

# Physical Activity and Mental Health in College Students before and during COVID-19

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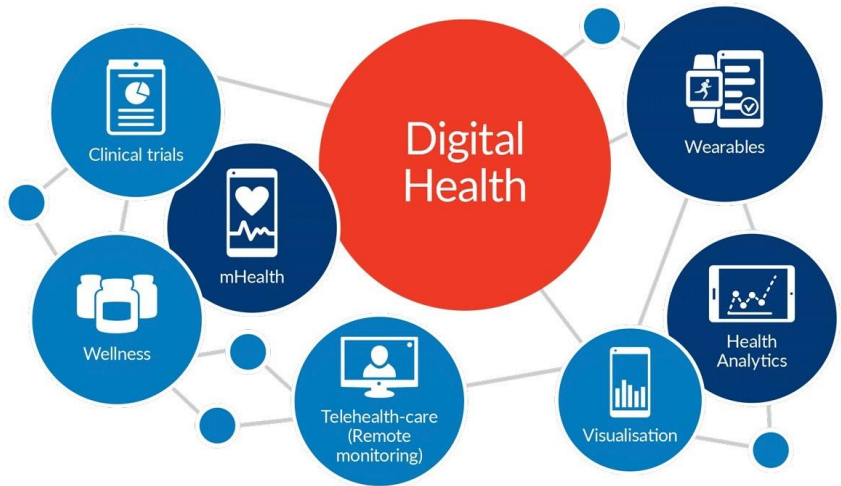


**Validation study**



**Accuracy**

**Intervention study**



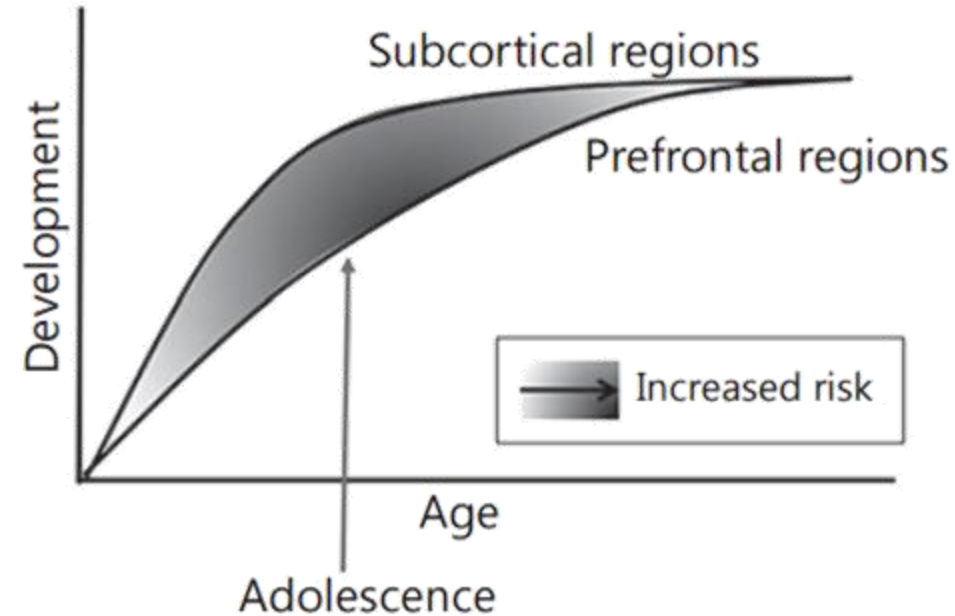
**Increase physical activity**  
**Reduce sedentary behavior**

# Background of Wellness Environment Study

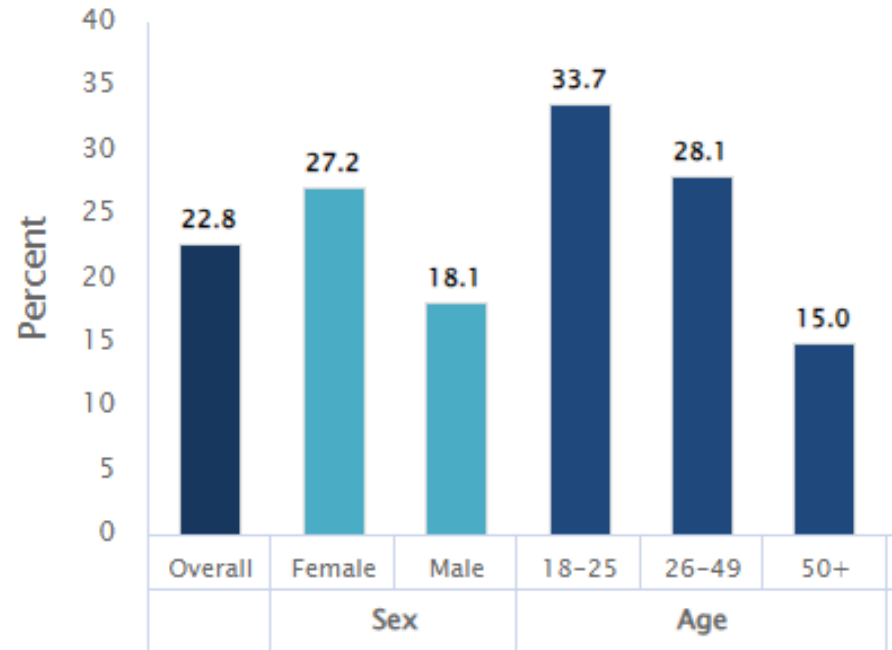


**A neuroscience inspired, incentive-based, behavior change program to build healthy brains and healthy bodies in UVM students.**

# Developmental Mismatch Hypothesis



1. Leaving home and entering college
2. Easier access to alcohol and drugs
3. High-risk social activities
4. Social transition
5. Academic adjustments
6. Financial Management



