.286	65.000	5.790	0.000
pOW_c100	0.081	0.037	65.000	2.179	0.033
nComorbid	1.031	0.845	65.000	1.219	0.227
LoadB2	-17.177	1.012	73.000	-16.968	0.000
pOW_c100:nComorbid	-0.049	0.021	65.000	-2.364	0.021

Pattern of results remained unchanged when restricting to IQ >=70.

### 4.1.2 False Alarms

Table 36: Nback Load x Percent of Overweight: d'

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Month_AED	23.963	7.988	3	68	0.476	0.700
Mother_ed	11.680	11.680	1	68	0.696	0.407
Age_yr	99.420	99.420	1	68	5.927	0.018
pOW_c100	10.679	10.679	1	68	0.637	0.428
Load	303.891	303.891	1	73	18.117	0.000
pOW_c100:Load	1.863	1.863	1	73	0.111	0.740

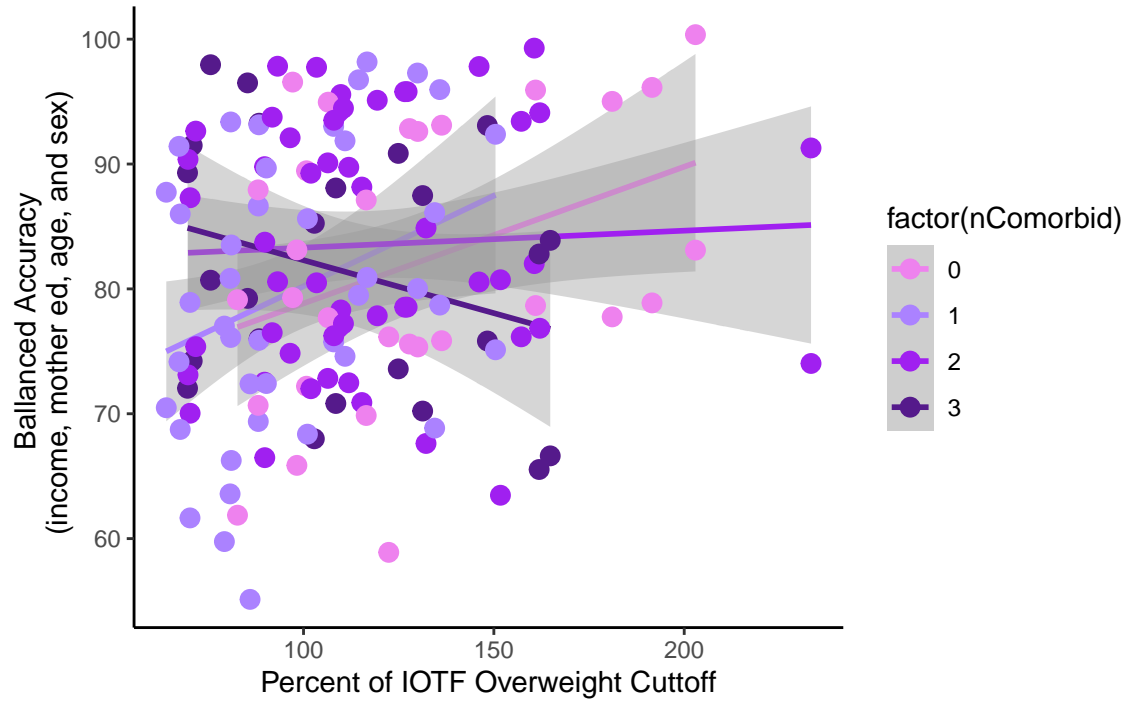
There was no interaction and no main effect of percent of overweight. There was a significant effect of Load with lower false alarm percentage in 1- than 2-back. Age was negatively associated with false alarm percentage overall.

Table 37: Nback Load x Percent of Overweight: Ballanced Accuracy - IQ  $\geq 70$

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Month_AED	24.041	8.014	3	67	0.473	0.702
Mother_ed	11.859	11.859	1	67	0.700	0.406
Age_yr	99.366	99.366	1	67	5.862	0.018
pOW_c100	10.557	10.557	1	67	0.623	0.433
Load	307.712	307.712	1	72	18.155	0.000
pOW_c100:Load	1.516	1.516	1	72	0.089	0.766

Pattern of results remained unchanged when restricting to IQ  $\geq 70$ .

### Association between Percent of Overweight Cutoff and Nback pe



#### 4.1.2.1 Comorbidity

Table 38: Nback nComorbid x Percent of Overweight: Percent False Alarm

	Estimate	Std. Error	df	t value	Pr(> t )
(Intercept)	8.006	4.092	66.877	1.957	0.055
Month_AED25,000 - 55,000 AED	0.488	1.437	66.000	0.340	0.735
Month_AED55,000 - 75,000 AED	-3.246	2.894	66.000	-1.121	0.266
Month_AED> 75,000 AED	-0.614	2.555	66.000	-0.240	0.811
Mother_ed	0.104	0.198	66.000	0.527	0.600
Age_yr	-0.543	0.234	66.000	-2.321	0.023
pOW_c100	-0.024	0.030	66.000	-0.799	0.427
nComorbid	-0.179	0.694	66.000	-0.258	0.797
LoadB2	2.963	0.665	74.000	4.457	0.000
pOW_c100:nComorbid	0.028	0.017	66.000	1.651	0.103

After controlling for Load, there was no interaction between percent of overweight and number of comorbidities. There was a significant effect of Load with better balanced accuracy in 1- than 2-back. Age was positively associated with balanced accuracy overall.



