

UAE Cognitive Function Paper 2

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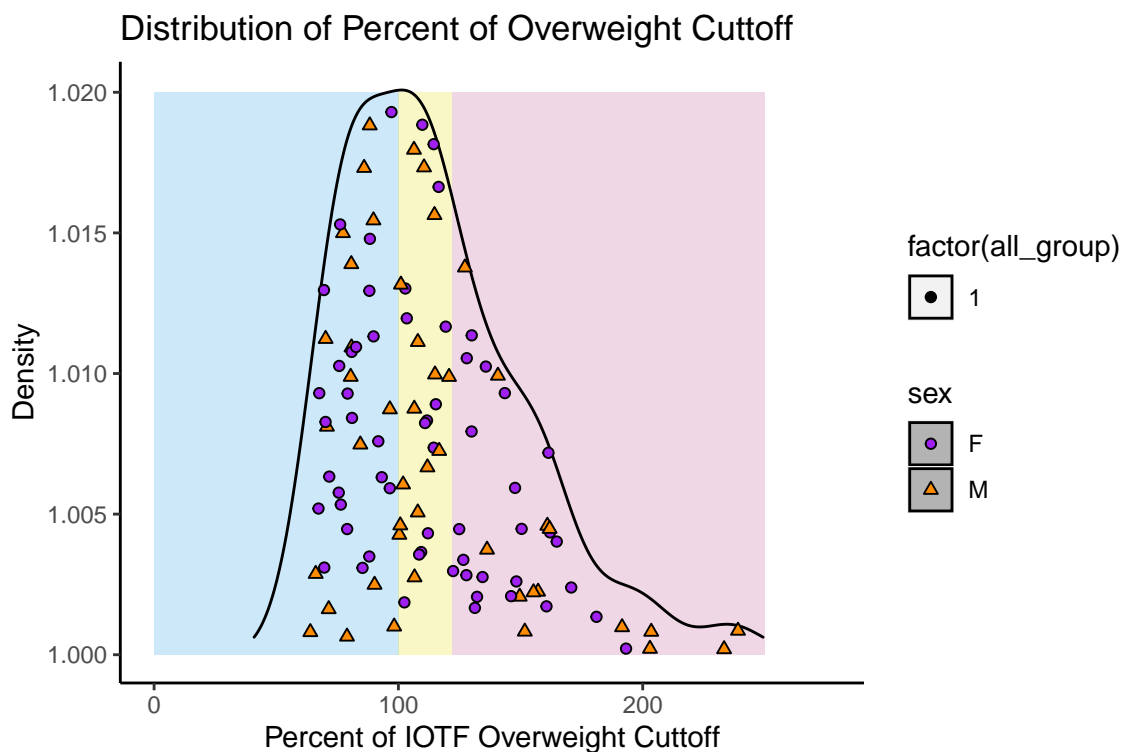
1 Measurement of Weight Status

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 kg/m^2) and obesity (OB; 30 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 Weight Status

Characteristic	N	HW, N = 41	OW, N = 29	OB, N = 37
sex	107			
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]
BMI	107	17.15 [12.71 - 22.72]	24.03 [18.70 - 28.86]	35.08 [21.87 - 55.52]
IOTF_pOWcutoff	107	80.86 [63.95 - 98.26]	109.66 [100.39 - 120.73]	155.80 [122.38 - 239.00]
Father_ed	106	12.68 [6.00 - 18.00]	13.60 [6.00 - 18.00]	12.03 [0.00 - 18.00]
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]
Unknown		1	2	1
Month_AED	103			
<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			
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			
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

¹ 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: IOTF_pOWcutoff 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 2: Correlations between percent of overweight cutoff and demographic characteristics

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

Table 3: P-values for the correlations between percent of overweight cutoff and demographic characteristics

	Age_yr	Father_ed	Mother_ed	IOTF_pOWcutoff
Age_yr				
Father_ed	0.795			
Mother_ed	0.15	0		
IOTF_pOWcutoff	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: IOTF_pOWcutoff
      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 4: 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%.

