

Reduce Obesity in Middle School Students?

Analyzing Pennsylvania's Active Schools Program (ASP)

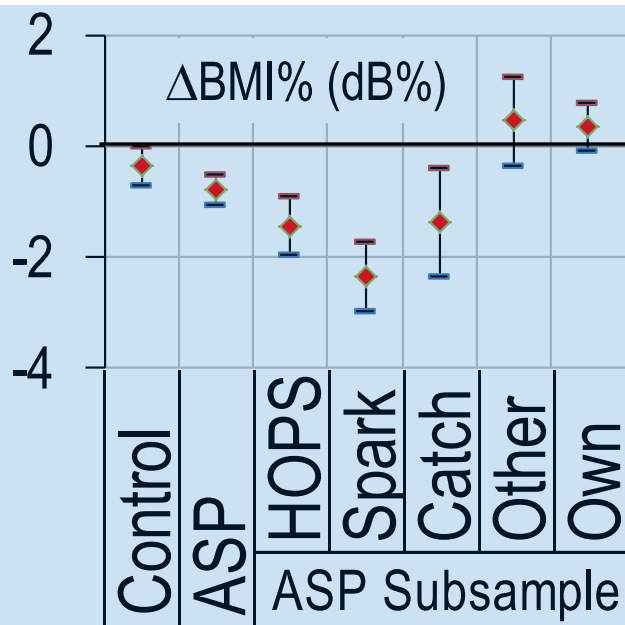
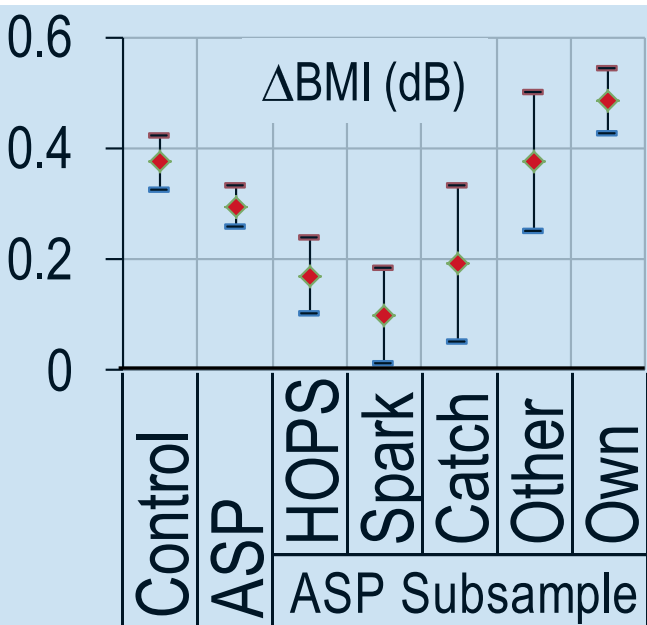
Stephen Erfle, Ph.D.

Presentation Outline

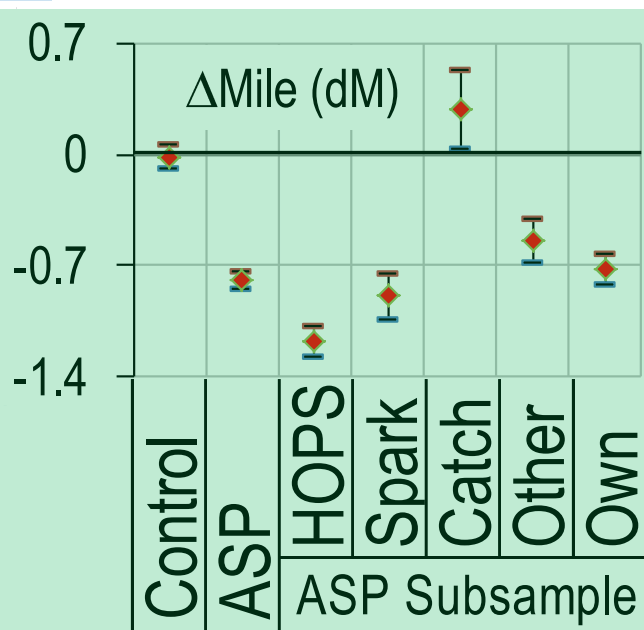
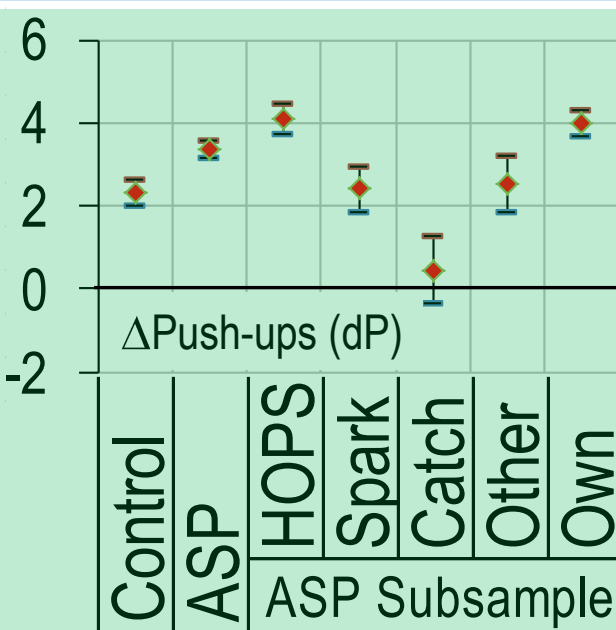
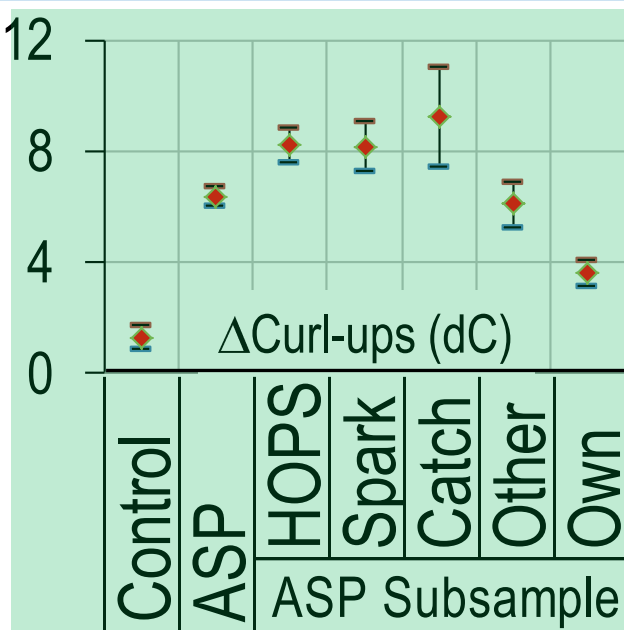
- Background of the ASP and ASP control schools
- Health & behavioral output measures with ASP assessments
- Comparing performance across Programs by output measure
- Disaggregating output measures by Program, Gender, and Obesity Status
- Comparing performance across output measures using Standardized Mean Differences
- Examining change in BMI percentile for overweight & obese students as a function of behavioral measures, gender and Program using regression models

