Secondary analysis of a university-based weight loss program in on-campus versus off-campus employees

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Abstract

Introduction: Many barriers prevent individuals from regularly engaging in physical activity (PA), including lack of time and access to facilities. Providing free gym membership close to one's work may alleviate both time and financial barriers, increase PA, and result in greater weight loss. The purpose of this secondary analysis was to determine if gym usage, self-reported leisure PA, and weight loss differed between participants working on the University of Colorado Anschutz Medical Campus (ON) versus working off-campus (OFF) during a 6-month weight loss trial.

Methods: 117 adults (ON, n = 62; OFF, n = 55) with overweight or obesity received free gym memberships for the duration of trial. Average gym check ins/week, self-report leisure PA, weight, and fat and lean mass were compared between groups.

Results: ON reported more check-ins than OFF (ON, 0.93 ± 0.16 times/week; OFF, 0.55 ± 0.10 times/week p = 0.038). Both groups reported increased leisure PA, with ON reporting more leisure PA than OFF at month 4. Both groups had reductions in weight and fat mass, which were similar between groups.

Conclusion: Gym usage in both groups was low, suggesting that convenient and free gym access only marginally promoted use of provided facilities, likely having little additional impact on PA and weight change.

CLINICAL TRIAL REGISTRATION: The parent trial was registered at clinicaltrials.gov: NCT02627105.

KEYWORDS
intervention, obesity, physical activity
1 | INTRODUCTION

Engaging in regular and sustained physical activity (PA) reduces the risk of many chronic diseases, such as cardiovascular disease and type 2 diabetes. Particularly for those with obesity, PA can elicit major health improvements, such as improving blood lipids, visceral adipose tissue, insulin sensitivity, and improving cardiovascular health even without weight loss. When PA is added to diet-induced weight loss, it can create even greater benefits to cardiovascular health, body composition, and can even improve metabolic flexibility. Data have demonstrated that while PA is not necessary for weight loss, a high level of PA is essential for preventing weight regain. Unfortunately, many people have difficulty adhering to PA recommendations, which in turn, contributes to poor long-term outcomes of behavioral weight loss interventions.

Many barriers exist to achieving the high level of PA recommended for long-term weight loss maintenance, including unsafe outdoor conditions, lack of access to an exercise facility due to either finances or proximity, and a lack of time to exercise due to busy schedules. Several studies have attempted to alleviate the financial barrier by providing incentives or gym memberships to participants. Providing these benefits may alleviate some PA related barriers, specifically financial barriers and those related to unsafe or uncomfortable environments. However, interventions that provide access to PA are often expensive for the researcher, do not address all PA barriers (e.g., time constraints), and sometimes do not provide much benefit to PA or weight loss. Thus, it is important to consider removing multiple barriers to PA participation in an attempt to increase engagement. Providing a gym membership near a person’s workplace may help to not only provide access to a gym, but also convenient access to a gym. With about half of the waking day spent at work for many individuals, this can help reduce travel time to the facility, reducing these time-related barriers. Thus, a question remains about how to use resources most effectively within an intervention to result in the greatest benefit for participants. For example, it is unclear if participant proximity to the gym may impact usage and hence, PA.

The purpose of this secondary analysis was to determine if gym usage differed between participants who worked on the University of Colorado Anschutz Medical Campus (ON) or off-campus (OFF) during their participation in a 6-month behavioral weight loss trial that provided no-cost gym memberships as an incentive to participation. Primary results of this trial have been published previously. The hypothesis was that ON participants would use the provided gym membership more frequently than OFF, which would lead to greater self-reported PA and greater weight loss during the trial.