Past year prevalence of any mental illness among U.S. Adults (2021)  
SAMHSA

# The UVM Wellness Environment: a College Undergraduate Health-Promoting Program

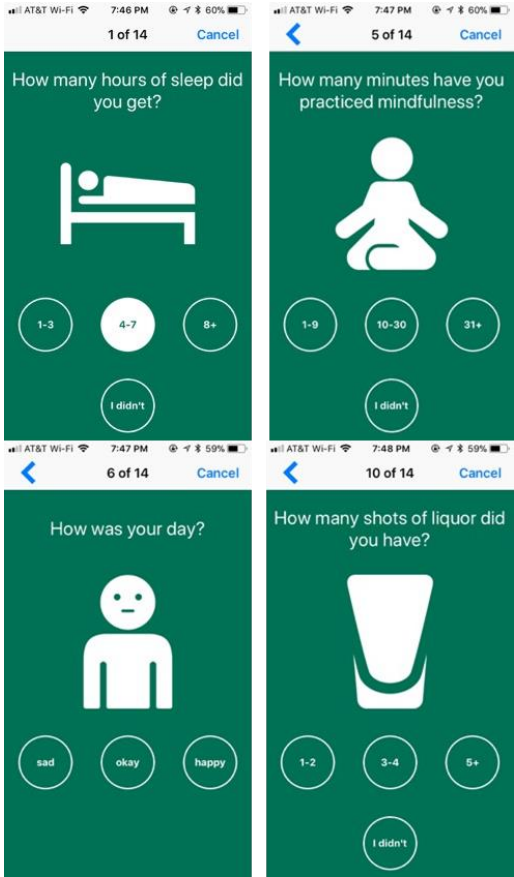
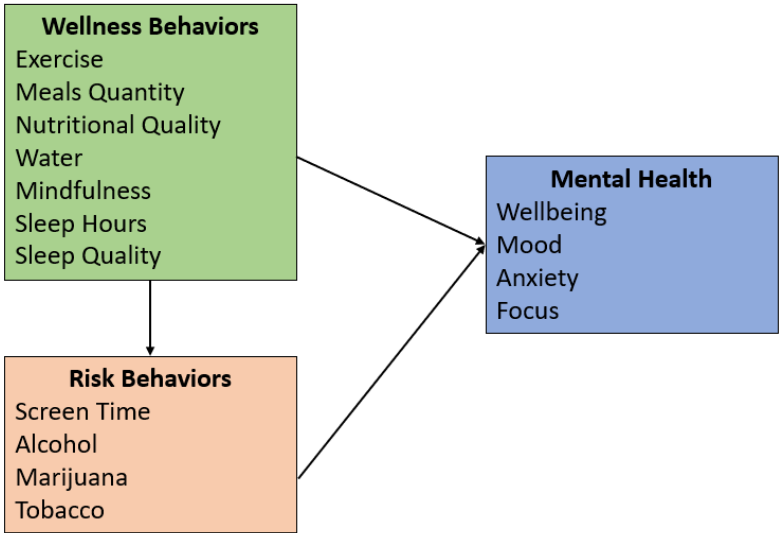
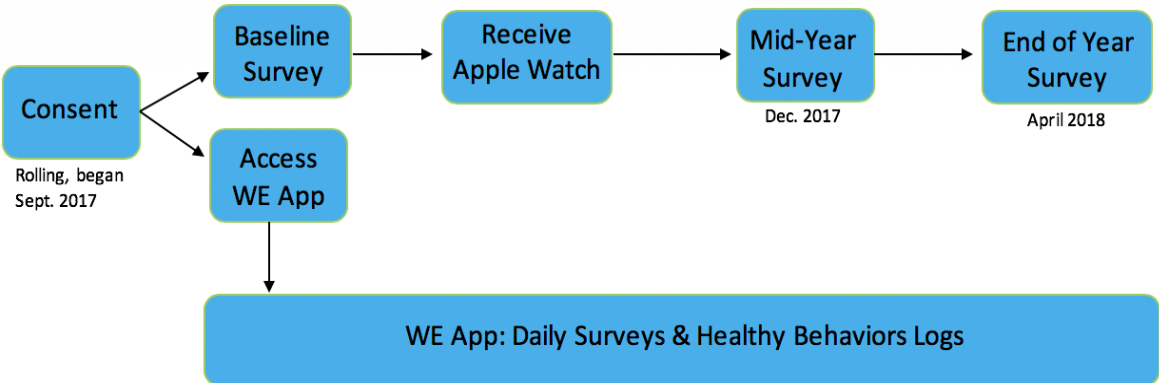
		Pillars of WE			
		Nutrition	Mindfulness	Fitness	Relate
Layers of Intervention	Healthy Brains, Healthy Bodies	Gut-Brain Connection	Neuroscience of Mindfulness and Yoga	Neuroscience of Exercise	Neuroscience of Relationships
	Residential Halls	Dorm Snacks CCRH Dining Hall In-house Cooking Classes	In-house Yoga Mindfulness Events	In-house Gym Fitness On Demand In-house Pelaton bikes Incentivized Fitness Passes WE 420 5k	WE Mentors WE Mentor Events
	WE App	Log Water and Meals WE Coin Incentive for Logging Food	Yoga and Mindfulness Library	Exercise Library Log Workouts/Track Fitness WE Coin Incentive for Exercise	WE Coin Incentive for attending Events WE Event Calendar

Bai, Copeland, Adams, Lerner, King, Szopinski, Devadanam, Rettew & Hudziak (2019) The University of Vermont Wellness Environment: Feasibility and Initial Results of a College Undergraduate Health-Promoting Program. *Child and Adolescent Psychiatric Clinics*.