- Basic attributes of the PADOH's Active Schools Program
 - Conceived by PA Sec. of Health James and Sec. of Education Zahorchak
 - Provided one-time \$15K grants to middle schools that agreed to institute 30 minutes of daily PA and to assess physical activity performance at the start and end of the 2009/10 school year
 - Preference was given to schools coming from districts with above state average BMI% \geq 85 (of 33.5%)
 - Schools were allowed to choose from a palate of evidence-based programs provided by PADOH or they were allowed to propose their own program
 - Three programs were chosen by multiple schools: Hopsports (9), Spark (7), and Catch (2)
 - 3 other programs were chosen by 1 school each and 9 schools created their own program
- PADOH did not fund control schools; ALR Rapid Response Grant #68311 provided funding to obtain control school data for the ASP
 - Control schools assessed student physical activity performance using ASP protocols at the start and end of the 2010/11 school year but otherwise maintained their schedule of non-daily PA
- ASP data allows analysis at the health and behavioral outcome levels

Mean and 95% CI for 2 Health & 3 Behavioral Outcome Measures $\Delta x = x_{\text{Spring}} - x_{\text{Fall}}$



	N_{schools}	N_{students}
Control	9	3,513
ASP	30	6,693
ASP Subsample		
HOPS	9	2,066
Spark	7	1,069
Catch	2	601
Other	3	331
Own	9	2,626



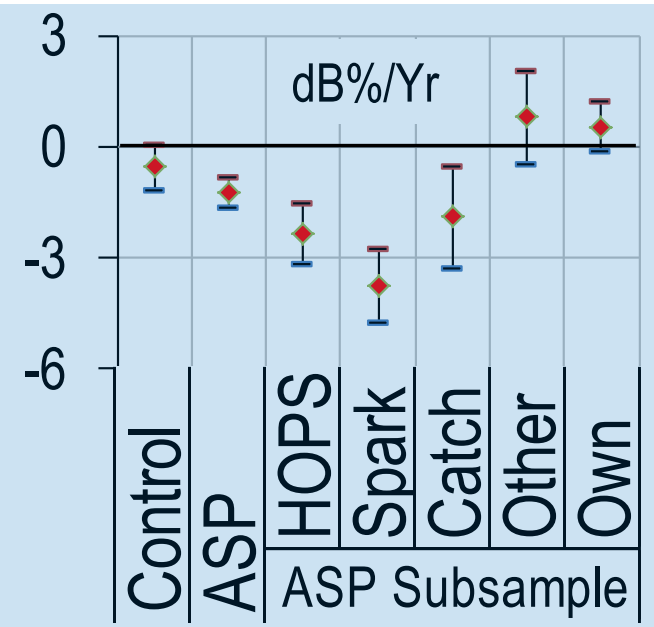
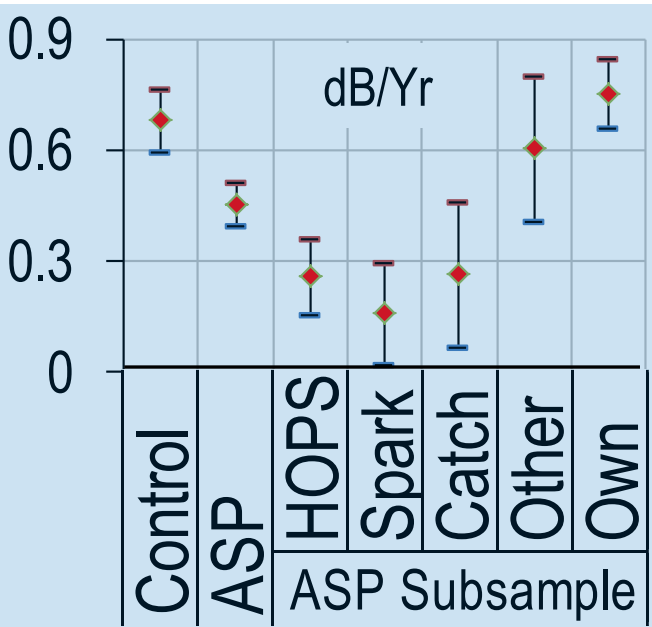
• ASP schools appear to exhibit superior performance on both health & behavioral outcomes