3 Sleep Behavior

3.1 Correlation Matrix

Table 5: Correlations between sleep subscales and percent of overweight

	IOTF_pOWcutoff	BedResit	OnsetDelay	Duration	Anxiety	NightWaking	Parasomnias	I
IOTF_pOWcutoff								
BedResit	-0.13							
OnsetDelay	0.31*	0.13						
Duration	0.04	0.41*	0.4*					
Anxiety	-0.18	0.62*	-0.1	0.02				
NightWaking	0.05	0.21	0.05	0.29*	0.23*			
Parasomnias	0.04	0.17	0.02	0.04	0.12	0.41*		
DisorderBreathing	0.37*	0.19	0.03	0.1	0.13	0.4*	0.43*	
DaySleepiness	-0.04	0.28*	0.16	0.21	0.28*	0.05	0.18	0
Total	0.1	0.63*	0.29*	0.47*	0.52*	0.47*	0.52*	0

Table 6: Correlations between sleep subscales and percent of overweight

	IOTF_pOWcutoff	BedResit	OnsetDelay	Duration	Anxiety	NightWaking	Parasomnias	I
IOTF_pOWcutoff								
BedResit	0.207							
OnsetDelay	0.002	0.227						
Duration	0.679	0	0					
Anxiety	0.07	0	0.322	0.851				
NightWaking	0.61	0.051	0.621	0.005	0.025			
Parasomnias	0.692	0.108	0.833	0.693	0.256	0		
DisorderBreathing	0	0.074	0.785	0.344	0.222	0	0	
DaySleepiness	0.676	0.011	0.127	0.052	0.008	0.622	0.101	0
Total	0.401	0	0.013	0	0	0	0	0

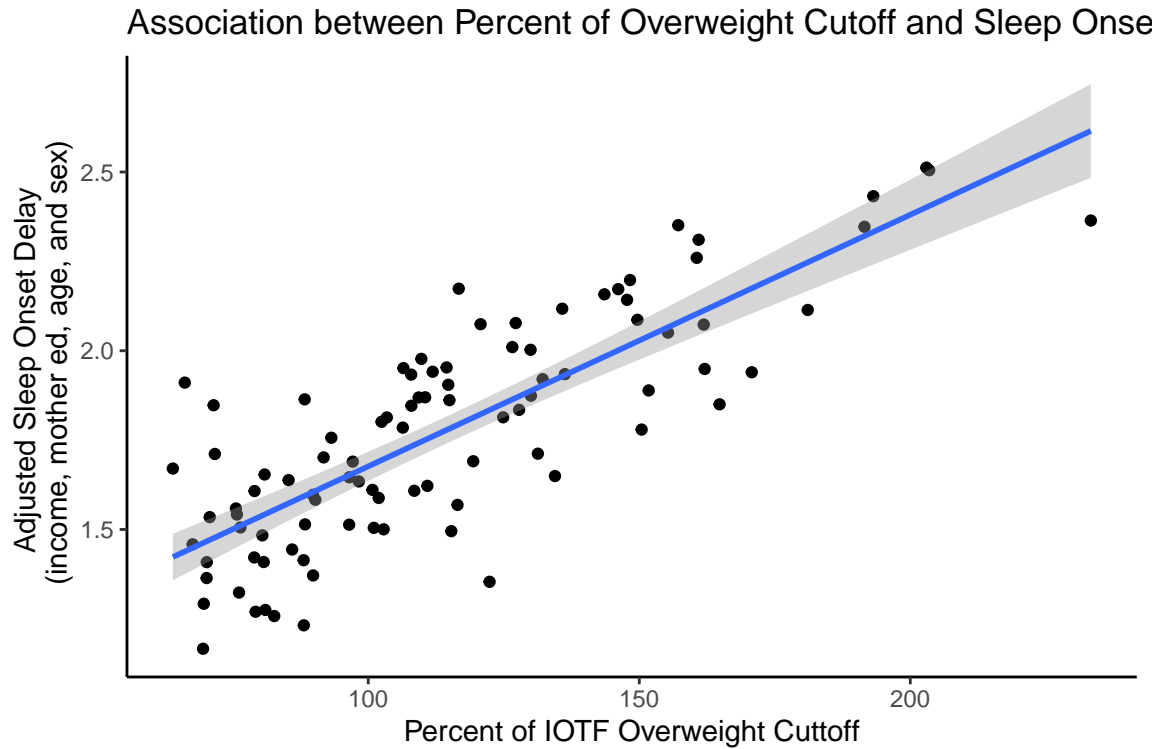
Examining correlations between sleep sub-scales and percent of overweight cutoff reveals greater percent of overweight cutoff was associated with greater parent reported sleep onset delay and sleep disordered breathing.