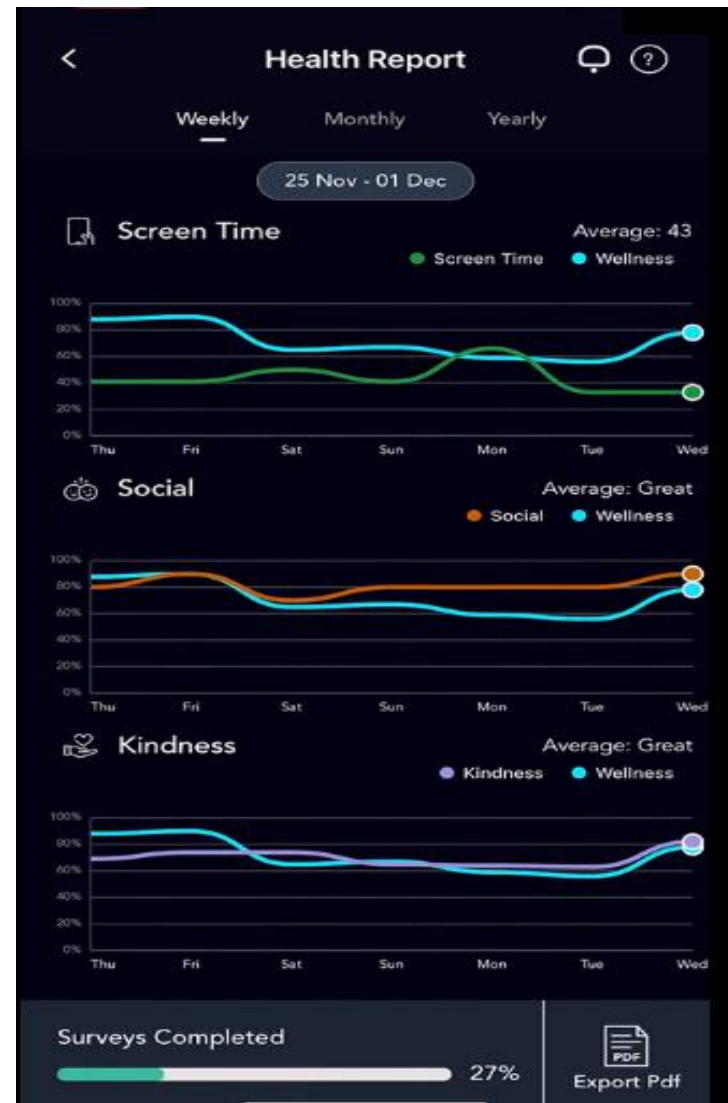
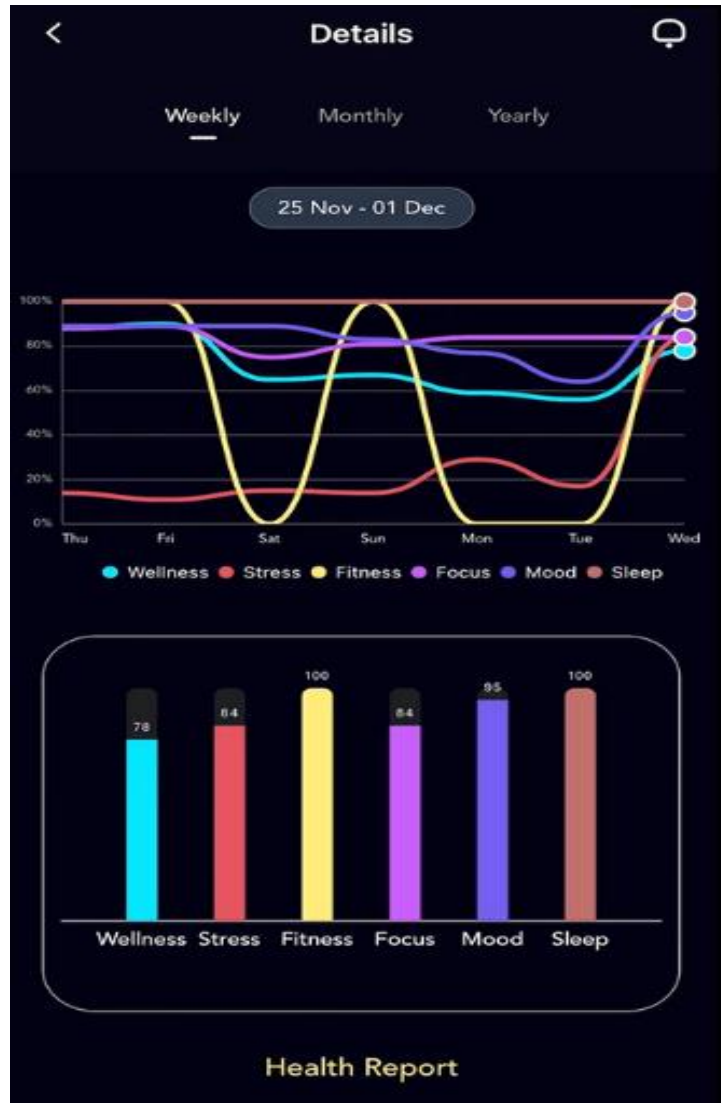


# The UVM Wellness Environment: a College Undergraduate Health-Promoting Program

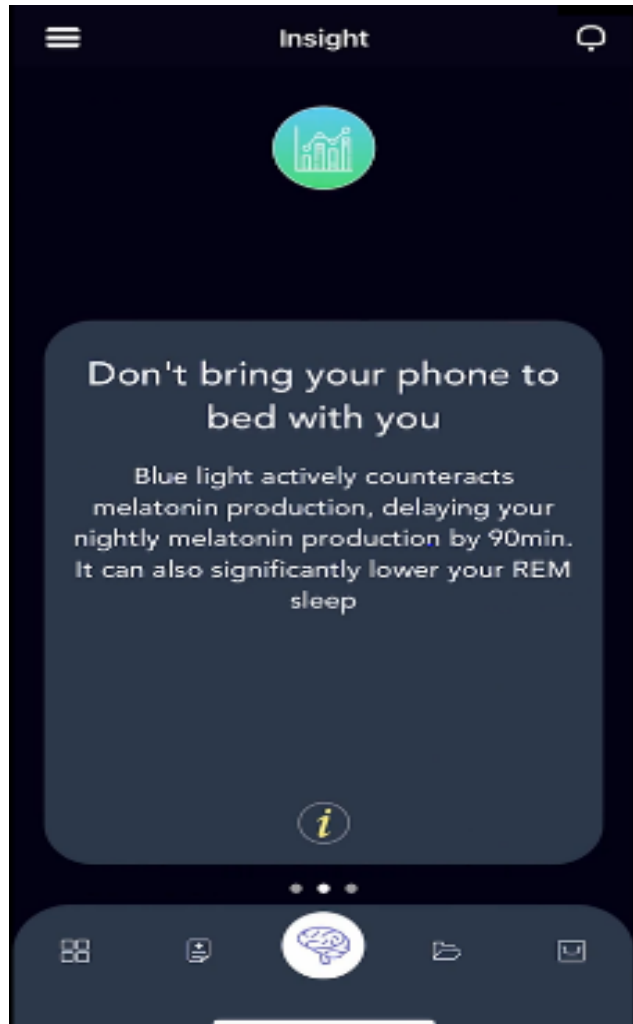
**WE App Study Participant Flow Chart for 2017-2018 School Year (Year 1)**



