

Appendix
The Dose–Response Relationship Between Physical Activity
and Cardiometabolic Health in Adolescents
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Appendix Table 1. Distribution of Physical Activity and Cardiometabolic Measures Among Adolescents (Age 12–19 Years),^a NHANES

Variable	Median (Q1, Q3)
Physical activity	
Objective physical activity ^b	
Female	36.9 (18.4, 77.2) minutes/week
Male	68.0 (31.1, 142) minutes/week
Self-report physical activity ^c	
Female	266.0 (120.0, 526.0) minutes/week
Male	372.0 (179.0, 655.0) minutes/week
Cardiometabolic measure	
Median (Q1, Q3)	
Systolic blood pressure	
Female	105.5 (99.6, 111.7) mmHg
Male	110.8 (104.3, 117.4) mmHg
Diastolic blood pressure	
Female	61.4 (54.3, 67.6) mmHg
Male	59.2 (51.5, 66.7) mmHg
Total cholesterol	
Female	157.8 (140.1, 176.9) mg/dL
Male	150.3 (134.3, 171.2) mg/dL
High density lipoprotein	
Female	52.1 (45.0, 61.3) mg/dL
Male	47.8 (40.6, 55.5) mg/dL
BMI ^d	
Female	77.7 (69.0, 92.7) percentile
Male	80.8 (72.0, 95.3) percentile
VO ₂ max ^c	
Female	36.2 (32.3, 41.4) ml/kg(min)
Male	44.3 (39.1, 49.9) ml/kg(min)

^aReported among adolescents with any reported physical activity or cardiometabolic measure.

^bData from NHANES 2003–2006.

^cData from NHANES 2007–2016.

^dBMI represented as percent of the 95th percentile.

NHANES, National Health and Nutrition Examination Survey.

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Appendix Table 2. Sample Characteristics of Adolescents (Age 12–19 Years), NHANES 2003–2006

Characteristics	Females (N=1,850) % (95% CI)	Males (N=1,927) % (95% CI)
Age, median (Q1, Q3)	14.7 (12.9, 16.6)	14.4 (12.6, 16.5)
Race/Ethnicity		
Non-Hispanic White	63.0 (57.1, 68.9)	64.3 (57.5, 71.2)
Non-Hispanic Black	15.2 (11.2, 19.2)	14.9 (10.8, 19.0)
Mexican American	11.2 (8, 14.4)	11.4 (8.4, 14.3)
Other Hispanic	4.7 (2.5, 7.0)	4.5 (2.7, 6.3)
Other	5.8 (3.8, 7.8)	4.9 (2.8, 7.0)
Federal poverty level ratio distribution		
<1	19.5 (15.8, 23.3)	18.8 (15.5, 22.0)
1–1.9	21.2 (17.9, 24.5)	19.2 (16.2, 22.3)
2–2.9	17.5 (14.0, 21.0)	18.9 (15.5, 22.4)
3–3.9	15.2 (12.3, 18.2)	15.3 (12.2, 18.5)
≥4	26.6 (21.0, 32.2)	27.7 (23.8, 31.6)
Missing	3.8 (2.4, 5.3)	3.2 (1.6, 4.8)
Insurance type		
No insurance	11.7 (8.9, 14.5)	12.2 (10.0, 14.3)
Private insurance	70.5 (65.8, 75.1)	67.9 (63.0, 72.7)
Medicaid	15.4 (11.5, 19.3)	15.0 (12.0, 18.0)

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Appendix Table 3. Sample Characteristics of Adolescents (Age 12–19 Years), NHANES 2007–2016