3.1.1 Sensitivity Tests

3.1.1.1 Sleep Onset Delay After controlling for family income, mother education, child age, and child sex, percent of overweight was positively associated with sleep onset delay such that a child with 110% of overweight, compared to 100% of overweight, would be expected to have a sleep onset delay score that was 0.06 points higher (range of scores = 0 - 3). Additionally, age was positively associated with sleep onset delay such that each year older, the expected sleep disordered breathing score would be 0.12 points higher (range of scores = 0 - 7).

Table 7: Linear Model: Sleep Onset Delay - SES category + Maternal Education + Age + Sex + pOWcutoff

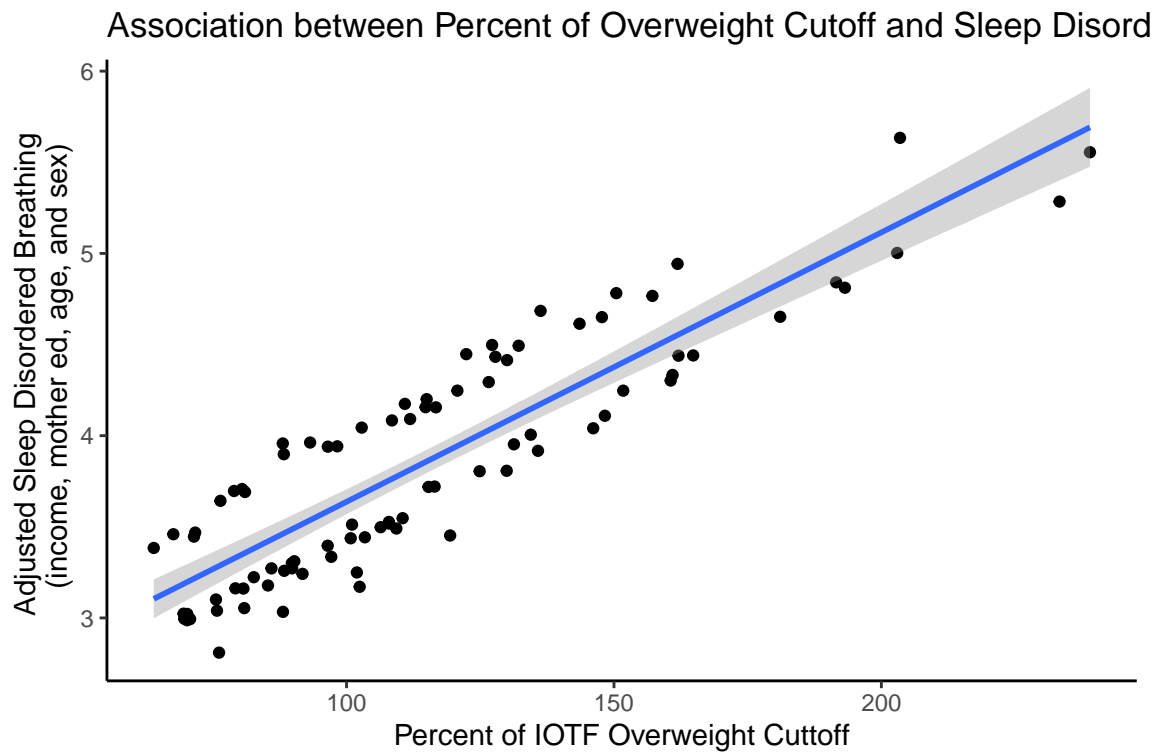
	b	se	t	p	
(Intercept)	0.152	0.627	0.242	0.809	
Month_AED25,000 - 55,000 AED	0.030	0.198	0.152	0.879	
Month_AED55,000 - 75,000 AED	-0.052	0.384	-0.136	0.892	
Month_AED> 75,000 AED	-0.067	0.402	-0.167	0.868	
Mother_ed	0.006	0.029	0.217	0.829	
Age_yr	0.065	0.033	1.945	0.055	.
sexM	0.154	0.178	0.865	0.389	
IOTF_pOWcutoff	0.006	0.003	2.192	0.031	*



3.1.1.2 Sleep Disordered Breathing After controlling for family income, mother education, child age, and child sex, percent of overweight was positively associated with sleep disordered breathing such that a child with 110% of overweight, compared to 100% of overweight, would be expected to have a sleep disordered breathing score that was 0.16 points higher(range of scores = 3 - 9).

