Feasibility of Retrofitting a University Library with Active Workstations to Reduce Sedentary Behavior

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Background: Libraries are an inherently sedentary environment, but are an understudied setting for sedentary behavior interventions.

Purpose: To investigate the feasibility of incorporating portable pedal machines in a university library to reduce sedentary behaviors.

Methods: The 11-week intervention targeted students at a university library. Thirteen portable pedal machines were placed in the library. Four forms of prompts (e-mail, library website, advertisement monitors, and poster) encouraging pedal machine use were employed during the first 4 weeks. Pedal machine use was measured via automatic timers on each machine and momentary time sampling. Daily library visits were measured using a gate counter. Individualized data were measured by survey. Data were collected in fall 2012 and analyzed in 2013.

Results: Mean (SD) cumulative pedal time per day was 95.5 (66.1) minutes. One or more pedal machines were observed being used 15% of the time (N=589). Pedal machines were used at least once by 7% of students (n=527). Controlled for gate count, no linear change of pedal machine use across days was found (b=−0.1 minutes, p=0.75) and the presence of the prompts did not change daily pedal time (p=0.63). Seven of eight items that assessed attitudes toward the intervention supported intervention feasibility ($p < 0.05$).

Conclusions: The unique non-individualized approach of retrofitting a library with pedal machines to reduce sedentary behavior seems feasible, but improvement of its effectiveness is needed. This study could inform future studies aimed at reshaping traditionally sedentary settings to improve public health.

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Introduction

Excessive time spent sedentary is an independent risk factor for multiple chronic diseases and health outcomes.[1–12] The need to reduce sedentary behavior has been recognized as an important public health priority.[6,13] Because libraries are typically available to a large population and the activities therein are predominantly sedentary,[14–17] libraries may offer an opportunistic setting for reducing sedentary behaviors. University libraries may be useful for piloting this idea, as they are typically well populated[17] and college-aged adults are as sedentary as most other age groups.[18] The purpose of this study was to test the feasibility of a multilevel intervention aimed at reducing sedentary behaviors of university library visitors.

Methods

The study was approved by a University and Medical Center IRB. This 11-week intervention targeting university students began near the beginning of the fall 2012 semester, ending just prior to Thanksgiving (the fourth Thursday of November). Although the library was accessible to the public, we assumed that most visitors would be students.

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Portable Pedal Machines

Thirteen portable pedal exercise machines (MagneTrainer, 3D Innovations, Greeley CO) were placed in three areas on the first floor of the main university library. These pedal machines give users the freedom to be active while studying. Visitors were free to move the pedal machines (weight=10 kg) throughout the first floor and adjust the resistance setting.

Prompts

Four types of prompts containing the message "Burn calories while studying" and an image of a man using a pedal machine encouraged pedal machine use. One e-mail announcement was sent to all students on the fifth day of the intervention in a message containing 12 other advertisements. A poster was placed just inside the library entrance. The message was shown intermittently on the library website homepage (approximately one of six advertisements) and on 94 advertising monitors placed around campus (approximately one of ten advertisements). All prompts were removed at the end of the fourth week.

Measurements

The pedal machines automatically recorded total daily pedal time (minutes). The total number of daily library visits was counted using a gate counter placed at the only library entrance. Observational scans of pedaling activity were performed three to ten times daily (mean=7.6, SD=1.6) dispersed between 8:00AM and 9:00PM. The number of pedal machines in use and the gender of the users were recorded. After the intervention, 5,000 student e-mail addresses were randomly selected to complete a feasibility survey, which measured demographic information, library visits, prompt exposure, pedal machine use, and attitudes toward the intervention (5-point Likert-type items).

Statistical Analysis

Data were collected in 2012 and analyzed in 2013 using JMP, version 10 (SAS Institute, Cary NC). Descriptive statistics are shown as mean (SD) unless otherwise noted. Two multiple regression models were used to test whether time and presence of the prompts affected pedal machine use, controlling for gate count. Gate count was controlled because it was related to pedal time (r=0.39). The relationships between proportions were determined using Fisher's exact tests. Two-tailed alpha was set at 0.05.