Characteristics	Female (N=3,108) % (95% CI)	Male (N=3,303) % (95% CI)
Age, median (Q1, Q3)	14.9 (13.1, 16.7)	14.8 (13, 16.9)
Race/Ethnicity		
Non-Hispanic White	56.4 (52.3, 60.4)	56.4 (52, 60.8)
Non-Hispanic Black	14.8 (12.3, 17.3)	14.4 (12.0, 16.8)
Mexican American	13.6 (11.0, 16.2)	14.0 (11.5, 16.5)
Other Hispanic	7.2 (5.7, 8.6)	6.8 (5.4, 8.3)
Other	8.1 (6.7, 9.4)	8.4 (6.9, 9.9)
Federal poverty level ratio distribution		
<1	23.5 (20.9, 26.2)	21.8 (18.9, 24.6)
1–1.9	23.4 (20.8, 26.1)	22.7 (20.3, 25.0)
2–2.9	17.0 (14.5, 19.5)	14.7 (12.9, 16.5)
3–3.9	12.5 (10.3, 14.7)	13.8 (11.5, 16.1)
≥4	23.6 (20.3, 26.9)	27.1 (23.6, 30.5)
Missing	7.4 (6.0, 8.8)	7.1 (5.7, 8.5)
Insurance type		
No insurance	11.7 (9.9, 13.4)	12.1 (10.6, 13.6)
Private insurance	55.2 (51.7, 58.8)	54.8 (51.4, 58.1)
Medicaid	22.6 (20.2, 25.0)	21.1 (18.8, 23.3)

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Appendix Table 4. Estimated Mean Change of Cardiometabolic Measures for Total Self-Reported Physical Activity (Sum of Recreational, Occupational, and Transport) in Adolescents (Age 12–19 Years), NHANES 2007–2016

Variable	Total self-report (420 vs 0 weekly minutes) ^a	
	Unadjusted (SE)	Adjusted (SE)
Systolic blood pressure		
Female	0.04 (0.22)	–0.06 (0.23)
Male	0.56 (0.19)	0.02 (0.20)
Diastolic blood pressure		
Female	0.27 (0.20)	–0.07 (0.20)
Male	0.50 (0.19)	–0.18 (0.18)
Total cholesterol		
Female	–0.50 (0.60)	–0.95 (0.67)
Male	0.25 (0.50)	–0.23 (0.57)
High density lipoprotein		
Female	0.40 (0.23)	0.41 (0.26)
Male	1.32 (0.53)^b	1.40 (0.52)
BMI		
Female	–1.14 (0.36)	–0.71 (0.37)
Male	–0.23 (0.30)	–0.08 (0.33)

Notes: Boldface indicates statistical significance ($p < 0.05$). BMI represented as percent of the 95th percentile.

^aData from NHANES 2007–2016. Change in cardiometabolic measure at 420 weekly minutes (per adolescent physical activity guideline recommendations) compared to 0 minutes of activity.

^bIndicates non-linear relationship.

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Appendix Table 5. Estimated Mean Change of Cardiometabolic Measures for Physical Activity in Adolescents (Sensitivity Analysis for Ages 12–17 Years), NHANES 2003–2016

Measure	Objective (150 vs 0 weekly minutes) ^a		Self-report (420 vs 0 weekly minutes) ^b	
	Unadjusted (SE)	Adjusted (SE)	Unadjusted (SE)	Adjusted (SE)
Systolic blood pressure				
Female	–3.12 (1.14)^c	–2.84 (1.12)	0.25 (0.40)	0.34 (0.40)
Male	–1.56 (0.62)	–1.14 (0.64)	0.58 (0.29)	0.48 (0.30)
Diastolic blood pressure				
Female	–2.81 (0.84)^c	–2.59 (0.97)	–1.07 (0.75)^c	–1.61 (0.70)
Male	–1.62 (0.79)	–0.92 (0.83)	–0.27 (0.38)	–0.65 (0.40)
Total cholesterol				
Female	–0.23 (3.35)	–0.40 (3.59)	–1.19 (1.04)	–1.51 (1.10)
Male	0.49 (1.59)	–2.38 (1.85)	–0.99 (0.95)	–0.67 (1.00)
High density lipoprotein				
Female	–0.95 (1.56)	–0.64 (1.86)	1.27 (0.45)	1.27 (0.45)
Male	3.85 (1.03)	2.42 (1.02)	1.5 (0.40)	1.69 (0.42)
BMI				
Female	–5.96 (2.36)^c	–6.84 (2.40)	–2.09 (0.60)	1.22 (0.64)
Male	–7.63 (2.17)^c	–9.07 (2.31)	–0.50 (0.59)	–0.17 (0.62)
VO ₂ max				
Female	0.97 (1.11)	0.13 (1.20)	N/A ^d	N/A ^d
Male	3.12 (1.15)	4.73 (1.37)	N/A ^d	N/A ^d

Notes: Boldface indicates statistical significance ($p < 0.05$). BMI represented as percent of the 95th percentile.