Table 8: Linear Model: Sleep Disordered Breathing - SES category + Maternal Education + Age + Sex + pOWcutoff

	b	se	t	p	
(Intercept)	2.718	1.126	2.415	0.018	
Month_AED25,000 - 55,000 AED	-0.545	0.375	-1.452	0.151	
Month_AED55,000 - 75,000 AED	-0.783	0.696	-1.125	0.264	
Month_AED> 75,000 AED	0.196	0.771	0.254	0.800	
Mother_ed	-0.009	0.051	-0.176	0.860	
Age_yr	-0.015	0.065	-0.237	0.813	
sexM	0.000	0.339	0.001	0.999	
IOTF_pOWcutoff	0.016	0.005	3.329	0.001	**



4 Strengths and Difficulties Questionnaire

Table 9: Strengths and Difficulties by Weight Status

Characteristic	N	HW, N = 41	OW, N = 29	OB, N = 37
Emotional Problems, raw	104	3.05 [0.00 - 8.00]	3.00 [0.00 - 7.00]	3.43 [0.00 - 9.00]
Unknown		2	1	0
Contact Problems, raw	102	2.00 [0.00 - 7.00]	1.68 [0.00 - 5.00]	2.24 [0.00 - 6.00]
Unknown		1	1	3
Hyperactivity, raw	103	3.65 [0.00 - 9.00]	3.07 [0.00 - 10.00]	3.46 [0.00 - 10.00]
Unknown		2	2	0
Peer Problems, raw	102	2.71 [0.00 - 7.00]	2.97 [0.00 - 5.00]	3.46 [1.00 - 6.00]
Unknown		3	0	2
Prosocial, raw	102	8.47 [4.00 - 10.00]	8.82 [6.00 - 10.00]	8.11 [2.00 - 10.00]
Unknown		2	1	2
Total Problems, raw	106	11.11 [0.00 - 29.00]	10.34 [4.00 - 20.00]	12.22 [3.00 - 23.00]
Unknown		1	0	0
Total Problems	93			
CloseToAverage		27 (73%)	17 (68%)	19 (61%)
High		5 (14%)	2 (8.0%)	5 (16%)
SlightlyRaised		3 (8.1%)	5 (20%)	4 (13%)
VeryHigh		2 (5.4%)	1 (4.0%)	3 (9.7%)
Unknown		4	4	6
Emotional Problems	104			
CloseToAverage		24 (62%)	18 (64%)	20 (54%)
High		7 (18%)	5 (18%)	7 (19%)
SlightlyRaised		5 (13%)	3 (11%)	6 (16%)
VeryHigh		3 (7.7%)	2 (7.1%)	4 (11%)
Unknown		2	1	0
Contact Problems	102			
CloseToAverage		26 (65%)	21 (75%)	22 (65%)
High		7 (18%)	4 (14%)	7 (21%)
SlightlyRaised		6 (15%)	3 (11%)	4 (12%)
VeryHigh		1 (2.5%)	0 (0%)	1 (2.9%)
Unknown		1	1	3
Hyperactivity	103			
CloseToAverage		29 (74%)	24 (89%)	32 (86%)
High		1 (2.6%)	0 (0%)	0 (0%)
SlightlyRaised		8 (21%)	1 (3.7%)	3 (8.1%)
VeryHigh		1 (2.6%)	2 (7.4%)	2 (5.4%)
Unknown		2	2	0
Peer Problems	102			
CloseToAverage		17 (45%)	12 (41%)	11 (31%)
High		10 (26%)	9 (31%)	11 (31%)
SlightlyRaised		7 (18%)	6 (21%)	7 (20%)
VeryHigh		4 (11%)	2 (6.9%)	6 (17%)
Unknown		3	0	2
Prosocial	102			
CloseToAverage		30 (77%)	22 (79%)	25 (71%)
Low		2 (5.1%)	2 (7.1%)	1 (2.9%)
SlightlyLowered		5 (13%)	4 (14%)	6 (17%)
VeryLow		2 (5.1%)	0 (0%)	3 (8.6%)
Unknown		2	1	2

¹ Mean [Range]; n (%)

There were no differences by weight status.

