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Introduction

- The use of wearable technology is rapidly increasing in popularity, specifically amongst college students^{1,2}.
- The ability of wearable devices to allow students to track physical activity and sleep offers students a means to self-monitor and reflect upon personal daily habits that may impact their overall performance in the classroom.^{3,4}
- The YouM study is designed to give students individualized real-time feedback on their habits including: daily physical activity, nightly sleep, and daily Ecological Momentary Assessment (EMA) survey scores through a study specific dashboard.
- Accurate use of data from this study requires better understanding of device use and compliance across the different study variables – physical activity, sleep, and EMA scores.

Purpose: Examine the compliance rate of wearable technology and study app usage among first-year college students over an academic semester.



Methods

- First-year college students (4 individual cohorts, n=333 total participants) were enrolled to investigate the use of digital and mobile technology to assess the effects of physical activity, sleep, and wellness on academic performance during an academic semester.
- Subjects were provided with a customized study app (Care Evolution, Ann Arbor, MI) for personalized on-demand feedback as well as a Fitbit Charge (4 or 5) device and tasked to wear the device daily and nightly.
- Over the academic semester in which participants were enrolled, subjects were presented with a brief EMA survey four times a week to evaluate alcohol use, mood, social connectivity, and academic engagement (Figure 1-2).
- Subjects were monetarily incentivized to complete 75% of all tasks with a randomized monthly lottery. Compliance was monitored regularly, and non-compliant subjects were given periodic reminders to achieve required compliance rates.
- Compliance rates were assessed within each cohort and across all cohorts to identify percentage of participants within each cohort, and across the study, who reached ~75% compliance of:
 - Daily step count
 - Night sleep records
 - Weekly EMA survey completions
 - All measures combined