Table 39: Nback nComorbid x Percent of Overweight: Ballanced Accuracy - IQ  $\geq 70$ 

	Estimate	Std. Error	df	t value	Pr(> t )
(Intercept)	8.005	4.200	65.839	1.906	0.061
Month_AED25,000 - 55,000 AED	0.483	1.463	65.000	0.330	0.742
Month_AED55,000 - 75,000 AED	-3.250	2.923	65.000	-1.112	0.270
Month_AED> 75,000 AED	-0.615	2.574	65.000	-0.239	0.812
Mother_ed	0.103	0.209	65.000	0.493	0.624
Age_yr	-0.543	0.237	65.000	-2.295	0.025
pOW_c100	-0.024	0.031	65.000	-0.793	0.431
nComorbid	-0.179	0.699	65.000	-0.256	0.799
LoadB2	3.003	0.673	73.000	4.465	0.000
pOW_c100:nComorbid	0.028	0.017	65.000	1.635	0.107

Pattern of results remained unchanged when restricting to IQ  $\geq 70$ .

#### 4.1.3 d'

Table 40: Nback Load x Percent of Overweight: d'

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Month_AED	0.623	0.208	3	68	1.006	0.396
Mother_ed	0.063	0.063	1	68	0.306	0.582
Age_yr	8.020	8.020	1	68	38.851	0.000
pOW_c100	0.025	0.025	1	68	0.120	0.730
Load	49.133	49.133	1	73	238.018	0.000
pOW_c100:Load	0.278	0.278	1	73	1.347	0.250

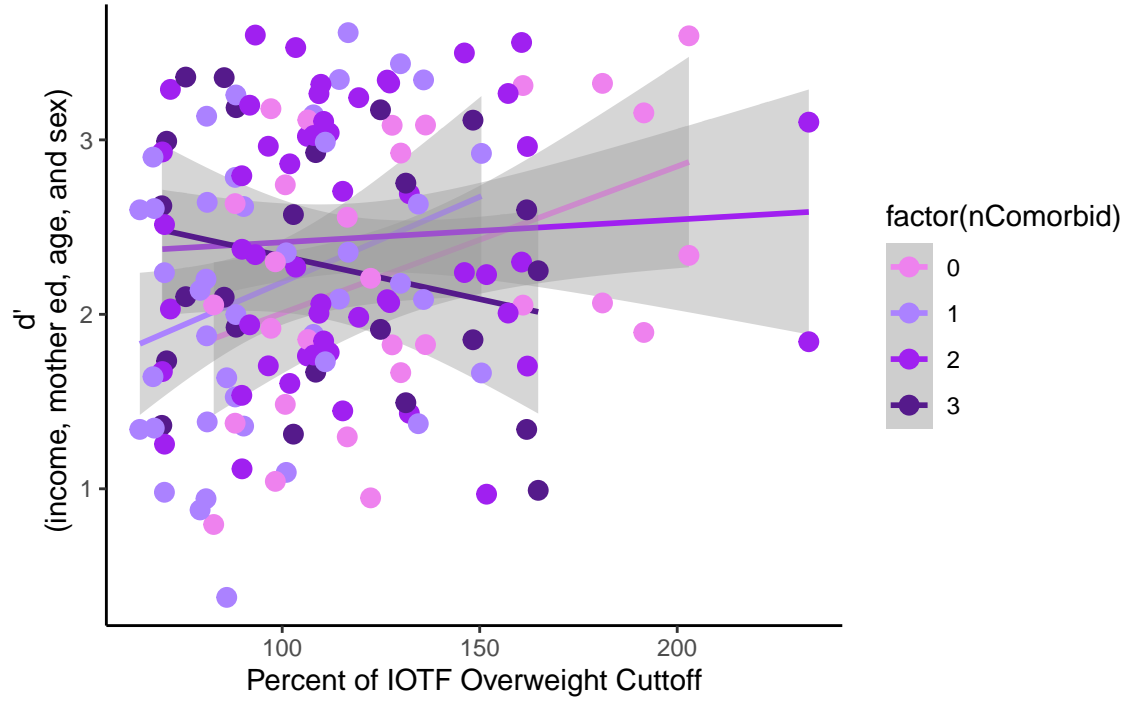
There was no interaction and no main effect of percent of overweight. There was a significant effect of Load with better d' in 1- than 2-back. Age was positively associated with d' overall.

Table 41: Nback Load x Percent of Overweight: Ballanced Accuracy - IQ  $\geq 70$ 

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Month_AED	0.505	0.168	3	67	0.805	0.496
Mother_ed	0.000	0.000	1	67	0.001	0.974
Age_yr	8.856	8.856	1	67	42.338	0.000
pOW_c100	0.032	0.032	1	67	0.154	0.696
Load	48.884	48.884	1	72	233.696	0.000
pOW_c100:Load	0.283	0.283	1	72	1.354	0.248

Pattern of results remained unchanged when restricting to IQ  $\geq 70$ .