Summary Statistics for Number of Days Between Assessments, dDays

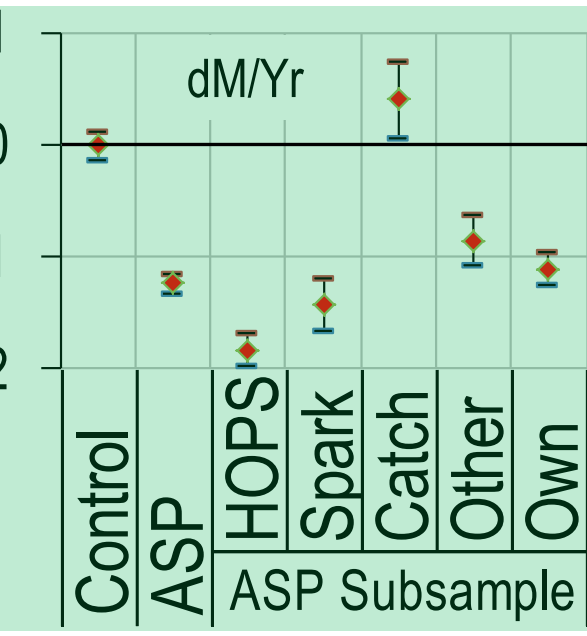
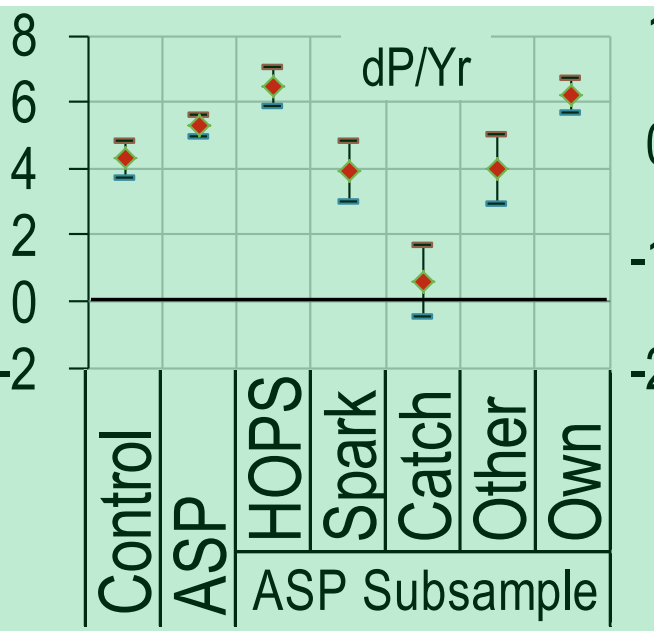
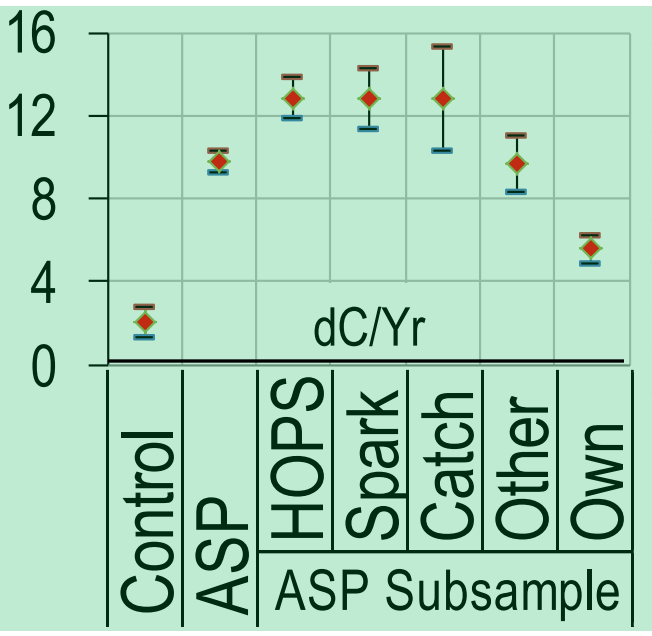
Subsample	<u>Subsample Size</u>		Mean	Std. Dev.	<u>Quartile values</u>					
	Schools	Students			25 th	Median	75 th	Minimum	Maximum	
Control	9	3,513	206.8	26.1	182	195	233	146	245	
ASP	30	6,693	235.7	18.4	225	233	245	143	283	
ASP Subsample	HOPS	9	2,066	232.2	22.5	223	224	237	176	279
	Spark	7	1,069	228.8	13.2	225	231	234	181	249
	Catch	2	601	265.0	2.4	263	263	267	260	283
	Other	3	331	229.5	9.4	228	230	230	182	257
	Own	9	2,626	235.4	12.3	230	234	243	143	271
Total	39	10,206	225.8	25.4	215	230	238	143	283	

- Part of the difference between ASP and control schools may be due to the shorter time between assessments (of approximately one month)
- Even among ASP schools there were significant differences in the time between assessments
- As a result, the health and behavioral outcomes are also examined using annualized changes
 - Annualized changes are calculated as: $dx/Yr = dx \cdot 365/dDays$

Annualized Statistics for 2 Health & 3 Behavioral Outcome Measures $dx/Yr = dx \cdot 365/dDays$