# Health Reports



## Insights and “WE MD” coins





# Recruitment

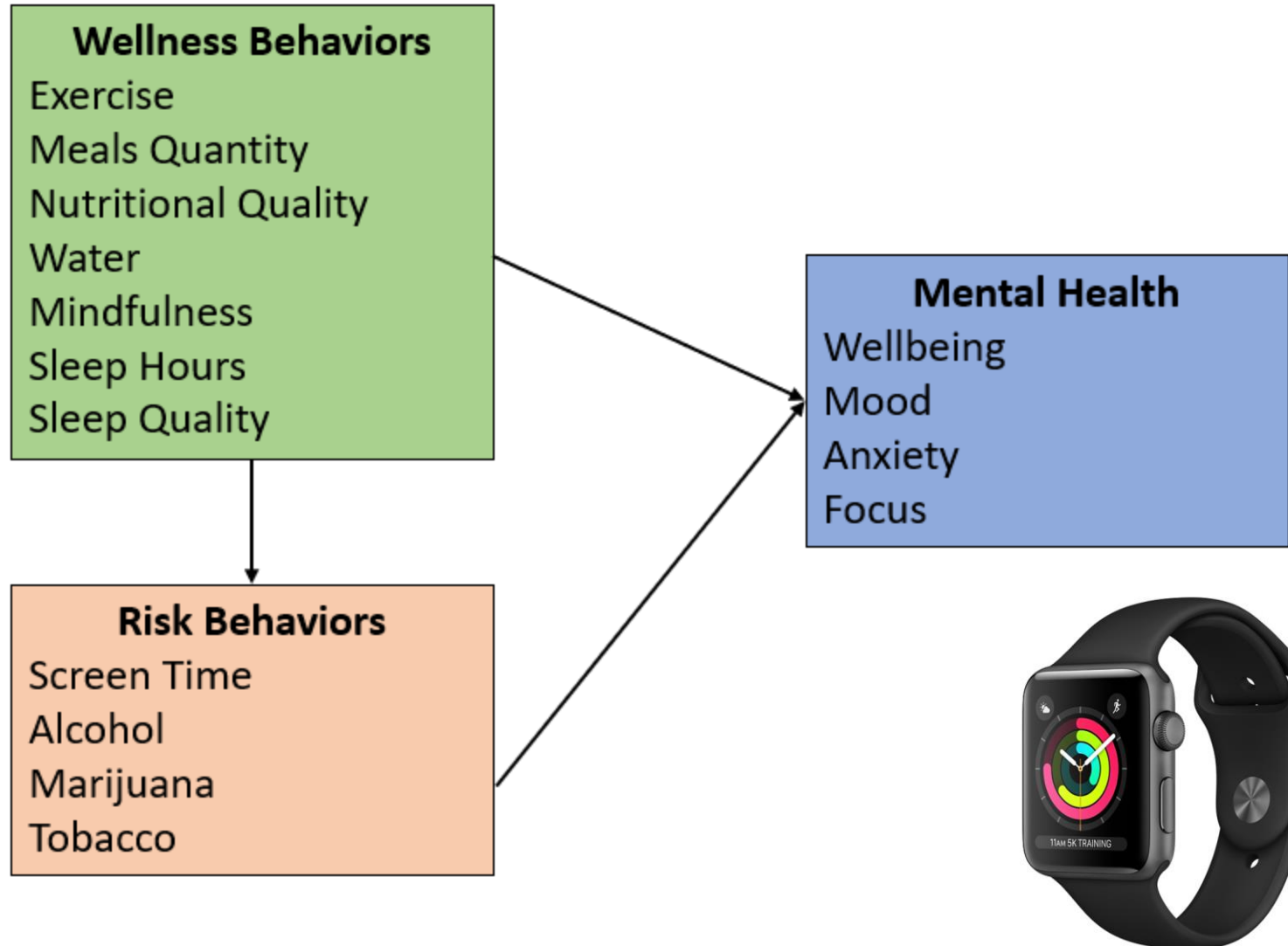
Figure 1. Sample size of the existing database

Year	Sample	Number of Obs	Average Obs per Subject
Undergraduate			
16-17	1,025	21,689	21
17-18	1,725	301,928	175
19-20	1,828	152,708	84
20-21	293	36,228	124
21-22	337	31,344	93
Medical Student			
21-22	231	22,196	96
Total	5439	566,093	104

# Objectives

- 1) how the lockdowns and social distancing of the COVID-19 pandemic changed the PA behaviors of U.S. college students.
- 2) examine whether mental health indicators and their association with PA were impacted by COVID-19.

# Ecological momentary assessment



## **Variables**

- ❑ PA: Daily exercise minutes and steps by Apple Watch
- ❑ Mental health outcomes: mood, anxiety, and stress

## **Sample**

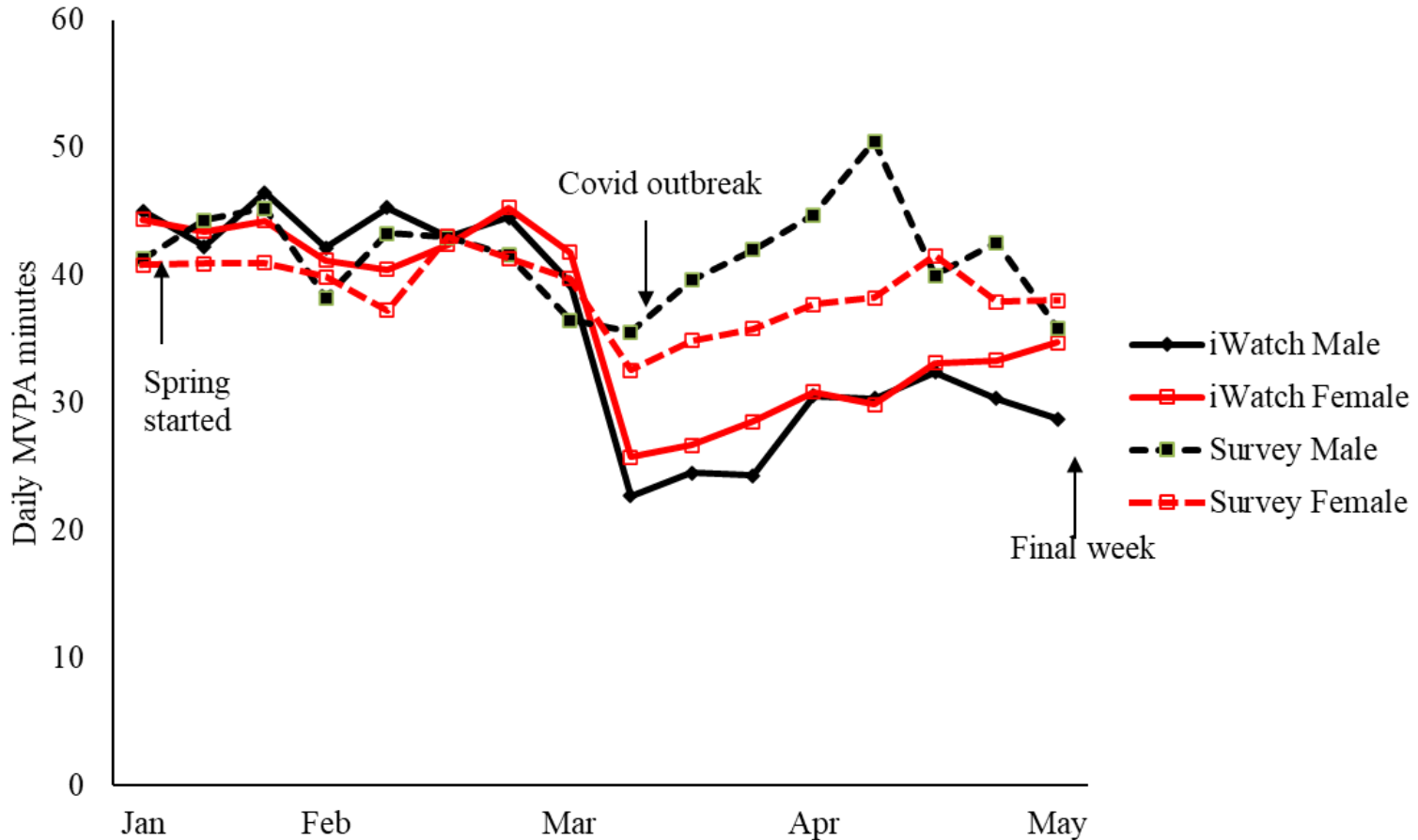
- ❑ 167 participants
- ❑ > 50% of daily surveys and had 20 days of valid Apple Watch data,
- ❑ 11,387 participant-days' of observations