2 | METHODS

2.1 | Overview

The rationale, methods, and primary results for the parent trial have been described in detail in a previous publication. Briefly, in the parent trial 120 participants with overweight or obesity (BMI ≥ 27 kg/m²) were randomized to a high protein diet that either required the consumption of ≥4 servings of beef per week or excluded all red meat. All participants, regardless of group assignment, took part in the State of Slim (SOS) weight management program. This is a group-based program focused on diet, physical activity, and lifestyle modification and lasted 16 weeks with weekly classes delivered by a trained coach. Participants were provided with a membership to the Anschutz Health and Wellness Center (AHWC) for the duration of their participation in the study. Participants completed study visits at baseline, immediately after the conclusion of the SOS classes (month 4), and a follow-up visit at month 6 during which there was no active intervention. The parent trial was registered on Clinicaltrials.gov (NCT02627105) and was approved by the Colorado Multiple Institutional Review Board.

2.2 | Participants

Participants were recruited from the Denver, Colorado area from October 2015–May 2016 and participated in the weight loss program in three cohorts, with the intervention beginning in January 2016 for cohort 1, March 2016 for Cohort 2 and April 2016 for cohort 3. From the N = 120 in the parent trial, three participants were excluded from this secondary analysis because those participants were employees of the AHWC where the gym was located and did not use a keycard to access the facilities. For this analysis, participants were grouped into the ON or OFF designations based on their working location. Those who worked on the University of Colorado Anschutz Medical Campus were labeled ON, which included those who worked at the on-campus hospitals (UC Health University of Colorado Hospital, Children’s Hospital Colorado, and Rocky Mountain Regional VA Medical Center). Those who worked outside of the University of Colorado Anschutz Medical Campus were labeled OFF.

2.3 | Anthropometrics

Participants were weighed at each study visit using a digital platform scale (PS-6600 ST, Befour, Inc., Saukville WI, USA) following an ≥8-h fast and while wearing light clothing and after voiding. Height was measured using a stadiometer at the baseline visit and used to calculate BMI throughout the trial. Body composition (fat and lean mass) was measured at baseline and month 4 using dual x-ray absorptiometry (Discovery QDR DXA System, APEX software version 4.5, Hologic, Inc., Marlborough, MA, 01752, USA). Body composition was not measured at the month 6 study visit.

2.4 | Gym usage and physical activity assessment

Gym usage was tracked via check-ins using the membership keycard at the front desk of the AHWC and was calculated as the average number of gym check-ins per week during the participants’
engagement in the trial. Membership was revoked upon a participant leaving the study.

Leisure physical activity was measured using the International Physical Activity Questionnaire (IPAQ), which is a self-report measure of physical activity. Participants completed the 31-question IPAQ which has demonstrated strong reliability and validity. This version provides information on time spent engaging in physical activity in several domains, such as household or yard work, leisure-time, commuting to a job, job-related activity, as well as sedentary time and only the leisure-time domain was used for the purposes of this analysis. The IPAQ defines leisure-time as any activity performed solely for the purpose of recreation, sport, or exercise, leaving it most reflective of engagement in purposeful exercise. This questionnaire was completed at baseline, month 4, and month 6.

2.5 | Statistical analyses

Study data were collected and managed using REDCap electronic data capture tools hosted at University of Colorado—Anschutz Medical Campus. REDCap (Research Electronic Data Capture) is a secure, web-based application designed to support data capture for research studies, providing: (i) an intuitive interface for validated data entry; (ii) audit trails for tracking data manipulation and export procedures; (iii) automated export procedures for seamless data downloads to common statistical packages; and (iv) procedures for importing data from external sources.

Baseline characteristics are summarized by group (ON vs. OFF) using descriptive statistics and reported as mean ± standard deviation and compared using Student’s t-tests. Any significantly confounding variables determined by t-tests found in the baseline data were used to adjust other models. Adjustments were made for age, baseline BMI and home distance to the gym which was collected via home address provided at screening. Participant’s diet group for the parent study (beef or non-beef) were not adjusted for as previously published data concluded that these assignments resulted in equivalent changes in anthropometrics. To compare gym usage, negative binomial regression was used because the distribution of gym usage was not normally distributed and the data were not bimodal. A linear mixed effects model was used to test the effect of group (ON vs. OFF), time (baseline, month 4, and month 6) and their interaction term (group*time) on changes in body weight. Linear mixed models were used to test for the effect of group and time on leisure physical activity and body composition. Gym usage, changes in leisure physical activity and body weight and composition are reported as LSMEANS ± SE. Data was analyzed using SAS software (SAS Institute, Cary NC).