^aData from NHANES 2003–2006. Change in cardiometabolic measure at 150 weekly minutes (per adult physical activity guideline recommendations) compared to 0 minutes of activity.

^bData from NHANES 2007–2016. Change in cardiometabolic measure at 420 weekly minutes (per adolescent physical activity guideline recommendations) compared to 0 minutes of activity.

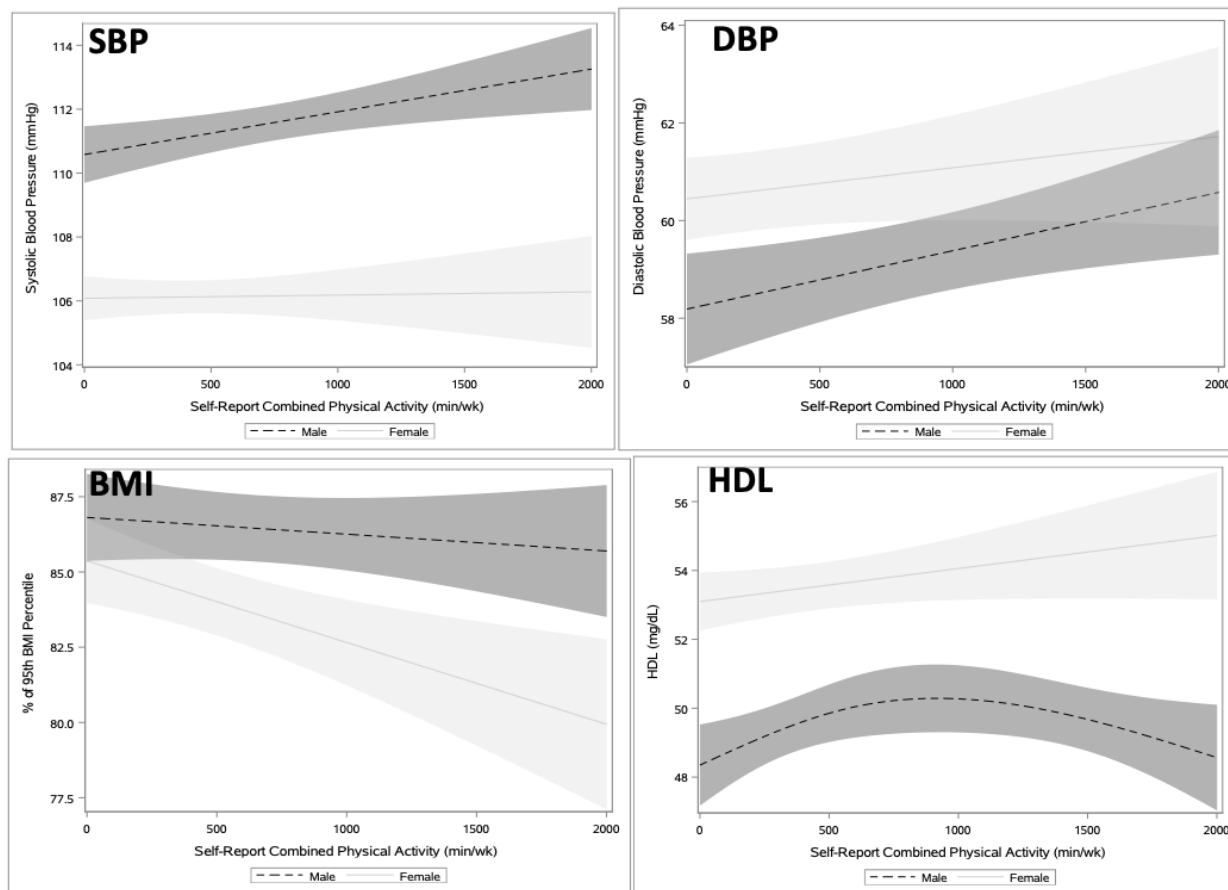
^cIndicates non-linear relationship.