Results

Mean pedal time per day across all 13 machines was 95.5 (66.1) minutes (median=96.5, interquartile range=104.7, Figure 1). An average of 3,674 (2,030) visits to the library were registered daily (median=4,430, interquartile range=3,577). Controlled for gate count, no linear change in pedal machine use over time was found (b=−0.1 minutes, p=0.75). Controlled for gate count, pedal time was 7.1 minutes higher on days in which the prompts were displayed, but this difference was not significant (p=0.63). Of 589 total observations, one or more pedal machines were being used in 15% (95% CI=13, 15) and two or more in 5% (95% CI=4, 8) of all observations. Fifty percent of users were women (95% CI=43, 58). Relative to the population (60% women),[19] men used the pedal machines more often (p=0.013).

A total of 527 students responded to the survey (response rate=11%); mean respondent age was 26.2 (10.2) years. Of all respondents, 74% visited the library at least once (95% CI=70, 77); 7% used a pedal machine at least once (95% CI=5, 9); and 32% saw at least one prompt (95% CI=28, 36). Participants recalled seeing the poster more frequently (25%) than the e-mail (8%); website (8%); or monitors (11%). The percentage of pedal

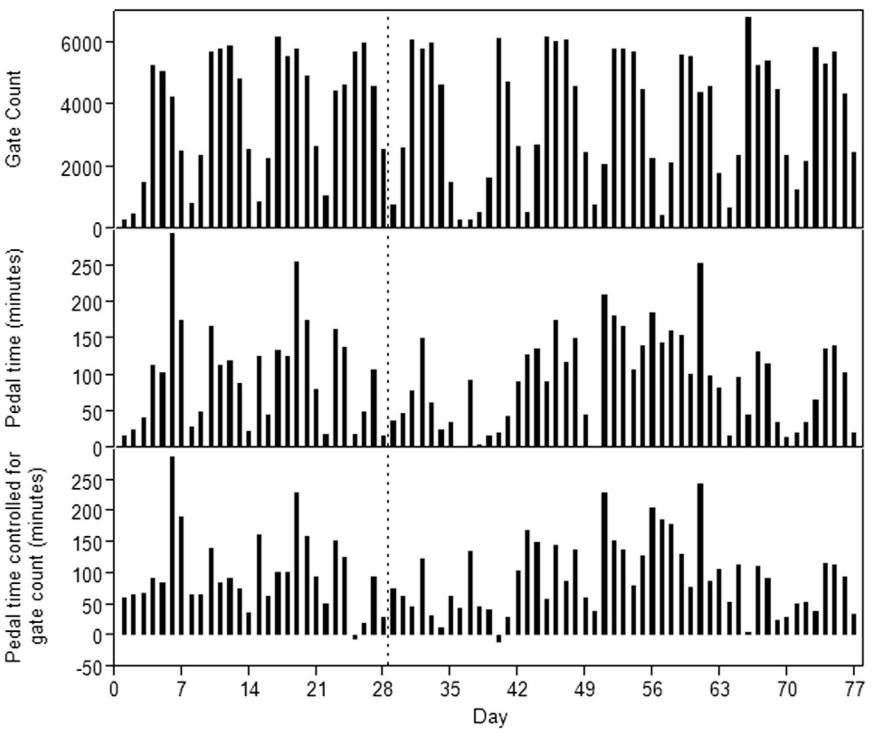

Figure 1. Trends across the 11-week intervention

Note: The top two plots are graphs of gate count and objectively measured pedal time by days across the intervention. The bottom plot is the graph of residuals of predicting pedal time from gate count plus the mean pedal time. The vertical dotted line indicates the point at which the prompts to encourage pedal machine use were removed. Day 1 was a Saturday.