Table 1. Descriptive statistics about sample characteristics

		MVPA			Steps	
	N (%)	Mean-before	Mean after		Mean-before	Mean after
<b>Male</b>	35 (21.0%)	48.0 (31.1)	28.4 (34.3)		9050 (3664)	5944 (3398)
<b>Female</b>	132 (79.0%)	47.3 (35.4)	30.8 (32.2)		10147 (4126)	6481 (3678)
<b>WE</b>	113 (67.7%)	46.4 (34.6)	31.7 (34.5)		9677 (3909)	6474 (3604)
<b>CAU</b>	54 (32.3%)	49.5 (33.9)	26.9 (28.2)		10232 (4269)	6108 (3661)
<b>Low SES</b>	120 (71.9%)	47.2 (34.4)	30.3 (33.6)		9772 (4001)	6447 (3667)
<b>High SES</b>	47 (28.1%)	48.0 (34.3)	30.1 (30.5)		10104 (4134)	6162 (3515)
<b>Caucasian</b>	154 (92.2%)	47.4 (34.4)	30.4 (32.7)		9861 (4076)	6397 (3587)
<b>African American</b>	1 (0.6%)	44.8 (21.0)	26.6 (23.8)		11657 (3832)	6161 (2072)
<b>Asian</b>	5 (3.0%)	34.0 (22.8)	31.6 (28.2)		8707 (2662)	5361 (2479)
<b>Latina/Latino</b>	3 (1.8%)	40.4 (29.2)	10.9 (15.2)		8736 (3552)	3108 (598)
<b>Pacific Islander</b>	1 (0.6%)	34.9 (22.6)	2.8 (2.3)			
<b>Other</b>	3 (1.8%)	78.4 (39.6)	58.4 (38.6)		10276 (3617)	8873 (5866)



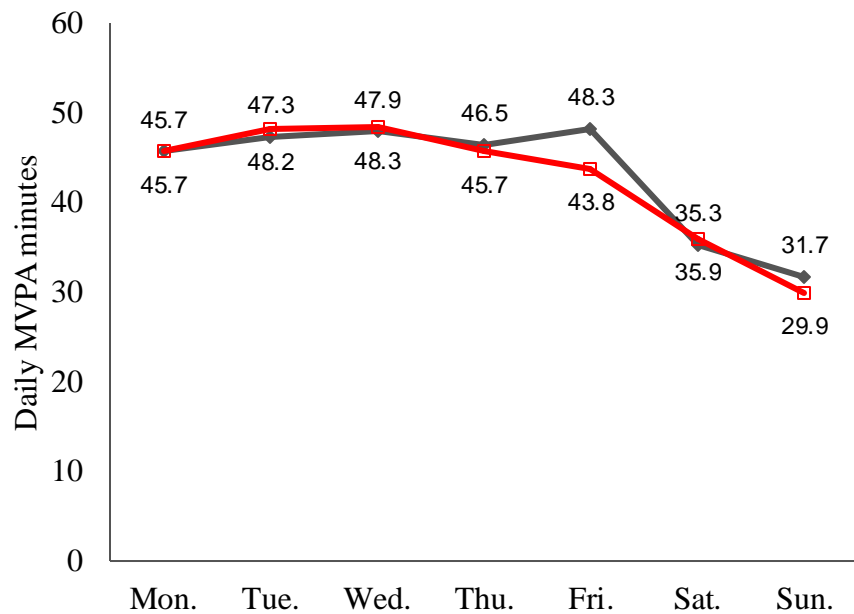
# The prevalence of daily exercise minutes across the Spring semester