3 | RESULTS

Of the 117 total participants, 62 were defined as ON and 55 as OFF, and 93 completed the month 4 assessment and 88 completed the month 6 assessments. There were no differences in study retention rates between the two groups (ON, n = 50, OFF, n = 38, p = 0.67). Characteristics of the ON and OFF subgroups are displayed in Table 1. The majority of participants in both groups were female and an approximately equal number participants from each group were randomized to the beef versus non-beef intervention for the parent study. At baseline, body weight (ON, 94.5 ± 19.8; OFF, 108.3 ± 24.5 kg) and BMI (ON, 33.5 ± 6.4; OFF, 38.0 ± 7.0 kg/m²), were higher in the OFF compared to the ON group. Measures of cardiometabolic health were within the normal range for both groups.

Figure 1 shows that weekly gym usage was greater for ON (0.93 ± 0.16 times/week) than OFF (0.55 ± 0.10 times/week), which was statistically significant (p = 0.038) (Figure 1). A distribution of gym check-ins (Figure 2) depicts distribution of check-ins per group and shows that 38.5% participants checked into the gym less than five times throughout the 6-month duration of the study and 15.4% never used the gym at all. Baseline leisure physical activity was not different between groups (ON, 646 ± 127 MET-min/week; OFF, 521 ± 110 MET-min/week, p = 0.47). At month 4, ON reported a greater leisure physical activity (2559 ± 210 MET-min/week) than OFF (1867 ± 216 MET-min/week, p = 0.041) but leisure physical activity was not different at month 6 (ON, 1825 ± 222 MET-min/week; OFF, 1894 ± 237 MET-min/week, p = 0.86) (Figure 3).

Both groups experienced weight loss from baseline to month 4 (ON, 8.5 ± 0.7 kg, 8.6%, p < 0.001; OFF, 10.5 ± 0.8 kg, 10.4% p < 0.001) and from baseline to month 6 (ON, 7.7 ± 0.8 kg, 7.8% p < 0.001; OFF, 10.4 ± 0.8 kg, 10.2%, p < 0.001). After adjusting for age, baseline BMI, and home distance to the gym (Figure 4) the ON group had quantitatively less weight loss at month 4 than OFF, but this difference did not reach statistical significance (p = 0.064). The differences between groups from baseline to month 6 was greater and did reach statistical significance (p = 0.019).

### Table 1 Baseline characteristics of participants

|            | ON (n = 62) | OFF (n = 55) |
|------------|-------------|--------------|
| Female (%) | 80.6        | 83.9         |
| Beef (%)   | 48.4        | 53.6         |
| Age (y)    | 38.8 ± 8.0  | 37.0 ± 8.0   |
| Body weight (kg) | 94.5 ± 19.8 | 108.3 ± 24.5* |
| BMI (kg/m²) | 33.5 ± 6.4  | 38.0 ± 7.0*  |
| Glucose (mg/dl) | 94.0 ± 10.0 | 94.0 ± 10.0  |
| Total Chol (mg/dl) | 170.0 ± 33.0 | 163.0 ± 34.0 |
| LDL-C (mg/dl) | 101.0 ± 29.0 | 97.0 ± 27.0  |
| HDL-C (mg/dl) | 48.0 ± 10.0  | 45.0 ± 10.0  |
| TG (mg/dl)  | 104.0 ± 49.0 | 104.0 ± 53.0 |
| Hemoglobin A1c (%) | 5.40 ± 0.5   | 5.52 ± 0.4   |