Table 10: Strengths and Difficulties

Characteristic	N	N = 107
Total Problems	93	
CloseToAverage		63 (68%)
High		12 (13%)
SlightlyRaised		12 (13%)
VeryHigh		6 (6.5%)
Unknown		14
Emotional Problems	104	
CloseToAverage		62 (60%)
High		19 (18%)
SlightlyRaised		14 (13%)
VeryHigh		9 (8.7%)
Unknown		3
Contuct Problems	102	
CloseToAverage		69 (68%)
High		18 (18%)
SlightlyRaised		13 (13%)
VeryHigh		2 (2.0%)
Unknown		5
Hyperactivity	103	
CloseToAverage		85 (83%)
High		1 (1.0%)
SlightlyRaised		12 (12%)
VeryHigh		5 (4.9%)
Unknown		4
Peer Problems	102	
CloseToAverage		40 (39%)
High		30 (29%)
SlightlyRaised		20 (20%)
VeryHigh		12 (12%)
Unknown		5
Prosocial	102	
CloseToAverage		77 (75%)
Low		5 (4.9%)
SlightlyLowered		15 (15%)
VeryLow		5 (4.9%)
Unknown		5

¹ n (%)

There were no differences by weight status.

4.1 Exploratory Sex x Percent of Overweight Models

4.1.1 Emotional Problems

Often complains of headaches

Many worries

Often unhappy, downhearted

Nervous or clingy in new situations

Many fears, easily scared

Table 11: Logistic Model: Emotional Problems (Elevated vs Not) - SES category + Maternal Education + Age + Sex + pOWcutoff

	b	e ^b	se	e ^{2.5} CI	e ^{97.5} CI	z	p
(Intercept)	1.731	5.646	1.586	0.261	1.402990e+02	1.092	0.275
Month_AED25,000 - 55,000 AED	0.055	1.056	0.516	0.385	2.961000e+00	0.106	0.916
Month_AED55,000 - 75,000 AED	0.306	1.358	1.048	0.145	1.062700e+01	0.292	0.770
Month_AED> 75,000 AED	-16.508	0.000	1361.866	NA	1.153126e+40	-0.012	0.990
Mother_ed	-0.034	0.967	0.074	0.835	1.120000e+00	-0.459	0.646
Age_yr	-0.164	0.849	0.092	0.703	1.013000e+00	-1.771	0.077
sexM	-0.091	0.913	0.515	0.326	2.504000e+00	-0.176	0.861
IOTF_pOWcutoff_c100	0.012	1.012	0.009	0.994	1.032000e+00	1.268	0.205
sexM:IOTF_pOWcutoff_c100	-0.007	0.993	0.013	0.968	1.018000e+00	-0.522	0.601

4.2 Conduct Problems

Often has temper tantrums or hot tempers

Generally obedient - Reverse Scored

Often fights with other children

Often lies or cheats

Steals from home, school or elsewhere

Table 12: Logistic Model: Conduct Problems (Elevated vs Not) - SES category + Maternal Education + Age + Sex + pOWcutoff

	b	e ^b	se	e ^{2.5} CI	e ^{97.5} CI	z	p
(Intercept)	-0.094	0.910	1.482	0.048	17.066	-0.064	0.949
Month_AED25,000 - 55,000 AED	-0.257	0.773	0.503	0.287	2.090	-0.512	0.608
Month_AED55,000 - 75,000 AED	0.288	1.334	0.961	0.192	9.327	0.300	0.764
Month_AED> 75,000 AED	-0.144	0.866	0.916	0.131	5.121	-0.158	0.875
Mother_ed	-0.040	0.961	0.072	0.830	1.107	-0.551	0.581
Age_yr	0.044	1.045	0.085	0.884	1.236	0.517	0.605
sexM	-0.650	0.522	0.491	0.193	1.343	-1.324	0.186
IOTF_pOWcutoff_c100	-0.004	0.996	0.009	0.978	1.014	-0.401	0.689
sexM:IOTF_pOWcutoff_c100	0.006	1.006	0.012	0.983	1.030	0.534	0.593

4.2.1 Hyperactivity

Restless, overactive

Constantly fidgeting or squirming

Easily distracted, concentration wanders

Thinks things out before acting - Reverse Scored

Sees tasks through to the end - Reverse Scored

Table 13: Logistic Model: Hyperactivity Problems (Elevated vs Not) - SES category + Maternal Education + Age + Sex + pOWcutoff