# Association between Percent of Overweight Cutoff and Nback performance



## 4.1.3.1 Comorbidity

Table 42: Nback nComorbid x Percent of Overweight: d'

	Estimate	Std. Error	df	t value	Pr(> t )
(Intercept)	0.910	0.359	67.432	2.535	0.014
Month_AED25,000 - 55,000 AED	0.092	0.126	66.000	0.732	0.467
Month_AED55,000 - 75,000 AED	0.411	0.253	66.000	1.622	0.110
Month_AED> 75,000 AED	0.062	0.224	66.000	0.279	0.781
Mother_ed	0.019	0.017	66.000	1.078	0.285
Age_yr	0.122	0.020	66.000	5.931	0.000
pOW_c100	0.006	0.003	66.000	2.268	0.027
nComorbid	0.099	0.061	66.000	1.625	0.109
LoadB2	-1.259	0.074	74.000	-16.925	0.000
pOW_c100:nComorbid	-0.004	0.001	66.000	-2.511	0.014

Table 43: Nback nComorbid x Percent of Overweight: d' simple slopes

pOW_c100	nComorbid	pOW_c100.trend	SE	df	t.ratio	p.value
13.141	0	0.006	0.003	66	2.268	0.027
13.141	1	0.002	0.002	66	1.345	0.183
13.141	2	-0.001	0.002	66	-0.800	0.427
13.141	3	-0.005	0.003	66	-1.839	0.070

After controlling for Load, there was a significant interaction between percent of overweight and number of comorbidities such that the association between percent of overweight and d' becomes more negative with increasing number of comorbidities. With zero comorbidities there was a significant positive association

such that if percent of overweight increased by 10,  $d'$  is expected to increased by 0.06. There was not a significant association for those with 1 or 2 comorbidities but a trend for a negative association for those with 3 comorbidities such that if percent of overweight increased by 10,  $d'$  would be expected to decrease by 0.05. There was a significant effect of Load with better balanced accuracy in 1- than 2-back. Age was positively associated with balanced accuracy overall.

Table 44: Nback nComorbid x Percent of Overweight:  $d' - IQ \geq 70$

	Estimate	Std. Error	df	t value	Pr(> t )
(Intercept)	1.038	0.359	66.449	2.893	0.005
Month_AED25,000 - 55,000 AED	0.058	0.125	65.000	0.468	0.641
Month_AED55,000 - 75,000 AED	0.380	0.249	65.000	1.525	0.132
Month_AED> 75,000 AED	0.056	0.220	65.000	0.257	0.798
Mother_ed	0.009	0.018	65.000	0.496	0.622
Age_yr	0.125	0.020	65.000	6.171	0.000
pOW_c100	0.006	0.003	65.000	2.210	0.031
nComorbid	0.100	0.060	65.000	1.669	0.100
LoadB2	-1.260	0.075	73.000	-16.714	0.000
pOW_c100:nComorbid	-0.004	0.001	65.000	-2.392	0.020

Pattern of results remained unchanged when restricting to  $IQ \geq 70$ .

## 4.2 Nback - sleep models

### 4.2.1 Ballanced Accuracy

Table 45: Nback Load x CSHQ Total: Ballanced Accuracy

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Month_AED	286.205	95.402	3	52	2.450	0.074
Mother_ed	0.003	0.003	1	52	0.000	0.993
Age_yr	1480.574	1480.574	1	52	38.019	0.000
CSHQ_Total_no16	59.235	59.235	1	52	1.521	0.223
Load	653.026	653.026	1	57	16.769	0.000
CSHQ_Total_no16:Load	95.504	95.504	1	57	2.452	0.123

There was no interaction and no main effect of total sleep score. There was a significant effect of Load with better balanced accuracy in 1- than 2-back. Age was positively associated with balanced accuracy overall.

Table 46: Nback Load x CSHQ Total: Ballanced Accuracy - IQ &gt;=70

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Month_AED	218.981	72.994	3	51	1.879	0.145
Mother_ed	12.731	12.731	1	51	0.328	0.570
Age_yr	1630.912	1630.912	1	51	41.981	0.000
CSHQ_Total_no16	28.486	28.486	1	51	0.733	0.396
Load	696.040	696.040	1	56	17.916	0.000
CSHQ_Total_no16:Load	122.452	122.452	1	56	3.152	0.081

Pattern of results remained unchanged when restricting to IQ >=70.