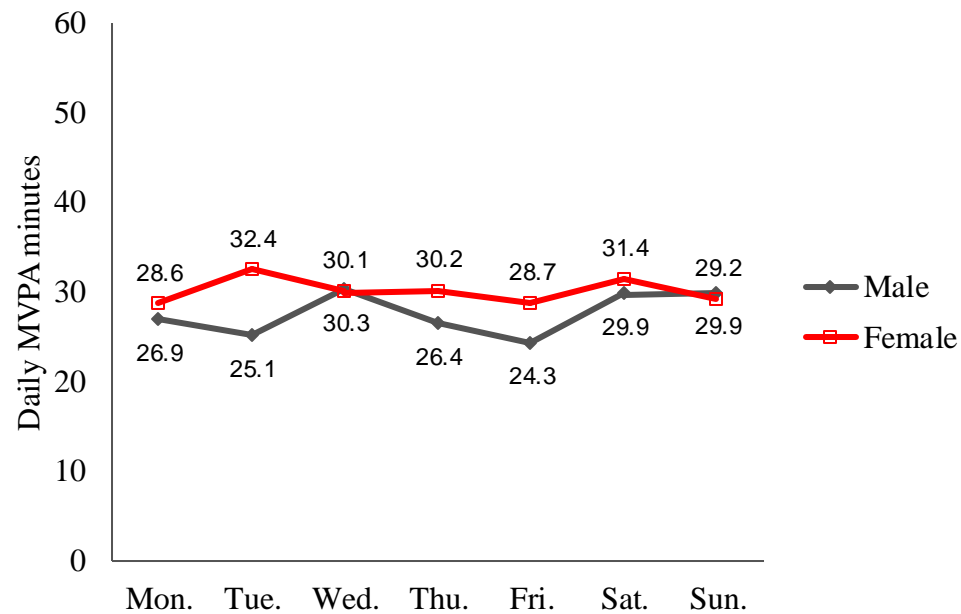
The piecewise linear regression analysis