	$N_{schools}$	$N_{students}$
Control	9	3,513
ASP	30	6,693
ASP Subsample		
HOPS	9	2,066
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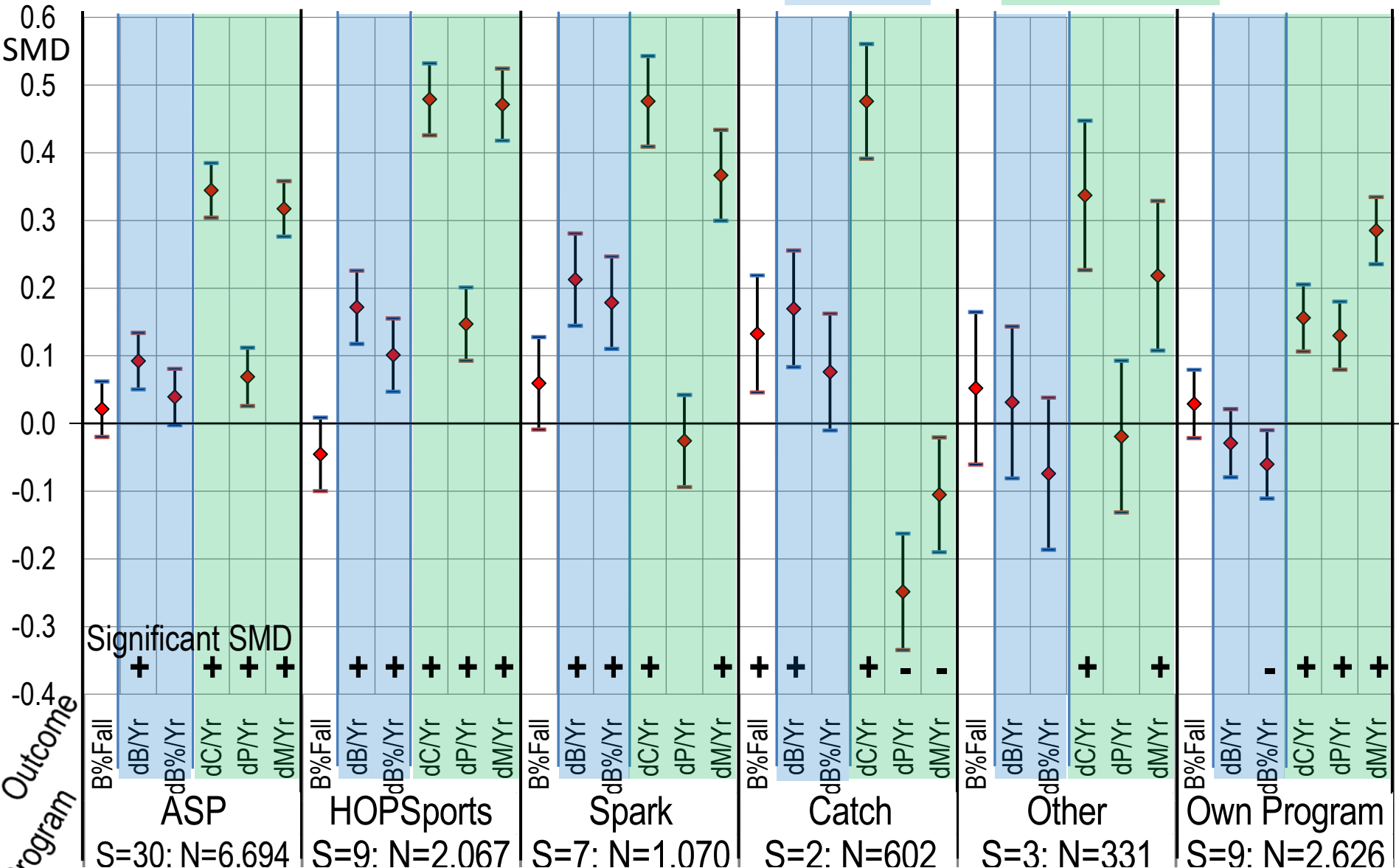


• Even with annualized metrics, ASP schools appear to exhibit superior performance outcomes

Difference between Means Tests: *Program - Control* for 5 Outcome Measures

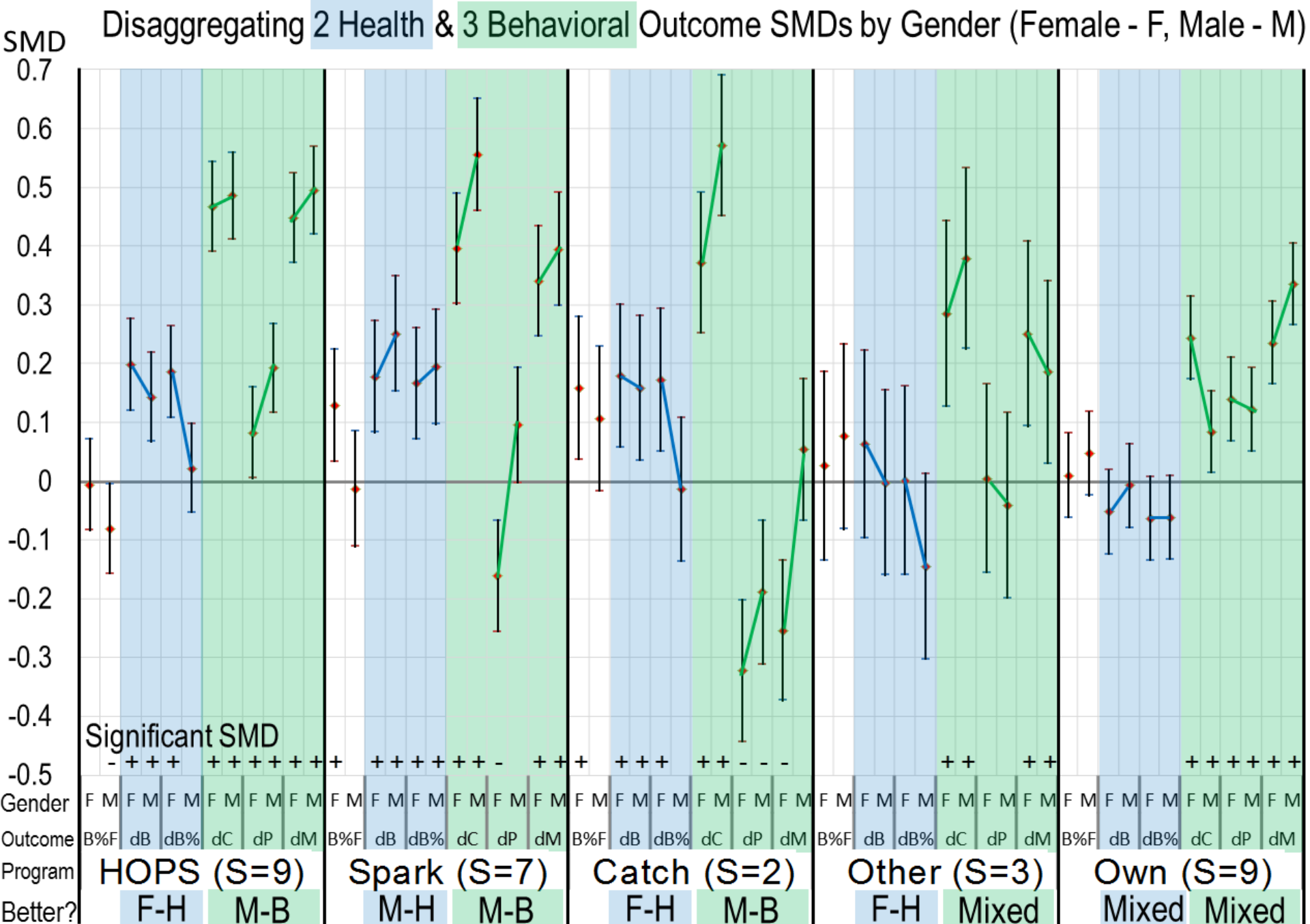
Health Outcome Measures	<u>Nominal</u>		<u>Annualized</u>		Program	Behavioral Outcome Measures	<u>Nominal</u>		<u>Annualized</u>	
	Mean Δ	Sig. level	Mean Δ	Sig. level			Mean Δ	Sig. level	Mean Δ	Sig. level
Δ BMI (dB, dB/Yr)	-0.08	.009	-0.23	< .001	ASP	Δ Curl-ups (dC, dC/Yr)	5.08	< .001	7.78	< .001
	-0.21	< .001	-0.42	< .001	HOPS		6.91	< .001	10.81	< .001
	-0.28	< .001	-0.52	< .001	Spark		6.90	< .001	10.75	< .001
	-0.18	.006	-0.42	< .001	Catch		7.93	< .001	10.74	< .001
	0.00	.997	-0.08	.585	Other		4.80	< .001	7.61	< .001
	0.11	.005	0.07	.256	Own		2.29	< .001	3.52	< .001
Δ BMI%ile (dB%, dB%/Yr)	-0.42	.066	-0.70	.065	ASP	Δ Push-ups (dP, dP/Yr)	1.05	< .001	1.02	< .001
	-1.08	< .001	-1.81	< .001	HOPS		1.76	< .001	2.17	< .001
	-1.99	< .001	-3.20	< .001	Spark		0.07	.812	-0.38	.458
	-1.02	.039	-1.36	.084	Catch		-1.88	< .001	-3.68	< .001
	0.82	.203	1.33	.196	Other		0.20	.705	-0.29	.735
	0.72	.013	1.08	.019	Own		1.66	< .001	1.92	< .001
<i>Program</i> is better than <i>Control</i> if:					ASP	Δ Mile time (dM, dM/Yr)	-0.78	< .001	-1.23	< .001
- sign on both Health Outcomes					HOPS		-1.16	< .001	-1.83	< .001
+ sign on Δ Curl-ups & Δ Push-ups					Spark		-0.88	< .001	-1.43	< .001
- sign on Δ Mile					Catch		0.29	.004	0.41	.015
					Other		-0.53	< .001	-0.85	< .001
					Own		-0.71	< .001	-1.11	< .001
Significance differences		Sig. Perverse Sign								