#### 4.2.2 Flase Alarms

##### Association between Sleep and Nback False Alarm Percent (adjusti

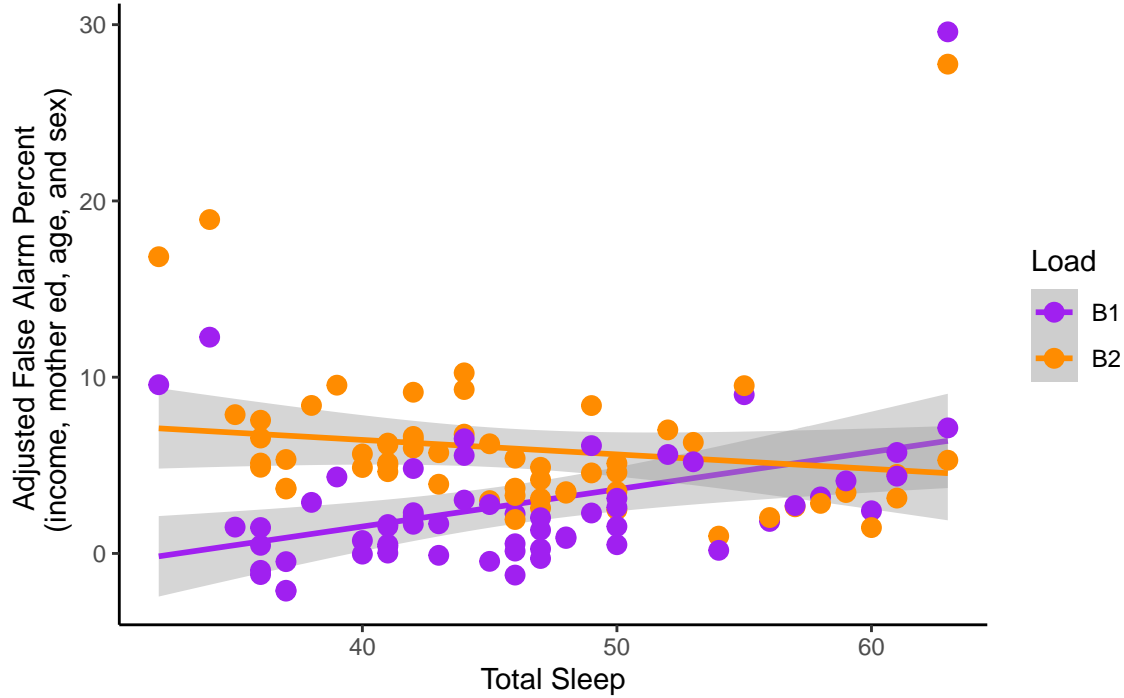


Table 47: Nback Load x CSHQ Total: Percent False Alarms'

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Month_AED	19.549	6.516	3	52	0.386	0.764
Mother_ed	44.511	44.511	1	52	2.636	0.111
Age_yr	84.559	84.559	1	52	5.008	0.030
CSHQ_Total_no16	19.503	19.503	1	52	1.155	0.287
Load	228.979	228.979	1	57	13.560	0.001
CSHQ_Total_no16:Load	154.544	154.544	1	57	9.152	0.004

Table 48: Nback Load x PCSHQ Total: Percent False Alarms' simple slopes

CSHQ_Total_no16	Load	CSHQ_Total_no16.trend	SE	df	t.ratio	p.value
45.966	B1	0.247	0.105	78.831	2.352	0.021
45.966	B2	-0.047	0.105	78.831	-0.446	0.656

There was a significant interaction between load and total sleep score such that 1-back percent False Alarms was positively related to total sleep score while there was no association for 2-back. Age was positively associated with percent False Alarms overall.

Table 49: Nback Load x CSHQ Total: Percent False Alarms no outlier'

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Month_AED	19.290	6.430	3	51	0.379	0.768
Mother_ed	8.764	8.764	1	51	0.517	0.475
Age_yr	104.990	104.990	1	51	6.192	0.016
CSHQ_Total_no16	25.666	25.666	1	51	1.514	0.224
Load	186.506	186.506	1	56	10.999	0.002
CSHQ_Total_no16:Load	118.340	118.340	1	56	6.979	0.011

Pattern of results remained unchanged when removing 1 outlier.

Table 50: Nback Load x CSHQ Total: Percent False Alarms - IQ &gt;=70

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Month_AED	19.451	6.484	3	51	0.377	0.770
Mother_ed	43.665	43.665	1	51	2.542	0.117
Age_yr	85.124	85.124	1	51	4.955	0.030
CSHQ_Total_no16	17.309	17.309	1	51	1.008	0.320
Load	223.090	223.090	1	56	12.986	0.001
CSHQ_Total_no16:Load	149.942	149.942	1	56	8.728	0.005

Pattern of results remained unchanged when restricting to IQ >=70.