^dMeasure not available for survey years used for self-report physical activity data.

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Appendix Figure 1. Association between self-reported total (recreational, occupational, transportation) physical activity and cardiometabolic measures among adolescents (age 12–19 years), NHANES 2007–2016.

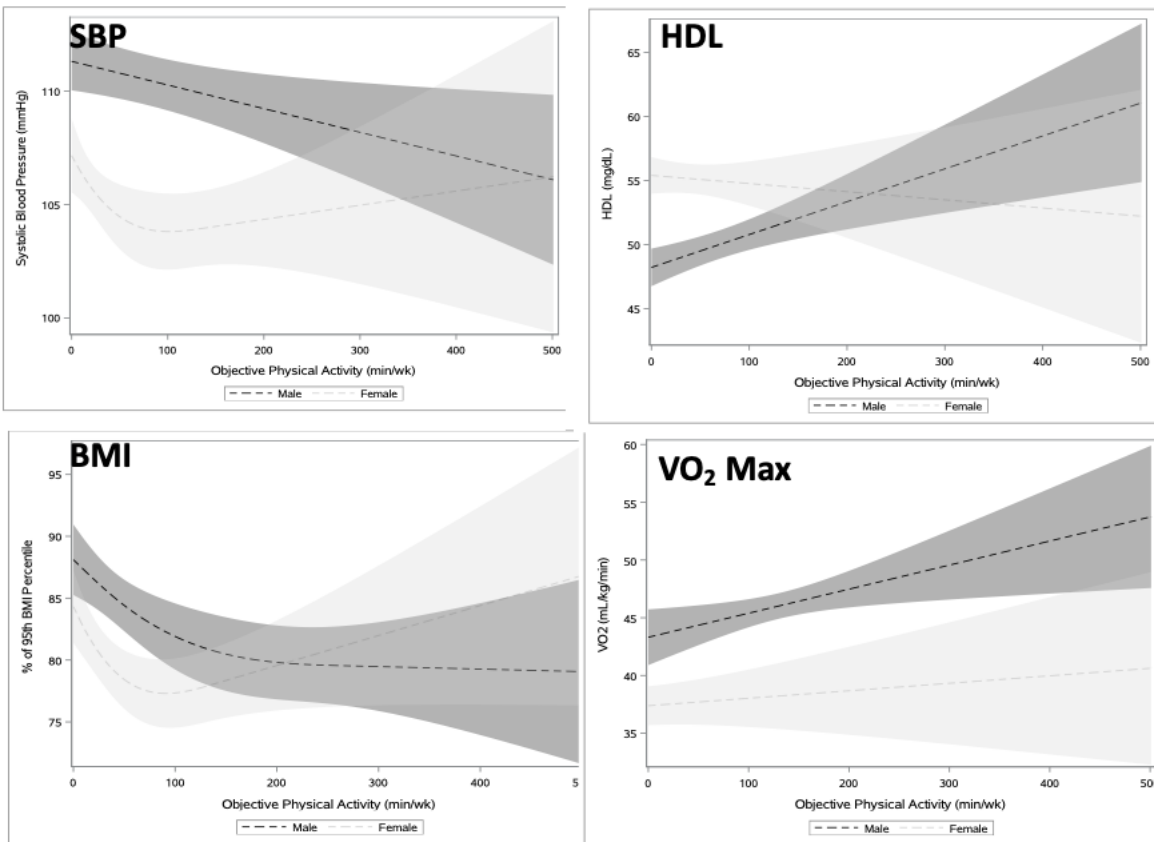


Notes: Unadjusted models. Shading represents 95% CI. Self-Reported Total Physical Activity includes recreational, occupational, and transportation physical activity.