Standardized Mean Difference & 95% CI for 2 Health and 3 Behavioral Outcomes



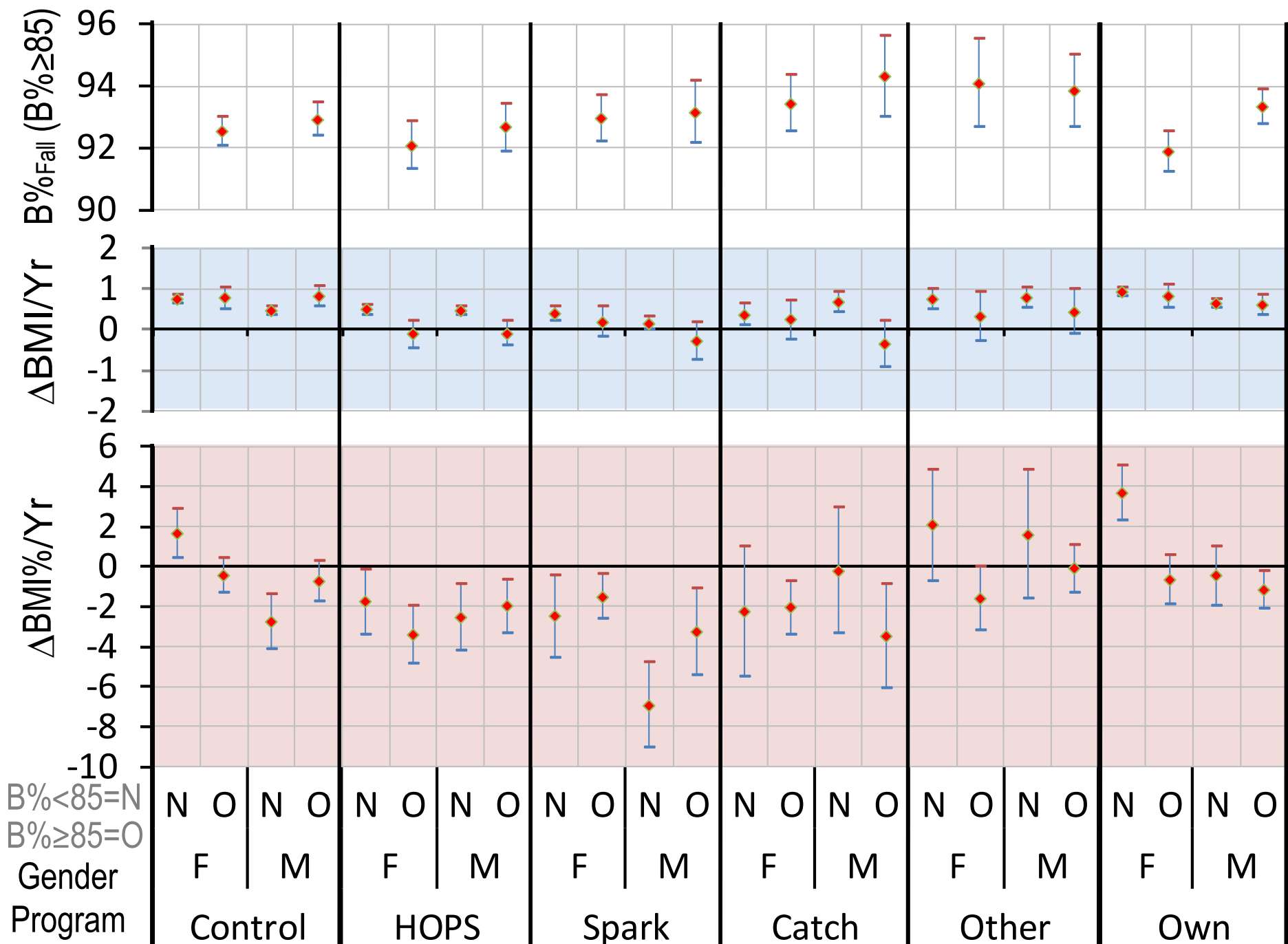
SMD = (annualized mean difference)/(total standard deviation). Differences defined so

that an SMD > 0 means higher performance by Program than Control schools (N=3,513) for that variable. Also includes B% Fall SMD (as (Program - Control) on white background).