### 4.2.3 d'

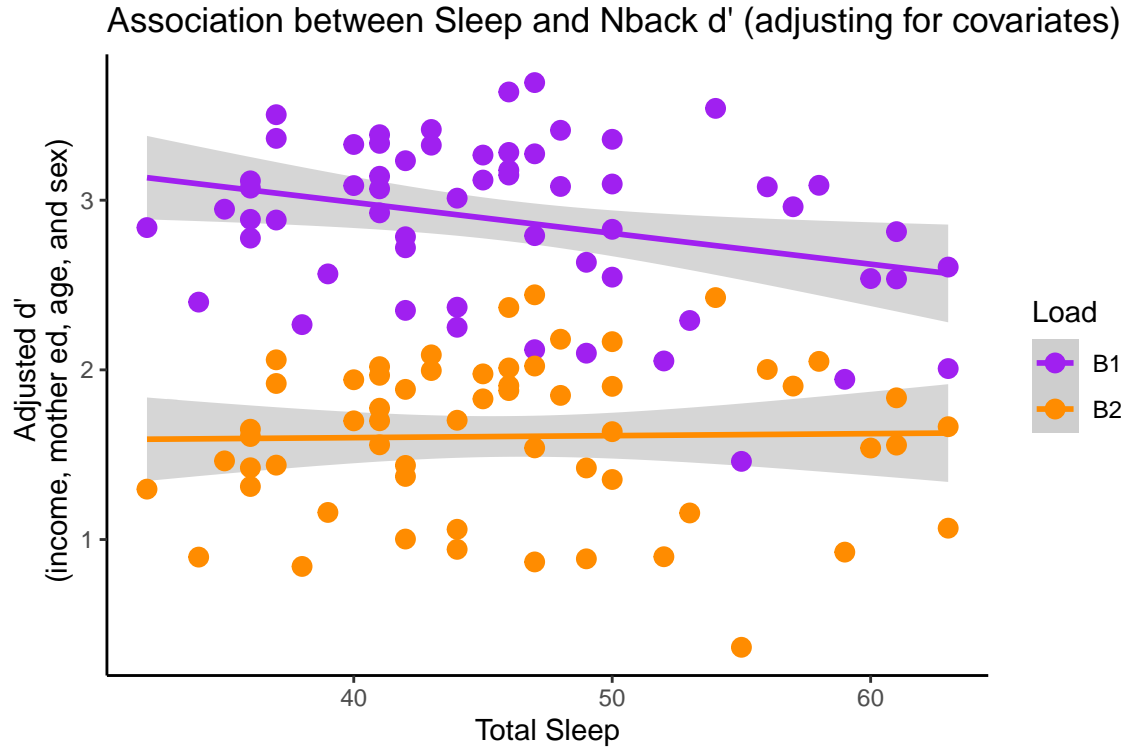


Table 51: Nback Load x CSHQ Total: d'

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Month_AED	1.041	0.347	3	52	1.669	0.185
Mother_ed	0.029	0.029	1	52	0.139	0.711
Age_yr	9.279	9.279	1	52	44.654	0.000
CSHQ_Total_no16	0.438	0.438	1	52	2.106	0.153
Load	3.861	3.861	1	57	18.582	0.000
CSHQ_Total_no16:Load	0.675	0.675	1	57	3.247	0.077

Table 52: Nback Load x PCSHQ Total: d' simple slopes

CSHQ_Total_no16	Load	CSHQ_Total_no16.trend	SE	df	t.ratio	p.value
45.966	B1	-0.021	0.009	94.926	-2.223	0.029
45.966	B2	-0.001	0.009	94.926	-0.151	0.880

There was a trend-level interaction between load and total sleep score such that 1-back d' was significantly negatively associated with toaal sleep score while 2-back was not associated.

Table 53: Nback Load x CSHQ Total: d' - IQ  $\geq 70$ 

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Month_AED	0.810	0.270	3	51	1.278	0.292
Mother_ed	0.185	0.185	1	51	0.875	0.354
Age_yr	10.337	10.337	1	51	48.943	0.000
CSHQ_Total_no16	0.246	0.246	1	51	1.167	0.285
Load	3.796	3.796	1	56	17.973	0.000
CSHQ_Total_no16:Load	0.688	0.688	1	56	3.257	0.077

Pattern of results remained unchanged when restricting to IQ  $\geq 70$ .

### 4.3 Nback - SDQ

#### 4.3.1 Ballanced Accuracy

Table 54: Nback Load x SDQ Total: Ballanced Accuracy

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Month_AED	165.224	55.075	3	67	1.437	0.240
Mother_ed	4.435	4.435	1	67	0.116	0.735
Age_yr	1416.255	1416.255	1	67	36.954	0.000
SDQ_TotalProb_raw	116.577	116.577	1	67	3.042	0.086
Load	1919.858	1919.858	1	72	50.094	0.000
SDQ_TotalProb_raw:Load	1.250	1.250	1	72	0.033	0.857

There was no interaction but there was a trending main effect of total SDQ score. Higher SDQ scores were associated with lower balanced accuracy overall. There was a significant effect of Load with better balanced accuracy in 1- than 2-back. Age was positively associated with balanced accuracy overall.

Table 55: Nback Load x SDQ Total: Ballanced Accuracy - IQ  $\geq 70$ 

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Month_AED	115.856	38.619	3	66	1.001	0.398
Mother_ed	4.756	4.756	1	66	0.123	0.727
Age_yr	1617.208	1617.208	1	66	41.910	0.000
SDQ_TotalProb_raw	132.940	132.940	1	66	3.445	0.068
Load	1872.735	1872.735	1	71	48.532	0.000
SDQ_TotalProb_raw:Load	1.670	1.670	1	71	0.043	0.836

Pattern of results remained unchanged when restricting to IQ  $\geq 70$ .