\*Significantly lower MVPA/day by -18.2 minutes/day

# The prevalence of daily exercise minutes across the day of the week before and during COVID



Before Covid

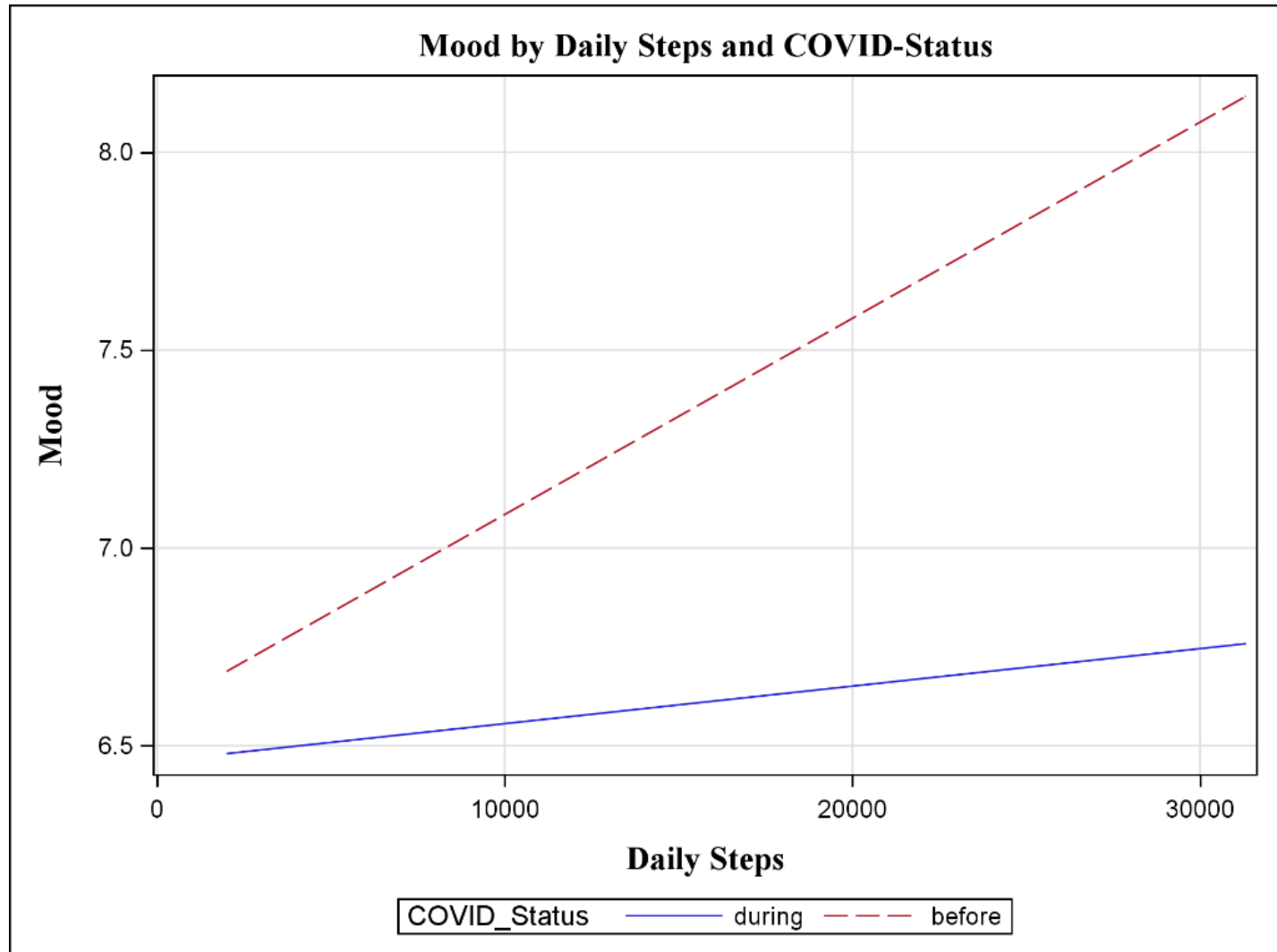


During Covid

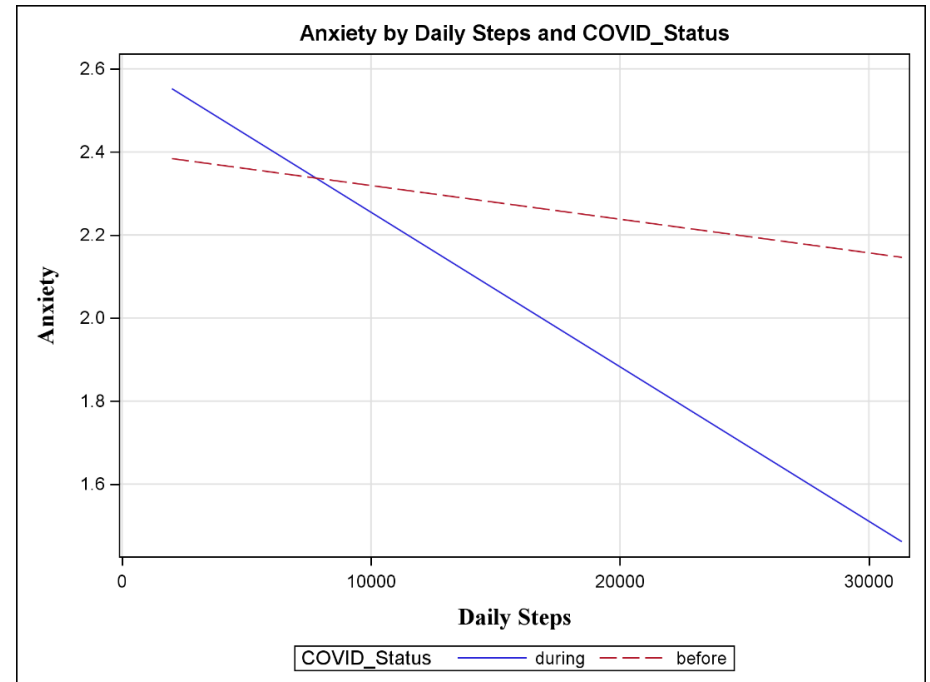
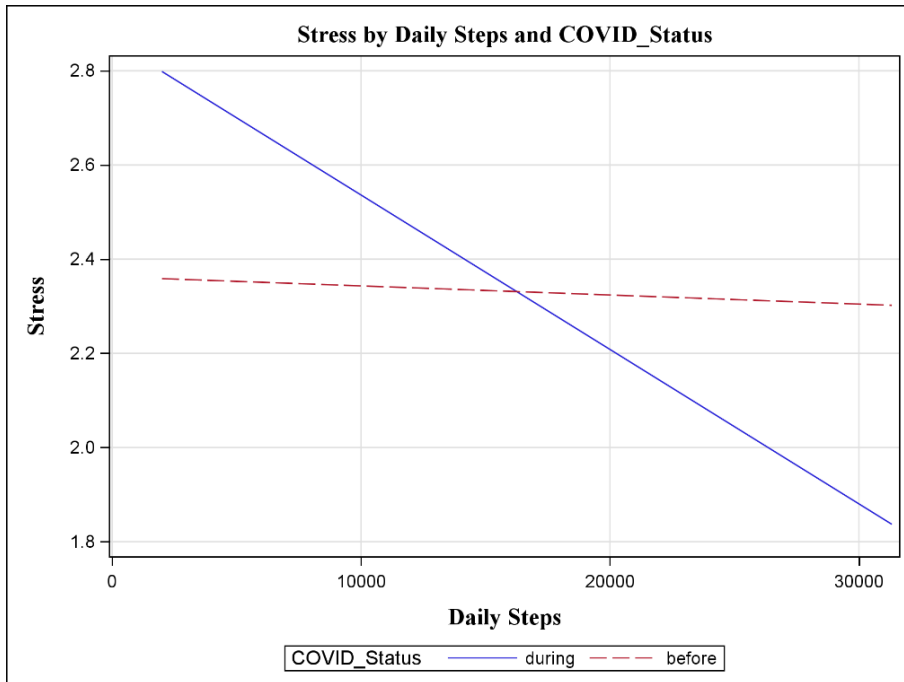
Table 3. Concurrent Associations of Daily Steps With Wellness Behaviors

Outcomes	Predictors	Model 1 (univariable model)		Model 2 (Interaction effect)	
		beta (SE)	<i>p</i>	beta (SE)	<i>p</i>
Mood	Steps	.06 (.006)	<.0001	.090 (.018)	<.0001
	COVID			-.13 (.11)	0.2397
	COVID*Steps			-.04 (.013)	0.0014
Anxiety	Steps	-.019 (.00062)	0.0026	.029 (.02)	0.156
	COVID			.50 (.12)	<.0001
	COVID*Steps			-.031 (.014)	0.03
Stress	MVPA	-.028 (.0066)	<.0001	0.021 (.019)	0.276
	COVID			.23 (.12)	0.05
	COVID*Steps			-.03 (.01)	0.03

# Interaction effect of Covid and Exercise on mood



# Interaction effect of Covid and Exercise on Stress (L) and Anxiety (R)





# Conclusions

1. The COVID-19 pandemic led to a dramatic decline in PA among college students, coinciding with a period of heightened stress and anxiety.
2. Despite a slight recovery in PA levels during the pandemic, the strengthened association between exercise and anxiety/stress during this time underscores the vital role of PA in promoting mental health.

Questions?

# Variables

	Item wording	Response options	Cutoff
<b>Sleep hours</b>	How many hours of sleep did you get?	0, 1-3, 4-7, 8+	8+ hours
<b>Exercise</b>	How many minutes did you exercise?	0, 1-30, 31-60, 61+	30+ minutes
<b>Nutrition</b>	How many servings of fruit/vegetables did you eat?	0, 1-3, 4+	1+ servings; change to 4 +
<b>Hydration</b>	How many bottles of water did you have?	0, 1-3, 4-6, 7+	4+ bottles/glasses; leave
<b>Mindfulness</b>	How many minutes have you practiced mindfulness?	0, 1-9, 10-30, 31+	1+ minutes meditating; leave
<b>Music</b>	How many minutes did you play an instrument or sing today?	0, 1-30, 31-60, 61+	1+ minute playing instrument/singing; leave
<b>Mood</b>	How was your day?	sad, okay, happy	happy
<b>Screen time</b>	How many hours did you spend non-academic screen time?	0, 1-2, 3-6, 7+	3+ hours screen time; leave at risk
<b>Drinks</b>	How many drinks did you have?	0, 1-2, 3-4, 5+	1+ drinks
<b>Liquor</b>	How many shots of liquor did you have?	0, 1-2, 3-4, 5+	1+ shots
<b>Marijuana</b>	How many times did you smoke/use marijuana?	0, 1-3, 4+	1+ times
<b>Cigarettes</b>	How many cigarettes did you smoke?	0, 1-3, 4+	1+ times
<b>Illicit Drugs</b>	How many times did you take illicit drugs?	0, 1-3, 4+	1+ drugs