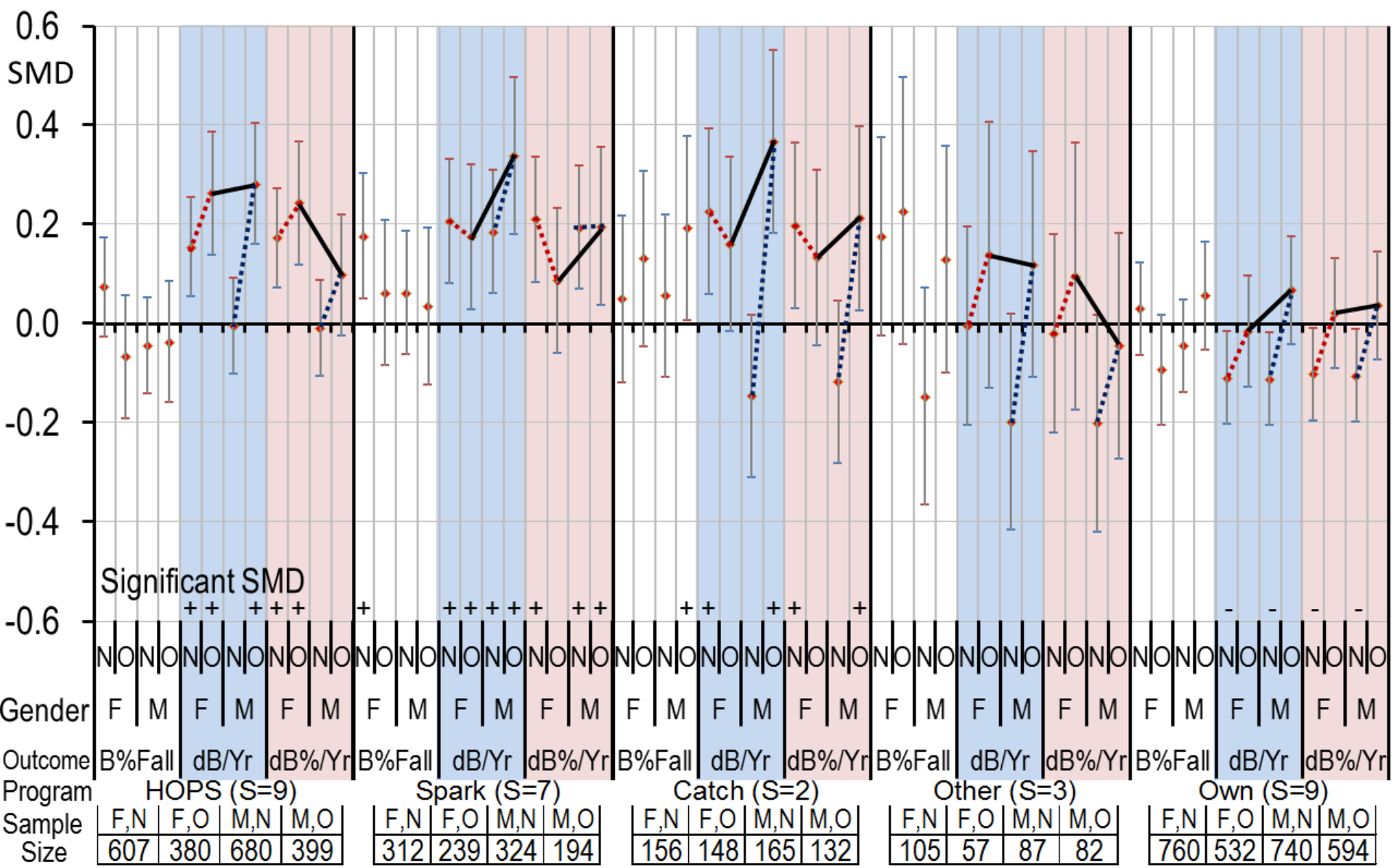


Note. Sign of sloped segment signifies who did better on this outcome: F if - slope; M if + slope.

