

## **Authors**

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### **(1) Have any data been collected for this study already?**

We have collected pilot data. No other data have been collected.

### **(2) What's the main question being asked or hypothesis being tested?**

Do incentives for sleep improve sleep, educational achievement and health?

What is the impact of reminders and feedback, incentive timing (immediate or delayed) and incentive type (financial or non-financial) on sleep habits?

### **(3) Key dependent variables and how measured**

The primary outcomes are sleep habits, academic achievement and health.

Sleep habits during the intervention period and after the intervention period:

Primary outcome: Sleeping at least 7 hours per night on weeknights (Sunday-Thursday), measured by the Fitbit

Secondary outcomes: Sleeping at least 7 hours or 7-9 hours per night on weeknights and weekends, hours per night, sleep including naps, bedtime, wake up time, regularity, and quality, all measured by the Fitbit.

Academic achievement during and after the study:

Primary outcome: GPA, measured using administrative data

Secondary outcomes: Course completion, grades conditional on completion, credits, major, attainment, academic behaviors if the data are available, measured using administrative data

Health during the intervention period and after the intervention period:

Primary outcomes: activity and resting heartrate measured by the Fitbit, mental health measured by GAD-7 and CES-D

Secondary outcomes: BMI (measured by height and weight), blood pressure, survey measures of health behaviors.

Secondary outcomes during and after the intervention: Actual behavior compared to predicted and desired behavior, willingness to pay for incentives to sleep, time use and cognitive function, measured through surveys and cognitive tasks.

### **(4) Conditions**

We will give undergraduate participants a Fitbit to wear throughout the study. We will collect 1-3 weeks of baseline data. We will randomize participants at the individual level to Control (no intervention) or one of the following intervention groups: Non-Financial

Incentives with Reminders/Feedback, Financial Incentives with Reminders/Feedback, Delayed Financial Incentives with Reminders/Feedback, Delayed Financial Incentives with no Reminders/Feedback, or Reminders/Feedback only. In the treatment groups, we will encourage students to sleep at least seven hours per night on weekday nights (Sunday – Thursday). For six weeks, each weeknight, we will provide participants with reminders to go to bed; and each weekday, we will provide feedback about how much they slept (except for Delayed Financial Incentives with no Reminders/Feedback). For the first four of the six weeks, in the Incentives treatments, we will additionally provide participants with an incentive each night they sleep at least seven hours by 9 am. In the Non-Financial Incentives treatment, we will provide a “Breakfast Treat” coupon that can be redeemed at participating campus coffee shops the same day it is earned. In the Financial Incentives treatment, we will provide an electronic cash transfer equivalent to the value of the Breakfast Treat coupon. In the Immediate Financial Incentives treatment, we will provide the transfer the same day it is earned. In the Delayed Financial Incentives treatment, we will provide the transfer at the end of the study. After the intervention period ends, we will continue to track participants.

#### **(5) Analysis**

We will use Intent-to-treat (ITT) regression analysis to measure the impact of the interventions on sleep. We will use ITT and instrumental variables (IV) regression analysis (instrumenting for improved sleep) to measure the impact of the interventions on academic and health outcomes, as well as our secondary outcomes. We will estimate the impact of Financial Incentives (Immediate and Delayed) and Non-Financial Incentives both individually and pooled. We will correct for multiple hypothesis testing within families of secondary outcomes. We will examine mechanisms other than improved sleep that may be driving the impact on outcomes. We will examine sensitivity to non-compliance. And we will examine the response to daylight savings time. We will conduct analysis that includes all treatments once we have completed enrollment for the Delayed Financial Incentives and Reminders/Feedback only treatments. We will also conduct analysis once we have completed enrollment for the Control, Non-Financial Incentives and Financial Incentives treatments. See Section (7) for details on sample sizes.

#### **(6) Secondary analyses**

We will examine whether treatment effects are larger for people who are sleeping insufficiently at baseline. We will examine whether treatment effects on academic outcomes are larger in morning classes.

#### **(7) Aimed for sample size and power**

N=2100

Control n=600

Non-Financial Incentives with Reminders/Feedback: n=600 (MDES = 0.16 S.D.)

Financial Incentives with Reminders/Feedback: n=600 (MDES = 0.16 S.D.)

Delayed Financial Incentives with Immediate Reminders/Feedback: n=100

Delayed Financial Incentives with no Reminders/Feedback: n=100  
Reminders/Feedback only: n=100  
MDES for pooled treatments = 0.14 standard deviations

We will run the study across several semesters to enroll the full sample size. We will assign participants approximately equally across all treatment groups until the aimed for sample size in a treatment group is met. Once the two Delayed Financial Incentives treatment groups and the Reminders/Feedback only treatment groups reach approximately 100 participants, we will randomize participants approximately equally across Control, Non-Financial Incentives and Financial Incentives.