

Author(s)

Sakari Lemola (University of Warwick) - s.lemola@warwick.ac.uk
Brieze Read (University of Birmingham) - ber257@student.bham.ac.uk
Anna Gkiouleka (University of Warwick) - anna.gkiouleka@warwick.ac.uk
Anu Realo (University of Warwick & University of Tartu) - a.realo@warwick.ac.uk
Mark Elliott (University of Warwick) - m.t.elliott@warwick.ac.uk

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

It's complicated. We have already collected some data but explain in Question 8 why readers may consider this a valid pre-registration nevertheless.

2) What's the main question being asked or hypothesis being tested in this study?

RQ1. Does the use of a Smartphone based eHealth application (Sweatcoin) that rewards the number of steps increase physical activity in university staff?
RQ2. Does the use of such a "step rewards application" improve self-reported wellbeing and sleep quality in university staff?

Main hypotheses:

H1: The overall self-reported physical activity as measured with the short version of the International Physical Activity Questionnaire (IPAQ) score (Craig et al., 2003) is higher after the use of the Sweatcoin application (<https://sweatco.in/>) for one (t2), two (t3), or three (t4) months compared to the time before the use of the Sweatcoin application (t1).

H2: The mean number of daily steps recorded by Apple HealthKit among participants who used Apple iPhones is higher after the use of the Sweatcoin application for one (t2), two (t3), or three (t4) months compared to the mean daily step count over a 3-month period before the use of the Sweatcoin application.

3) Describe the key dependent variable(s) specifying how they will be measured.

For H1, it is the total self-reported physical activity measured at the individual level with the short version of the IPAQ and referring to the last seven days prior to the questionnaire completion. Namely, the total physical activity involves walking, cycling, and doing vigorous and moderate physical activity. The score of the Total Physical Activity will be calculated in the following manner:

(a) The duration of each activity will be calculated in minutes and then it will be multiplied by 7 so as to have the total number of minutes per week for each activity.

(b) The total metabolic equivalent (MET) per week will be calculated for each activity. Total duration of walking will be multiplied by 3.3 MET; total duration of cycling by 4 MET; total duration of moderate physical activity by 6 MET; and total duration of vigorous physical activity by 8 MET.

(c) The sum of total metabolic equivalent of all the activities will be calculated (i.e. $\text{Total_Physical_Activity} = \text{Walking_Total_MET} + \text{Cycling_Total_MET} + \text{ModeratePA_Total_MET} + \text{VigorousPA_Total_MET}$).

For H2, it is daily step count measured objectively using the smartphone accelerometer sensors and calculated using algorithms proprietary to the device. For this measure, we are only able to extract data from participants who used the Sweatcoin app on the Apple iPhone, as the data is retrieved via Apple HealthKit.

4) How many and which conditions will participants be assigned to?

All the participants have filled in the questionnaire once before the use of the Sweatcoin application (t1) and three consecutive times (t2, t3, and t4) after the use of the Sweatcoin application each a month apart.

5) Specify exactly which analyses you will conduct to examine the main question/hypothesis.

For the main hypotheses H1 and H2, we will conduct mixed effects regression models specifying time point as fixed effect (t1 vs. t2, t3, and t4) and between subject variance as random effects.

6) Describe exactly how outliers will be defined and handled, and your precise rule(s) for excluding observations.

Regarding outliers of total physical activity, we will truncate them recoding the values to new ones that will be $Q3 + 1.5 \times IQR$ (Where $Q3 = \text{Percentile } 75$; $IQR = \text{Interquartile Range } Q3 - Q1$) according to SPSS software strategy.

7) How many observations will be collected or what will determine sample size? No need to justify decision, but be precise about exactly how the number will be determined.

Recruitment and inclusion criteria for the participants include:

- Being University of Warwick staff member
- Having a score of moderately inactive, inactive or moderately active at the General practice physical activity questionnaire (GPPAQ)
- Being older than 18 years and younger than 70 years.
- Being a Smartphone user: iPhone 5S or above; android 4.4 KitKat or above

Sample was limited to first 150 participants who met the criteria.

8) Anything else you would like to pre-register? (e.g., secondary analyses, variables collected for exploratory purposes, unusual analyses planned?)

Regarding Q1, although the data has been collected, there has been no moderation, manipulation or analysis conducted. Thus, readers may consider this a valid pre-registration nevertheless.

There is one additional author with the following details: Lukasz Walasek (University of Warwick) - l.walasek@warwick.ac.uk

The main analyses will be run again but estimating further fixed effects for age, gender, and baseline-BMI.

Secondary hypotheses will be tested with correlation analyses:

H3a: Higher number of verified outdoor steps (measured with the SweatCoin app) correlates positively with higher levels of self-reported physical activity (measured with the IPAQ).

H3b: Higher number of steps (recorded with the Apple HealthKit) correlates positively with higher levels of self-reported physical activity (measured with the IPAQ).

Additional hypotheses will be tested with repeated measures analyses of covariance:

H4a: Perceived sleep quality, measured with the Pittsburgh Sleep Quality Index (PSQI) (Buysse et al., 1989) is higher at timepoints t2, t3, and t4 compared to the baseline (t1).

H4b: Positive affect, measured with ten items of the PANAS Scale (Watson et al., 1988), is higher at timepoints t2, t3, and t4 compared to the baseline (t1).

H4c: Negative affect, as measured with ten items of the PANAS Scale, is lower at timepoints t2, t3, and t4 compared to the baseline (t1).

H4d: Life satisfaction (LS) is higher at timepoints t2, t3, and t4 compared to the baseline (t1).

Life Satisfaction (LS) will be measured with the items "Overall, how satisfied are you with your life nowadays" and "Overall, to what extent do you feel that the things you do in your life are worthwhile?".

H4e: Higher overall self-reported physical activity (measured with the IPAQ) at t1, t2, t3, and t4 is related to higher levels of extraversion, openness to experience, conscientiousness, and to lower level of neuroticism measured with the Extra Short Five (XS5) Questionnaire (Konstabel et al., 2017).

H5: Higher levels of Sweatcoin application engagement are related to higher levels of self-reported physical activity measured with the IPAQ; higher subjective wellbeing (i.e. higher positive affect and LS, and lower negative affect), and better self-reported sleep quality in the timepoints t2, t3, t4.

Application engagement will be measured with the item "How frequently do you open the app?" and 7 additional questionnaire items measuring the type of use (e.g. Claimed the 'Daily Reward').

H6: Higher number of Sweatcoins generated are related to higher levels of self-reported physical activity measured with the IPAQ; higher subjective wellbeing, and better self-reported sleep quality in the timepoints t2, t3, t4.