Mean & 95% CI of Annualized Health Outcomes by Obesity Status and Gender

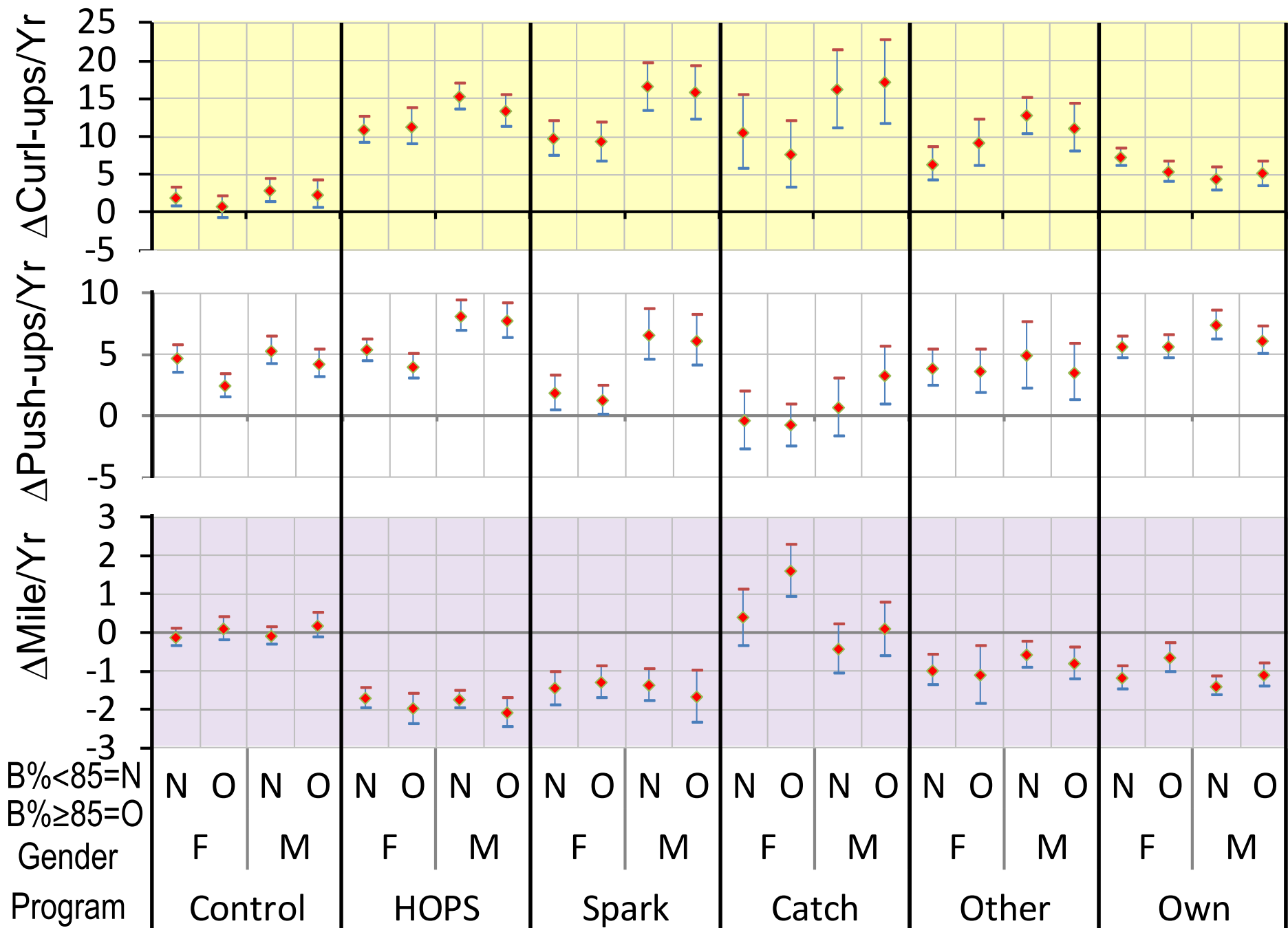


Disaggregating Gendered Health Outcome SMDs by Obesity Status (N is B% < 85, O is B% ≥ 85)

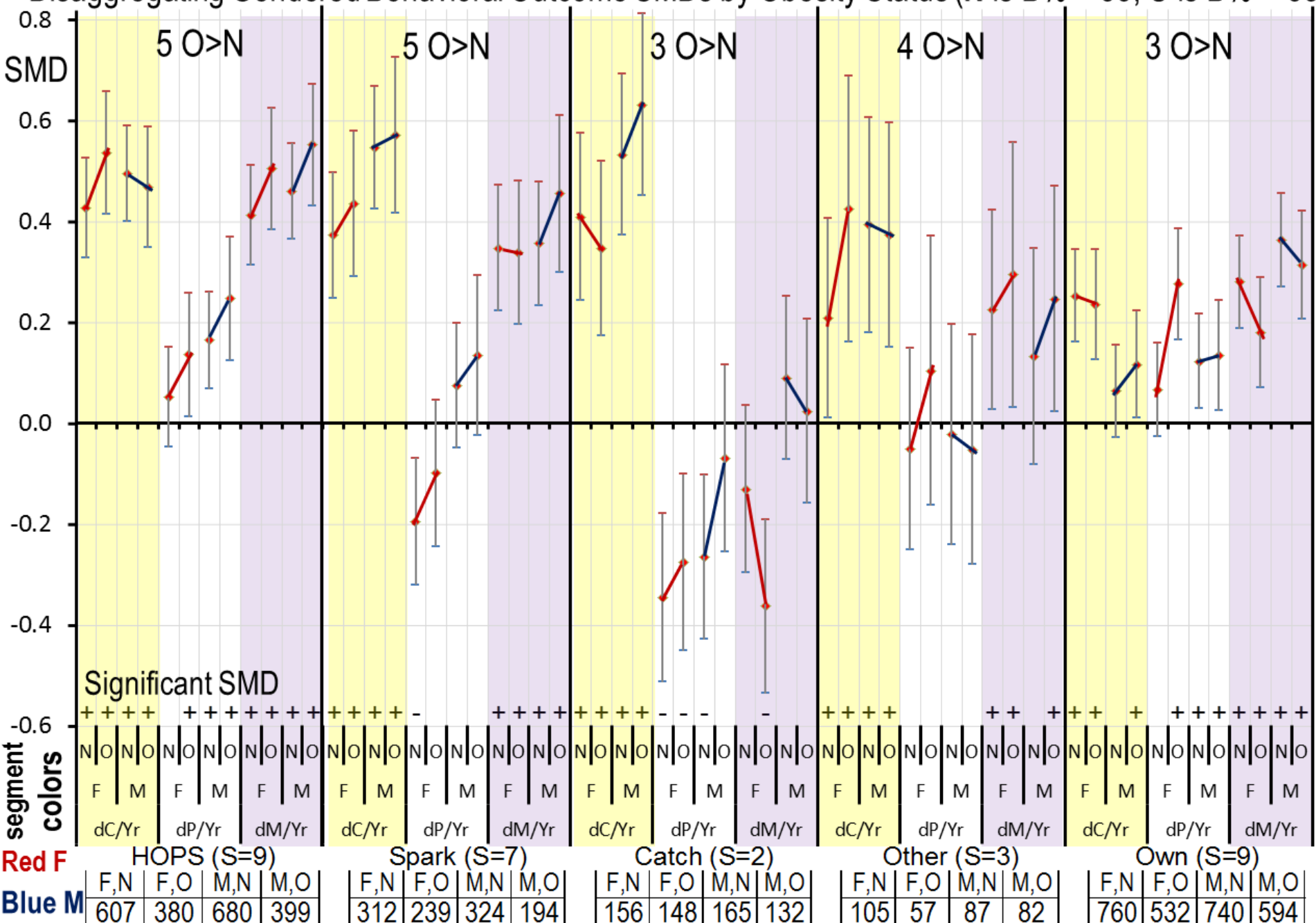


- Note: Health outcome measures are ambiguous for **N** subsamples, but not for **O** subsamples
- Solid black segments examine gender differences for the **O** subsamples: F if - slope; M if + slope
- Dashed segments examine **N** vs. **O** by gender (**red F** & **blue M**): **N** if - slope; **O** if + slope