### 4.3.2 Flase Alarms

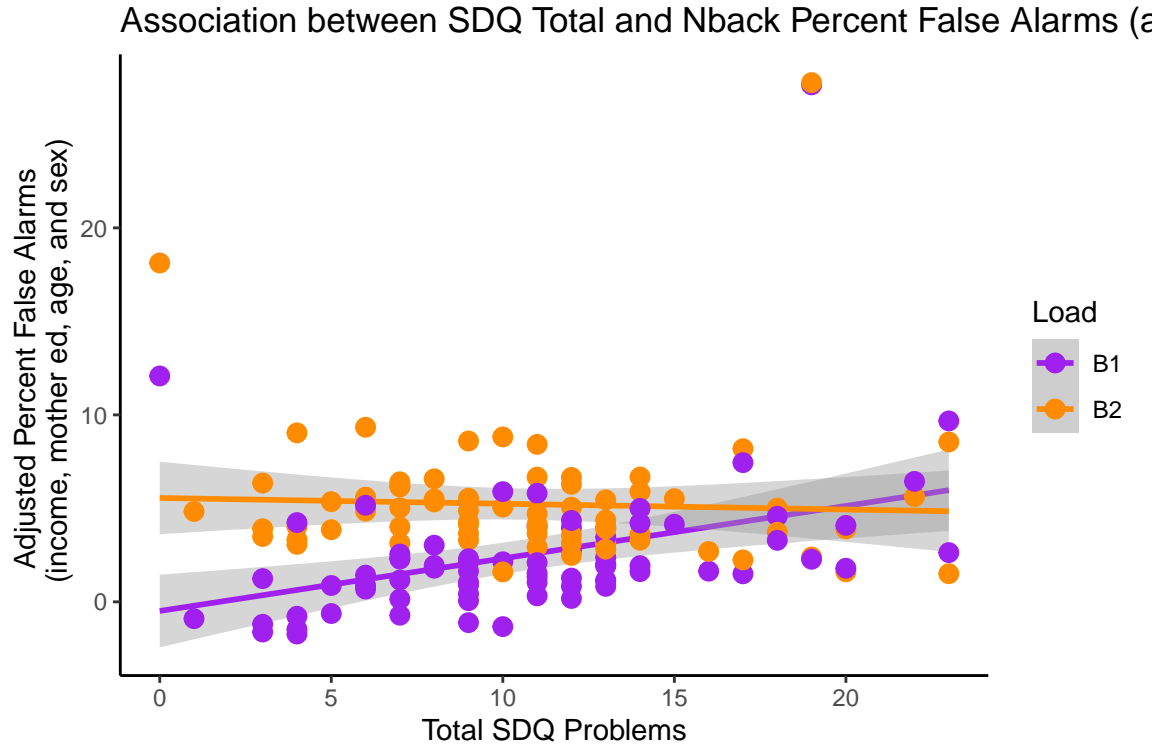


Table 56: Nback Load x SDQ Total: Percent False Alarms'

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Month_AED	16.500	5.500	3	67	0.419	0.740
Mother_ed	10.076	10.076	1	67	0.768	0.384
Age_yr	83.563	83.563	1	67	6.366	0.014
SDQ_TotalProb_raw	5.299	5.299	1	67	0.404	0.527
Load	249.126	249.126	1	72	18.980	0.000
SDQ_TotalProb_raw:Load	93.324	93.324	1	72	7.110	0.009

Table 57: Nback Load x SDQ Total: Percent False Alarms' simple slopes

SDQ_TotalProb_raw	Load	SDQ_TotalProb_raw.trend	SE	df	t.ratio	p.value
10.716	B1	0.226	0.125	102.048	1.805	0.074
10.716	B2	-0.085	0.125	102.048	-0.681	0.497

There was a significant interaction between load and total sleep score such that there was a trend for 1-Back percent False Alarms positively associated with SDQ total score. There was no association for 2-back. There was a significant effect of Load with lower percent False Alarms in 1- than 2-back. Age was positively associated with percent False Alarms overall.

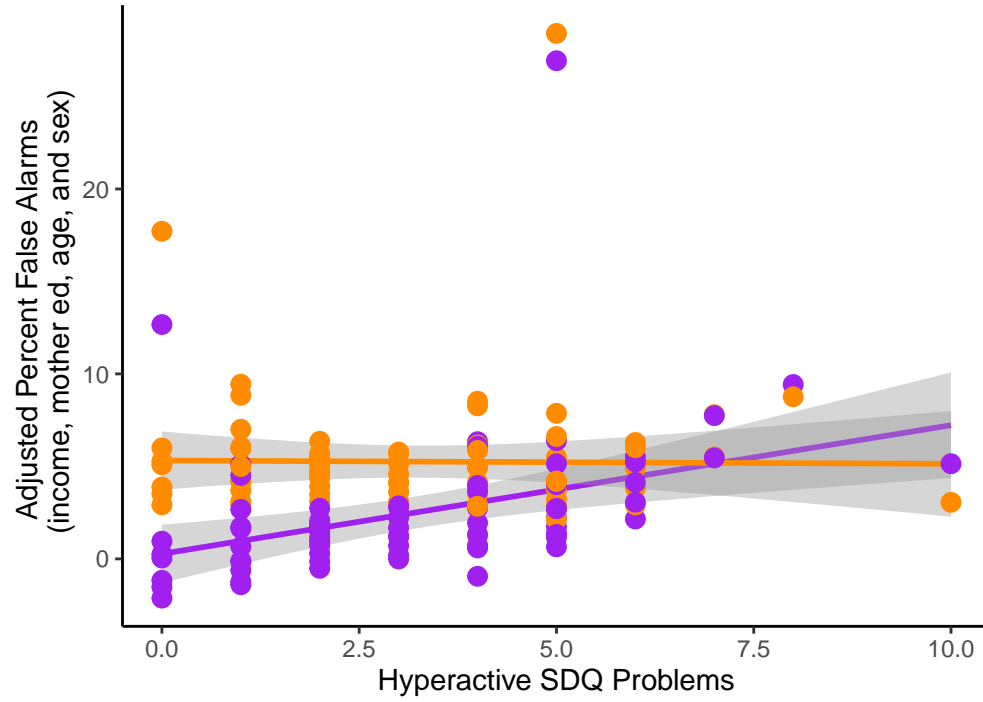


Table 58: Nback Load x SDQ Total: Percent False Alarms - IQ  $\geq 70$ 

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Month_AED	17.669	5.890	3	66	0.445	0.722
Mother_ed	12.042	12.042	1	66	0.910	0.344
Age_yr	85.044	85.044	1	66	6.425	0.014
SDQ_TotalProb_raw	5.432	5.432	1	66	0.410	0.524
Load	253.550	253.550	1	71	19.157	0.000
SDQ_TotalProb_raw:Load	94.943	94.943	1	71	7.173	0.009

Pattern of results remained unchanged when restricting to IQ  $\geq 70$ .