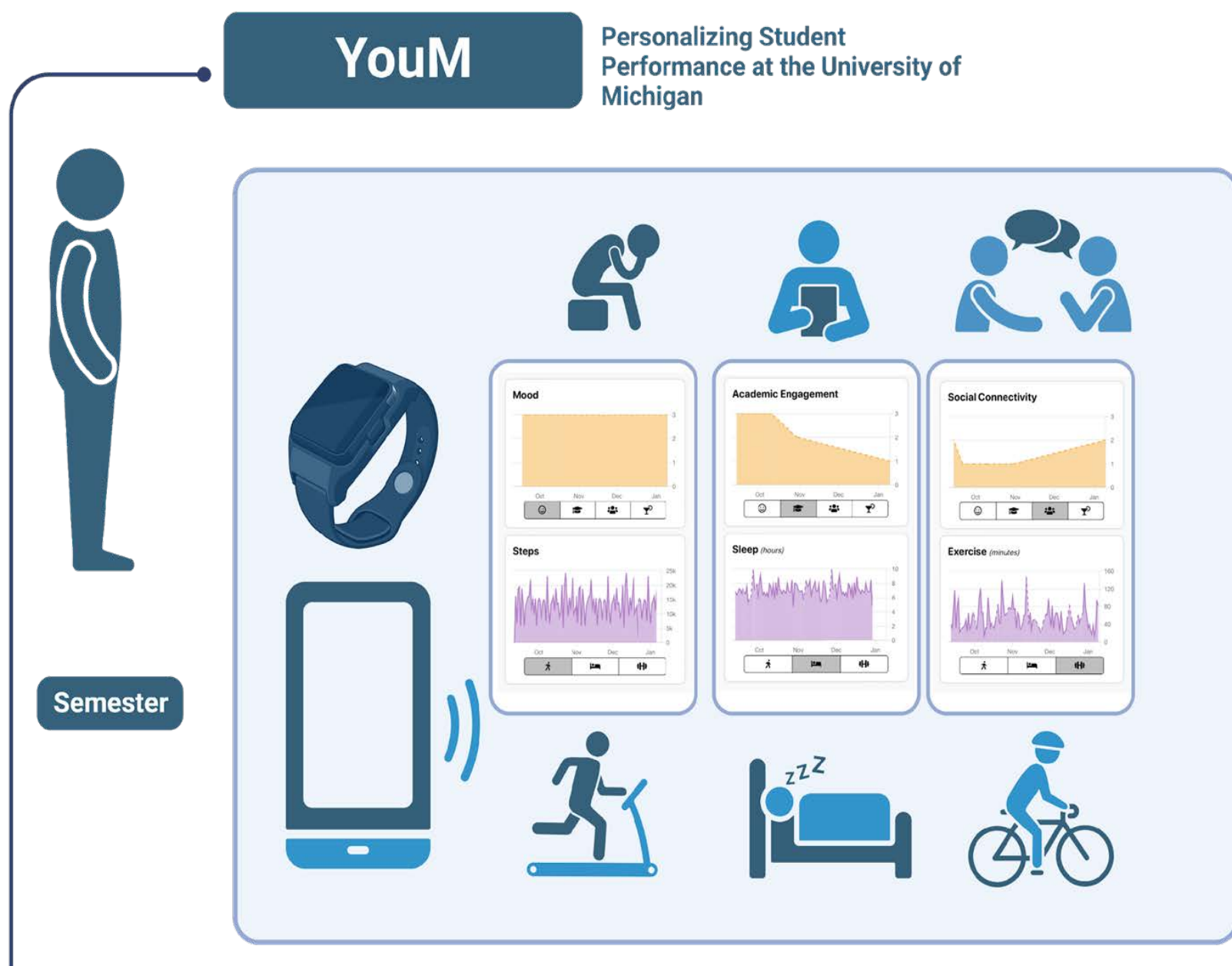


Figure 1: Representative data collection for one week over an academic semester. Fitbit collected daily and nightly sleep metrics. EMA surveys reflecting drug and alcohol use were collected on Mondays, and the remaining EMA survey delivery was randomized across Tuesday-Thursday.

Study App

- Provides push notification of all surveys throughout study
- Collects weekly subject self report data on:
 - Mood
 - Academic Engagement
 - Social Connectivity
 - Alcohol and Drug Use
- Aggregates daily activity (steps, minutes exercise) and sleep, providing daily collection and reflection on collected parameters.



Figure 2: EMA survey questions delivered to participants weekly.

	Cohort 21 F22	Cohort 22 W23	Cohort 31 F23	Cohort 32 W24	YouM Total*	Fall '22 First Year Enrollment+ +
Enrolled (N)	84	121	77	58	340	
Disenrolled (N)	3		4			
Total Study Completion (N)	81	121	73	58	333	7050
Apple Watch Users (excluded from analysis)	10	17	3	0	30	
Fitbit Users	71	104	70	58	303	
Sex						
Female	55.56%	62.81%	61.64%	68.42%	61.77%	56%
Male	44.44%	37.19%	38.36%	31.58%	38.23%	44%
Age						
Mean±SD	18.14±0.52	18.37±0.59	18.07±0.38	19.1±0.48	18.38±0.63	N/A
Race/Ethnicity						
2 or more	6.17%	3.31%	12.33%	1.75%	5.71%	5.73%
Asian	18.52%	35.54%	23.29%	29.82%	27.72%	20.97%
Black	4.94%	2.48%	4.11%	10.53%	4.84%	5.01%
Hispanic	12.35%	6.61%	10.96%	17.54%	10.86%	12.53%
White	54.32%	45.45%	43.84%	35.09%	45.45%	50.62%
Native American						0.12%
Not indicated/Unknown	3.70%	6.61%	5.48%	5.26%	5.42%	4.92%

Table 1: Study demographic data within each cohort and across total study. Demographics are reflective of typical first-year student enrollment demographics at the University of Michigan