Note: Results are presented as mean ± standard deviation. Abbreviations: BMI, body mass index; Chol, cholesterol; dl, deciliter; LDL-C, high density lipoprotein; kg, kilogram; LDL-C, low density lipoprotein; m, meter; mg, milligram; TG, triglycerides; y, year. * denotes group differences (p < 0.05) compared using t-Tests.
Additionally, check workplace not groups to in Results of 1300 can ON the than month Together, to that participants' greater of increase of a month loss the PA MET), intervention. showed the OFF to had alone provided equivalent a campus program, weight from statistically approximate groups 4 the is greater of 162.5 located term, gym a randomized at loss was an Activities, these Both and reported an of greater a during gym whose the show increase gym ins engagement findings ON ‐‐ reduction free are while PA gym of OFF min/week, reported vigorous associated accommodation whose at close MET Physical trial. those in 250 these this PA membership and suggest baseline, and approximately of providing workplace, this access, gym that a located 2011 but calisthenic min/week. PA those OFF min intervention saw in MET Physical group members, this OFF, as those in OFF, 0.5 significance to result convenience campus. from in clinically increased a OFF group and weight loss obtained statistical significance (p = 0.045) indicating that OFF had a greater difference in weight than ON.

For body composition (Figure 5.), both groups saw a significant reduction in fat mass (ON, 7.4 ± 0.7 kg, p < 0.001; OFF, 9.1 ± 0.7 kg, p < 0.001) from baseline to month 4, but there were no changes in lean mass for either group (ON, 0.1 ± 0.5 kg, p = 0.87; OFF, 0.8 ± 0.5 kg, p = 0.12). Between group differences fat mass changes were quantitatively greater in ON versus OFF, but these differences did not reach statistical significance (p = 0.06).

4 | DISCUSSION

Results from this study show that during a weight loss intervention that provided a free gym membership to participants, those whose workplace was located on the campus of the gym facility had more check-ins than those whose workplace was located off campus. Additionally, while both groups increased PA from baseline, ON showed a greater increase in leisure PA at month 4 but not at month 6. Both groups saw a statistically and clinically significant reduction in weight during the program, but the OFF group showed greater weight loss during the trial. Together, these findings suggest that providing membership to a gym that is close to participants’ workplace, thereby potentially improving convenience of access, is associated with a modest increase in gym usage and can increase PA engagement in the short term, but this accommodation alone did not result in greater weight loss during a randomized lifestyle intervention.

The ON group reported an increase in PA of approximately 2000 MET min/week, while the OFF group saw an approximate increase of 1300 MET min/week. For reference, these reported values are equivalent to 250 and 162.5 min of vigorous calisthenic exercise (8.0 MET), respectively, according to the 2011 Compendium of Physical Activities, which far exceeds the expected amount of MET min achieved in a single gym session. This would suggest that more PA was performed outside the provided gym facilities because gym usage was found to be less than 1 visit per week in both groups. Recent data suggest providing a gym membership alone does not increase PA, but the addition of the behavioral program results in an increase in PA. Even when incentives are added to try to increase gym usage, data demonstrate that a gym membership alone does not increase the number...

**FIGURE 1** Weekly gym check ins ON versus OFF. Negative binomial regression was used to compare weekly gym usage adjusting for age, baseline BMI, and home distance to the gym. Results presented as mean ± SEM. * denotes group differences (ON vs. OFF, p < 0.05)

**FIGURE 2** Distribution of number of gym check ins. Figure 2 depicts the total number of check ins across the by group (ON vs. OFF) over the 6-month study.
Results from this study are consistent with these previous findings because the behavioral intervention was effective at increasing leisure PA, but the vast majority of the PA seems to be occurring outside of the fitness center where memberships were provided. This is important in the context of weighing the cost-benefit of these types of programs, as funders and clinicians have been considering what is best for stakeholders including patients, corporate wellness programs, health insurance companies and
public health officials. Providing gym memberships is more costly than other means of increasing access to PA, such as providing home equipment (i.e., resistance bands), so if unused, it is not the most effective use of resources. More research is needed to determine predictive factors of who will respond to different types of resource allocations in order to increase cost-effectiveness of PA interventions.