SBP, systolic blood pressure; DBP, diastolic blood pressure; HDL, high density lipoprotein; NHANES, National Health and Nutrition Examination Survey.

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Appendix Figure 2. Association between objective physical activity and cardiometabolic measures among adolescents (age 12–17 years), NHANES 2003–2006.

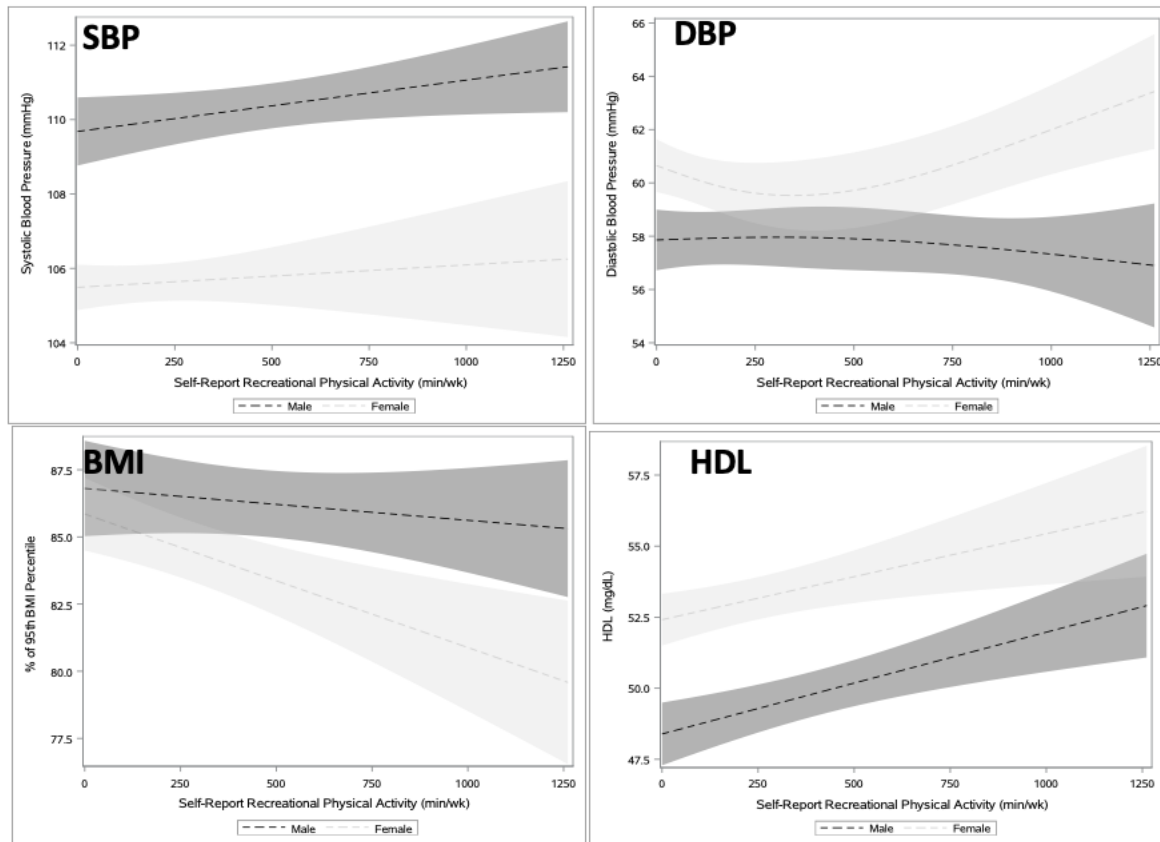


Notes: Unadjusted models. Shading represents 95% CI.

SBP, systolic blood pressure; HDL, high density lipoprotein; NHANES, National Health and Nutrition Examination Survey.

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Appendix Figure 3. Association between self-report (recreational) physical activity and cardiometabolic measures among adolescents (age 12–17 years), NHANES 2007–2016.



Notes: Unadjusted models. Shading represents 95% CI.

SBP, systolic blood pressure; DBP, diastolic blood pressure; HDL, high density lipoprotein; NHANES, National Health and Nutrition Examination Survey.