Association between SDQ Hyperactive and Nback Percent False Alarms



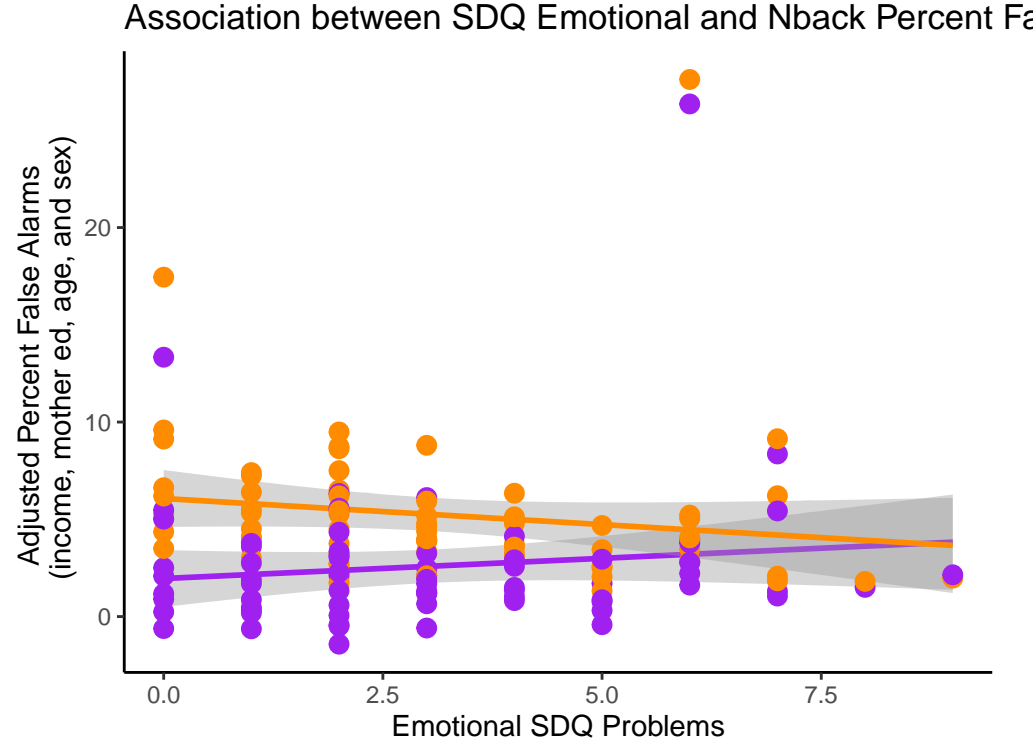
#### 4.3.2.1 Hyperactivity Problems

Table 59: Nback Load x SDQ Hyperactivity: Percent False Alarms'

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Month_AED	22.017	7.339	3	64	0.542	0.656
Mother_ed	7.214	7.214	1	64	0.532	0.468
Age_yr	73.804	73.804	1	64	5.446	0.023
SDQ_HyperactiveProb_raw	3.810	3.810	1	64	0.281	0.598
Load	273.946	273.946	1	69	20.216	0.000
SDQ_HyperactiveProb_raw:Load	83.227	83.227	1	69	6.142	0.016

Table 60: Nback Load x SDQ Hyperactivity: Percent False Alarms' simple slopes

SDQ_HyperactiveProb_raw	Load	SDQ_HyperactiveProb_raw.trend	SE	df	t.ratio	p.value
3.254	B1	0.505	0.315	95.988	1.603	0.112
3.254	B2	-0.208	0.315	95.988	-0.660	0.511