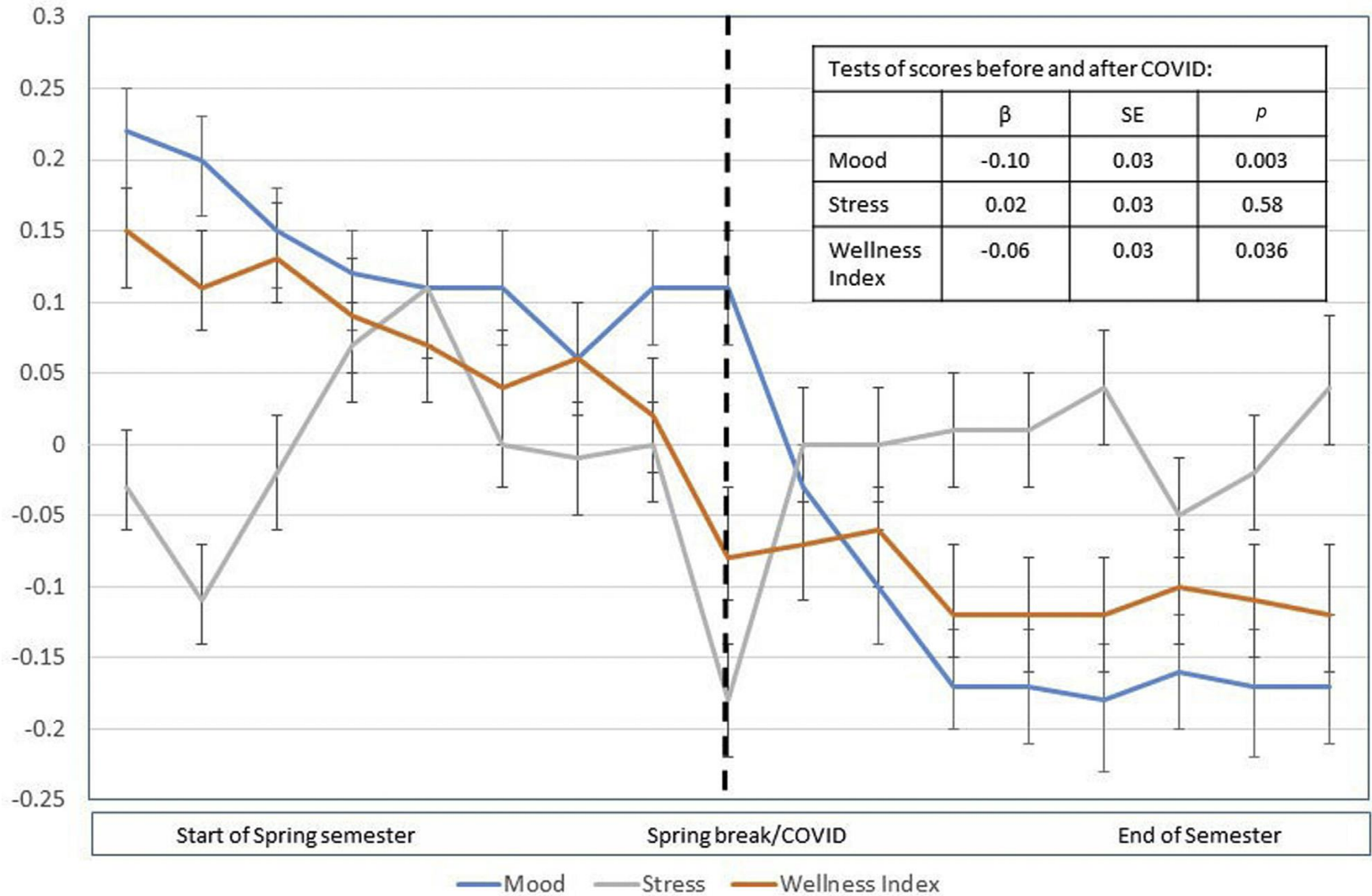
PA: Daily step data by Apple Watch

Demographic information.

Table 2. Concurrent Associations of Daily Exercise minutes With Wellness Behaviors

Outcomes	Predictors	Model 1 (Univariable model)		Model 2 (Interaction effect)	
		beta (SE)	<i>p</i>	beta (SE)	<i>p</i>
Mood	MVPA	.0082 (.00062)	<.0001	.013 (.0017)	<.0001
	COVID			-.38 (.057)	<.0001
	COVID*MVPA			-.0051 (.0011)	<.0001
Anxiety	MVPA	-.0014 (.00062)	0.029	.00077 (.0017)	0.66
	COVID			.042 (.057)	0.46
	COVID*MVPA			-.0016 (.0011)	0.17
Stress	MVPA	-.0015 (.00065)	0.0197	-.00005 (.0018)	0.98
	COVID			.16 (.06)	0.01
	COVID*MVPA			-.0006 (.0012)	0.61

# Nightly survey results Across Spring Semester 2020





Pasqualoni, S., Bai, Y. \*, Rettew, J., Curl, A., Rettew, J., Kimbal, L., Devadanam, V., Yousef, H. Hudziak, J., & Copeland, W. (2023). The effect of COVID-19 on the substance use behaviors of first-year college students. *Journal of American College Health*.

Copeland, W., Milne, A., Novelli, A., Watson, C., Yousef, H., Holterm, A., Bai, Y., Rosen, L., Curl, A., Pasqualoni, S., & Hudziak, J. (2023). The potential of real-time assessment of student behavior and wellbeing to improve medical student wellness. *Academic Medicine*.

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Rettew, D., McGinnis, E., Copeland, W., Nardone, H., Bai, Y., Rettew, J., Devadanam, V., & Hudziak, J. (2021). Personality trait predictors of adjustment during the COVID19 pandemic among college students. *Plos One*.

Copeland, W., McGinnis, E., Bai, Y., Nardone, H., Devadanam, V., Rettew, J., & Hudziak, J. (2021). Impact of COVID on college student mental health and wellness. *Journal of the American Academy of Child and Adolescent Psychiatry*.

Copeland, W., Bai, Y., Adams, Z., Lerner, M., King, J., Szopinski, S., Devadanam, V., Rettew, J., & Hudziak, J. (2020). Daily wellness behaviors in college students across a school year. *Journal of American College Health*.

Bai, Y., Copeland, W., Adams, Z., Lerner, M., King, J., Szopinski, S., Devadanam, V., Rettew, J., & Hudziak, J. (2019) The University of Vermont Wellness Environment: feasibility and initial results of a college undergraduate health-promoting program. *Child and Adolescent Psychiatric Clinics*.

Under Review

Milne, A., Novelli, A., Watson, C., Yousef, H., Copeland, W., Holterm, A., Bai, Y., Rosen, L., Curl, A., Pasqualoni, S., & Hudziak, J. Associations between daily wellness behaviors and outcomes among medical students.

Bai, Y., Burns, R. D., Copeland, W., Ma, C., Curl, A., & Hudziak, J. Objectively measured physical activity and wellness behaviors in college students before and during COVID.