Mean & 95% CI of Annualized Behavioral Outcomes by Obesity Status and Gender



Disaggregating Gendered Behavioral Outcome SMDs by Obesity Status (N is B% < 85, O is B% ≥ 85)



Red F

Blue M

Note. Sign of sloped segment signifies who did better on this outcome: N if - slope; O if + slope.

Modeling dB%/Yr for O&O Students, Part I

Variable	Subsample	ASP+	HOPS+	Spark+	Catch+	Other+	Own+
Intercept		-43.0 ***	-51.4 *	-33.3	-43.7	-19.1	-10.9
B% _{Fall}		9.19 ***	9.53 ***	9.26 ***	9.75 ***	8.50 ***	7.84 ***
B% ² _{Fall}		-0.18 ***	-0.19 ***	-0.19 ***	-0.20 ***	-0.18 ***	-0.17 ***
B% ³ _{Fall} /100		0.10 ***	0.10 ***	0.10 ***	0.10 ***	0.09 ***	0.09 ***
Male		-0.15	0.06	-0.87	-0.72	-0.30	-0.09
Program		-1.33 ***	-2.55 ***	-1.29 *	-1.76 **	0.72	-0.60
Adjusted R ²		.387	.412	.401	.405	.411	.388
F		530 ***	311 ***	250 ***	234 ***	218 ***	323 ***
N		4,187	2,209	1,863	1,710	1,569	2,556

Note. Raw regression coefficients. *s denote statistical significance: *p < .05; **p < .01; ***p < .001. Samples restricted to students with B% ≥ 85 and include 1,430 Control students. Each model controls for gender and starting B%.

- Program coefficients in these models do not control for differences in behavioral outcomes
- Part of the program effect is due to increased behavioral outcomes at ASP schools

Modeling dB%/Yr for O&O Students using Behavioral Outcomes

Variable \ Subsample		ASP+	HOPS+	Spark+	Catch+	Other+	Own+
Behavioral outcomes	dC/Yr	-0.024 ***	-0.019	-0.015	-0.018	-0.015	-0.021 *
	dP/Yr	-0.056 ***	-0.079 ***	-0.046 **	-0.054 **	-0.067 ***	-0.065 ***
	dM/Yr	0.25 ***	0.26 ***	0.32 ***	0.22 ***	0.24 ***	0.21 ***
	Male	0.10	0.29	-0.71	-0.51	-0.19	0.05
	Program	-0.74 *	-1.58 ***	-0.61	-1.86 **	1.11	-0.14
Summary statistics	Adjusted R ²	.399	.427	.415	.415	.425	.399
	F	349 ***	207 ***	166 ***	152 ***	144 ***	211 ***
	N	4,187	2,209	1,863	1,710	1,569	2,556
Program	Female	-1.24	-2.44	-1.13	-1.48	0.60	-0.60
Net Effect	Male	-1.32	-2.35	-2.20	-2.60	0.59	-0.54

Note. Raw regression coefficients. *s denote statistical significance: *p < .05; **p < .01; ***p < .001. Intercept, B%_{Fall}, B%²_{Fall}, & B%³_{Fall} terms suppressed in this table. Each

sample restricted to students with B% ≥ 85 & includes 1,430 Control students.

Program net effect is expected dB%/yr at gendered O&O means, so the HOPSports female -2.44 = -1.58 -0.019·(11.3 - 0.7) -0.079·(4.0 - 2.4) + 0.26·(-2.0 - 0.1), using female annualized O&O HOPSports & Control means for each behavioral outcome.

General Conclusions

- Daily PA in schools does have statistically significant health and behavioral outcomes relative to non-daily PA using difference between means tests and standardized mean differences
- As expected, the effects are stronger with behavioral metrics than with health metrics
 - The health impact was greater on BMI than BMI percentile
 - The behavioral impact was greater for curl-ups and mile run than push-ups
- These impacts varied by program chosen, gender, and obesity status

Mean SMD across Outcomes by Gender & Obesity Status			HOPS		Spark		Catch		Other		Own						
			N	sig.	$\overline{\text{SMD}}$	N	sig.	$\overline{\text{SMD}}$	N	sig.	$\overline{\text{SMD}}$	N	sig.	$\overline{\text{SMD}}$			
2 Health Outcomes	Female	B% \geq 85	2		0.25	1		0.13	0		0.15	0		0.12	0		0.00
	Male		1		0.19	2		0.27	2		0.29	0		0.04	0		0.05
3 Behavioral Outcomes	Female	B% $<$ 85	2		0.30	2,-1		0.17	1,-1		-0.02	2		0.13	2		0.20
		B% \geq 85	3		0.39	2		0.22	1,-2		-0.10	2		0.27	3		0.23
	Male	B% $<$ 85	3		0.37	2		0.32	1,-1		0.12	1		0.17	2		0.18
		B% \geq 85	3		0.42	2		0.39	1		0.19	2		0.19	3		0.19
Total significant (out of 16)			14		0.32	11,-1		0.25	6,-4		0.10	7		0.15	10		0.14

- Except for Catch Females, daily PA has larger mean SMD for O&O than non-O&O subsample
- Hopsports and Spark appear to have the best overall outcomes
 - Spark exhibits greater benefit for males, and Hopsports is more balanced across genders

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