#### 4.3.2.2 Emotional Problems

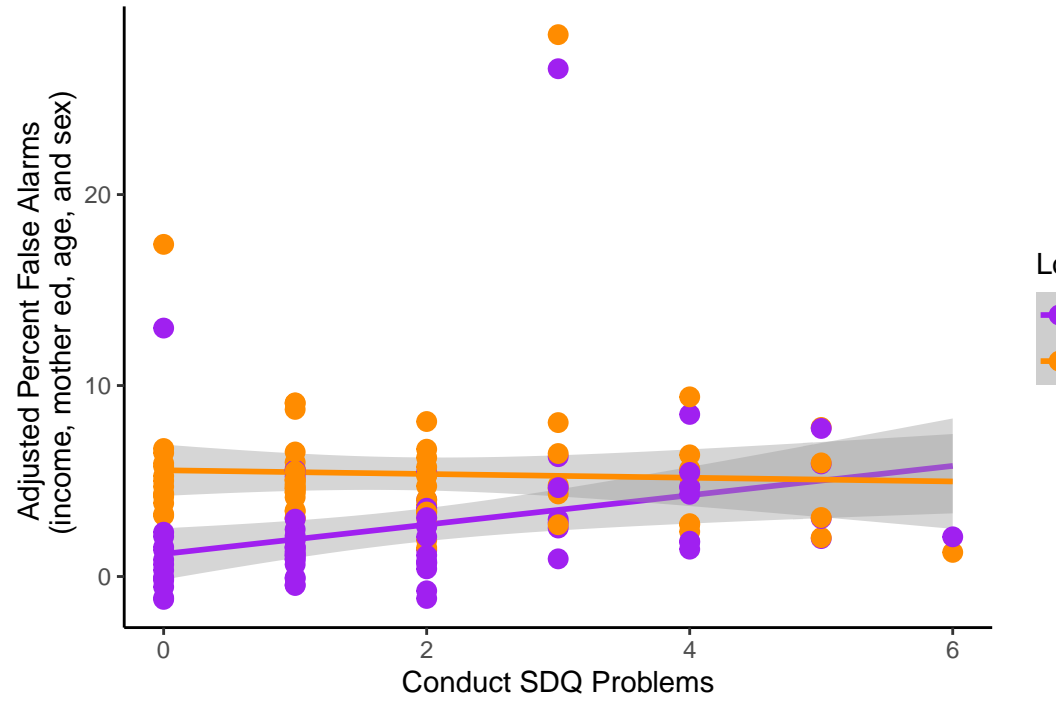
Table 61: Nback Load x SDQ Emotional: Percent False Alarms'

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Month_AED	21.243	7.081	3	65	0.508	0.678
Mother_ed	18.261	18.261	1	65	1.311	0.256
Age_yr	118.668	118.668	1	65	8.517	0.005
SDQ_EmotionProb_raw	2.345	2.345	1	65	0.168	0.683
Load	209.338	209.338	1	70	15.024	0.000
SDQ_EmotionProb_raw:Load	40.184	40.184	1	70	2.884	0.094

Table 62: Nback Load x SDQ Emotional: Percent False Alarms' simple slopes

SDQ_EmotionProb_raw	Load	SDQ_EmotionProb_raw.trend	SE	df	t.ratio	p.value
3.069	B1	0.134	0.29	101.815	0.461	0.646
3.069	B2	-0.342	0.29	101.815	-1.179	0.241

# Association between SDQ Conduct and Nback Percent False



## 4.3.2.3 Conduct Problems

Table 63: Nback Load x SDQ Conduct: Percent False Alarms'

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Month_AED	16.630	5.543	3	64	0.399	0.754
Mother_ed	9.445	9.445	1	64	0.680	0.413
Age_yr	73.284	73.284	1	64	5.278	0.025
SDQ_ConductProb_raw	2.093	2.093	1	64	0.151	0.699
Load	279.060	279.060	1	69	20.098	0.000
SDQ_ConductProb_raw:Load	62.763	62.763	1	69	4.520	0.037

Table 64: Nback Load x SDQ Conduct: Percent False Alarms' simple slopes

SDQ_ConductProb_raw	Load	SDQ_ConductProb_raw.trend	SE	df	t.ratio	p.value
1.845	B1	0.584	0.439	97.205	1.331	0.186
1.845	B2	-0.282	0.439	97.205	-0.643	0.522

## 4.3.2.4 Peer Problems

Table 65: Nback Load x SDQ Peer: Percent False Alarms'

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Month_AED	20.255	6.752	3	66	0.469	0.705
Mother_ed	24.686	24.686	1	66	1.714	0.195
Age_yr	130.753	130.753	1	66	9.080	0.004
SDQ_PeerProb_raw	19.770	19.770	1	66	1.373	0.246
Load	117.066	117.066	1	71	8.130	0.006
SDQ_PeerProb_raw:Load	12.287	12.287	1	71	0.853	0.359

#### 4.3.3 d'

Table 66: Nback Load x SDQ Total: d'

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Month_AED	0.439	0.146	3	67	0.690	0.561
Mother_ed	0.056	0.056	1	67	0.263	0.609
Age_yr	9.799	9.799	1	67	46.232	0.000
SDQ_TotalProb_raw	0.705	0.705	1	67	3.326	0.073
Load	10.305	10.305	1	72	48.623	0.000
SDQ_TotalProb_raw:Load	0.005	0.005	1	72	0.023	0.880

There was no interaction between load and total SDA score but there was a main effect of total SDQ such that d' was worse with increasing (worse) SDQ Total Problem score. There was a significant effect of Load with better d' in 1- than 2-back. Age was positively associated with d' overall.

Table 67: Nback Load x SDQ Total: d' - IQ &gt;=70

	Sum Sq	Mean Sq	NumDF	DenDF	F value	Pr(>F)
Month_AED	0.306	0.102	3	66	0.474	0.702
Mother_ed	0.005	0.005	1	66	0.023	0.879
Age_yr	11.093	11.093	1	66	51.623	0.000
SDQ_TotalProb_raw	0.801	0.801	1	66	3.726	0.058
Load	10.257	10.257	1	71	47.732	0.000
SDQ_TotalProb_raw:Load	0.005	0.005	1	71	0.021	0.884

Pattern of results remained unchanged when restricting to IQ >=70.