	b	e ^b	se	e ^{2.5} CI	e ^{97.5} CI	z	p
(Intercept)	0.581	1.788	1.902	0.040	7.997200e+01	0.305	0.760
Month_AED25,000 - 55,000 AED	-0.535	0.586	0.639	0.165	2.105000e+00	-0.837	0.402
Month_AED55,000 - 75,000 AED	-16.550	0.000	1593.735	NA	1.263091e+46	-0.010	0.992
Month_AED> 75,000 AED	0.284	1.328	1.068	0.137	1.041600e+01	0.265	0.791
Mother_ed	0.011	1.011	0.094	0.843	1.227000e+00	0.114	0.910
Age_yr	-0.147	0.863	0.112	0.686	1.069000e+00	-1.316	0.188
sexM	-0.346	0.707	0.630	0.191	2.366000e+00	-0.550	0.583
IOTF_pOWcutoff_c100	-0.001	0.999	0.012	0.975	1.022000e+00	-0.075	0.940
sexM:IOTF_pOWcutoff_c100	0.002	1.002	0.017	0.969	1.035000e+00	0.150	0.881

4.2.2 Peer Problems

Rather solitary, tends to play alone

Has at least one good friend - Reverse Scored

Generally liked by other children - Reverse Scored

Picked on or bullied

Gets on better with adults than with other children

When examining odds of experiencing elevated peer problems, controlling for family income, mother education, child age, and child sex, percent of overweight, there was a significant sex x percent of overweight interaction.

Table 14: Logistic Model: Peer Problems (Elevated vs Not) - SES category + Maternal Education + Age + Sex + pOWcutoff

	b	e ^b	se	e ^{2.5} CI	e ^{97.5} CI	z	p
(Intercept)	1.131	3.098	1.655	0.128	89.909	0.683	0.494
Month_AED25,000 - 55,000 AED	0.311	1.365	0.531	0.480	3.920	0.585	0.558
Month_AED55,000 - 75,000 AED	2.148	8.564	1.278	0.927	203.707	1.680	0.093 .
Month_AED> 75,000 AED	0.377	1.457	0.923	0.233	9.253	0.408	0.683
Mother_ed	-0.174	0.840	0.086	0.700	0.985	-2.024	0.043 *
Age_yr	0.087	1.091	0.093	0.911	1.316	0.941	0.347
sexM	0.349	1.418	0.503	0.537	3.915	0.693	0.488
IOTF_pOWcutoff_c100	0.026	1.026	0.011	1.005	1.051	2.265	0.024 *
sexM:IOTF_pOWcutoff_c100	-0.032	0.969	0.014	0.941	0.995	-2.256	0.024 *

sex = F:

IOTF_pOWcutoff_c100	IOTF_pOWcutoff_c100.trend	SE	df	asympt.LCL	asympt.UCL
15.9	0.02570	0.0113	Inf	0.00346	0.0479

sex = M:

IOTF_pOWcutoff_c100	IOTF_pOWcutoff_c100.trend	SE	df	asympt.LCL	asympt.UCL
15.9	-0.00607	0.0086	Inf	-0.02292	0.0108

Results are averaged over the levels of: Month_AED

Confidence level used: 0.95

For females, a female child with 110% of overweight cutoff would have 1.27 times the odds of experiencing elevated peer problems than a female child with 100% of overweight cutoff. There was no association between percent of overweight cutoff and odds of peer problems in males.

4.3 Prosocial

Considerate of other people's feelings

Shares readily with other children

Helpful if someone is hurt

Kind to younger children

Often volunteers to help others

Table 15: Logistic Model: Prosocial Problems (Low vs Not) - SES category + Maternal Education + Age + Sex + pOWcutoff

	b	\hat{e}^b	se	$\hat{e}^{2.5}$ CI	$\hat{e}^{97.5}$ CI	z	p	
(Intercept)	-0.614	0.541	1.756	0.016	16.595	-0.350	0.727	
Month_AED25,000 - 55,000 AED	0.352	1.423	0.619	0.437	5.121	0.570	0.569	
Month_AED55,000 - 75,000 AED	-0.387	0.679	1.378	0.024	7.720	-0.281	0.779	
Month_AED> 75,000 AED	2.030	7.617	1.034	1.041	64.644	1.964	0.050	*
Mother_ed	-0.061	0.941	0.082	0.795	1.105	-0.740	0.459	
Age_yr	0.010	1.010	0.102	0.826	1.238	0.101	0.919	
sexM	-1.032	0.356	0.656	0.086	1.192	-1.574	0.116	
IOTF_pOWcutoff_c100	-0.004	0.996	0.010	0.975	1.016	-0.394	0.693	
sexM:IOTF_pOWcutoff_c100	0.024	1.024	0.014	0.998	1.054	1.730	0.084	.