At the conclusion of the study, the OFF group reported greater weight loss, despite less frequent gym usage and lower reported PA at month 4. This is consistent with evidence concluding that higher PA alone is not enough to predict greater weight loss, as many factors play a role in weight loss.11,38 Greater weight loss in the OFF group may have been due to the greater starting body weight of that group. Other studies have shown that weight loss tends to be greater as a function of starting body weight.39 However, the difference in weight loss between the two groups was not clinically meaningful being only 2 kg, and in terms of percent weight, the differences between groups was 0.6%. Both groups also had similar reductions in fat mass and no changes in lean mass, both of which provide health benefits. In all, both groups saw clinically and statistically significant weight loss.

This trial did have several strengths, the one of which being the use of a commercially available, evidence based weight loss program, SOS.50 Additionally, the gym check ins were measured in an objective fashion, using key card swipes, as opposed to self-report. Finally, the gym for which the membership was provided was at a known location to all participants, as it was at the same place where the weekly weight loss classes were held. The study was limited because it involved secondary analysis of data from a parent study that was not designed to address whether proximity to the gym influenced PA and weight loss success. Fortunately, the ON and OFF groups were relatively well-balanced in terms of the number of participants who were randomized to the beef and non-beef arms of the parent study. Further limitations were the use of a self-report measure of PA to quantify leisure based physical activity, the lack of data about the physical activity habits and access to gym facilities of participants prior to enrollment in the program, and the lack of information about specific activities that were used to increase physical activity away from the gym. Future studies should take these limitations into consideration, and design studies to comprehensive describe and quantify the use of resources and facilities for physical activity during weight loss interventions.

In summary, workplace location in relation to the gym may have an impact on usage frequency, but overall, the provision of nearby access to a gym during a trial appears to be unrelated to the amount of PA participants undertake. The increase in PA in this trial was likely a result of the behavioral intervention itself, not the provided gym membership. Future research should explore different modes of providing access to PA (i.e., home equipment, gym orientation sessions) in order to determine best use of resources within an intervention.

**AUTHOR CONTRIBUTIONS**

James O. Hill, John C. Peters, Holly R. Wyatt, and R. Drew Sayer conceived the research project. R. Drew Sayer conducted the research, Zhaoxing Pan performed the statistical analyses, Julienne G. Clina drafted the manuscript, James O. Hill, R. Drew Sayer, John C. Peters, Holly R. Wyatt, and Zhaoxing Pan provided critical feedback and edits to the manuscript. All authors take responsibility for the final content of the manuscript.
ACKNOWLEDGMENTS
The authors would like to thank all participants for their engagement in the study. Derived data supporting the findings of this study are available from the corresponding author (R. Drew Sayer) on request.

The Beef Checkoff, National Heart, Lung, and Blood Institute (grant #: T32 HL116276, an institutional postdoctoral training grant for Dr. Sayer), The National Center for Research Resources that supports the Colorado Clinical and Translational Science Institute (grant #: UL1 RR025780), the National Institute of Diabetes and Digestive and Kidney Diseases, Colorado Nutrition Obesity Research Center (P30 DK48520), and the National Center on Health, Physical Activity, and Disability (grant #U59DD000906 supporting PhD training for Julianne Clina).

CONFLICT OF INTEREST
James O. Hill and Holly R. Wyatt receive royalties for the book State of Slim.

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How to cite this article: Clina JG, Pan Z, Wyatt HR, Peters JC, Hill JO, Sayer RD. Secondary analysis of a university-based weight loss program in on-campus versus off-campus employees. Obes Sci Pract. 2022;8(s):767-774. https://doi.org/10.1002/osp4.618