Results

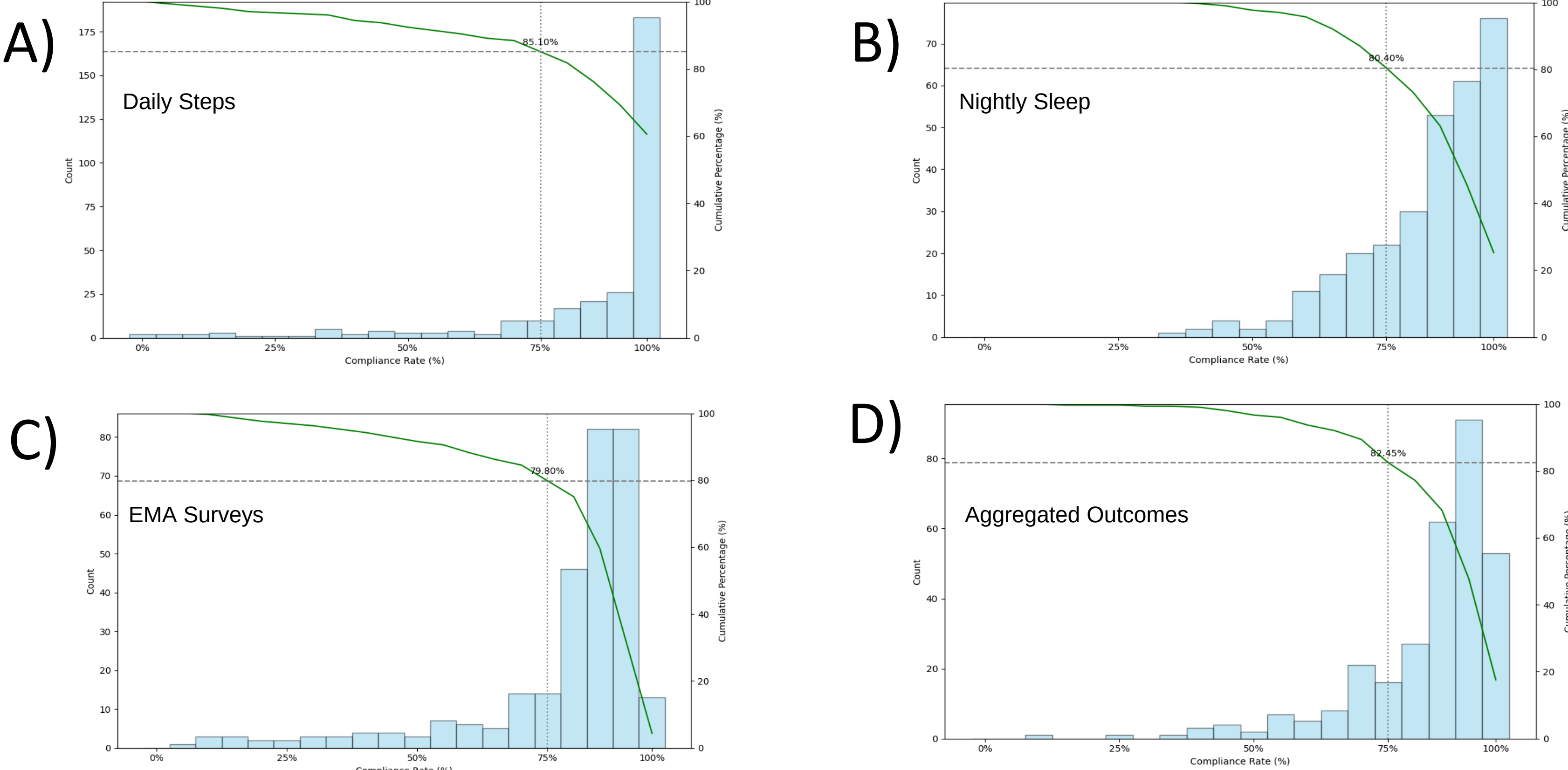


Figure 3: Average compliance rates of A) daily step count, B) nightly sleep hours, C) EMA survey completion, D) aggregated outcomes (step+sleep+EMA) for all subjects in all cohorts averaged over their enrolled semester. Intersection line designates percentage of subjects who reached or exceeded 75% compliance rate for each metric.

Cohort	Physical Activity (Daily Wear)	Sleep (Nightly Wear)	EMA Survey	Total
210	84.51%	80.00%	84.29%	86.96%
220	88.35%	84.47%	84.47%*	87.38%
310	84.29%	77.14%	75.76%	82.61%
320	81.03%	77.59%	70.69%*	72.41%

Table 2: Percentages of participants within each cohort that obtained at least 75% of compliance rates for each study measure. A Tukey's HSD test was performed among all compliance metrics. *Significant differences were observed between cohort 220 and 320 for EMA survey completion (p = 0.0168), with 220 having a higher compliance rate than 320. The other pairwise comparisons do not show statistically significant differences.

Conclusions

- The use of wearable technology and mobile data platforms is an effective tool for real-time assessments and feedback of individual daily habits.
- Few difference in compliance were observed between cohorts, suggesting that academic year and season (Fall vs Winter) did not impact overall compliance rates.
- High compliance (>75%) was observed in over 75% of our subjects, with no differences observed across modality (sleep, daily wear, and EMA).
- Understanding how these daily habits (physical activity, sleep, and EMA survey metric) recorded through wearable technology and mobile data platforms affect academic performance is the focus of ongoing research.