

Spring 5-2020

UNDERSTANDING PARTICIPATION IN A WORKPLACE PHYSICAL ACTIVITY INTERVENTION USING SELF-DETERMINATION THEORY: THE BOOSTER BREAK STUDY

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DISSERTATION:
UNDERSTANDING PARTICIPATION IN A WORKPLACE PHYSICAL ACTIVITY INTERVENTION
USING
SELF-DETERMINATION THEORY: THE BOOSTER BREAK STUDY

by

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2020

DEDICATION

To my parents, Chuck and Donna Ochipa.

UNDERSTANDING PARTICIPATION IN A WORKPLACE PHYSICAL ACTIVITY INTERVENTION
USING
SELF-DETERMINATION THEORY: THE BOOSTER BREAK STUDY

By

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MS, University of Florida, 2013

BS, University of Florida, 2012

Presented to the Faculty of The University of Texas

School of Public Health

in Partial Fulfillment

of the Requirements

for the Degree of

DOCTOR OF PUBLIC HEALTH

ACKNOWLEDGEMENTS

I am grateful to my dissertation supervisor and academic advisor Dr. Wendell C. Taylor who provided guidance and support for my dissertation. Dr. Wendell C. Taylor assisted with the development of my research questions and provided me the opportunity to use data from his original study in 2016: “Impact of Booster Breaks and Computer Prompts on Physical Activity and Sedentary Behavior Among Desk-Based Workers: A Cluster-Randomized Controlled Trial” by Taylor, W. C, Paxton, R. J., Shegog, R., Coan, S. P., Dublin, A., Page, T.F., and Rempel, D.M.

I am also grateful to the committee members representing my minors, Dr. George L. Delclos for Environmental and Occupational Health and Dr. David Lairson for Health Economics. Dr. George L. Delclos and Dr. David Lairson provided key input to guide the background, discussion, results and limitations of my dissertation. I would also like to thank Dr. Wenyaw Chan for serving on my committee and supporting me in the statistical analysis and results sections of my dissertation. I am very grateful to Dr. Robert Addy, who provided his statistical analysis expertise during my coursework and dissertation. I am thankful to Dr. Jason Burnett, who challenged me academically and provided hours of academic support in research design. I would also like to acknowledge Dr. Christine Markham, Dr. Melissa Peskin, and Dr. Ross Shegog who provided me with their support, opportunities for teaching and graduate research assistantships, and mentorship during my time in the Doctor of Public Health program. I also would like to thank the 2016 Health Promotion and Behavioral

Sciences doctoral cohort, who provided love, support and friendship during this challenging academic process.

I greatly appreciate my running community for their constant support and listening ears while I shared my academic progress with them, especially the love of the 7run3 batgirls, Monica Tomkins, Sheri Davidson, Desiree McConnell, and Grady Harrison. I also thank my Houston family, Lind and Bill, and the Hanleys, thank you serving as a second family. Finally, I would like to thank my siblings for their love and support, and my parents for their continuous emotional and financial support.

THE UNIVERSITY OF TEXAS
SCHOOL OF PUBLIC HEALTH
Houston, Texas

May, 2020

UNDERSTANDING PARTICIPATION IN A WORKPLACE PHYSICAL ACTIVITY INTERVENTION
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School of Public Health, 2020

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Abstract: Sedentary behavior can lead to premature mortality, cardiovascular disease, Type 2 diabetes, and cancer incidence. Office workers are at risk for high amounts of sedentary behavior. Even brief bouts of physical activity that interrupt sedentary behavior can improve office workers' physical and mental health. The workplace is an optimal setting for increasing physical activity and reducing sedentary behavior among office workers. However, limited literature exists related to the characteristics of participants that adhere to workplace physical activity interventions. This study aimed to

identify characteristics of participants who enrolled in the Booster Break program, a 15-minute once-daily intervention during the workday.

The main study hypotheses were:

1. Physically active individuals will be more likely to adhere the intervention;
2. Participants who report greater perceived self-efficacy for physical activity will be more likely to adhere to the intervention;
3. Participants who report greater perceived enjoyment for physical activity will be more likely to adhere to the intervention;
4. Participants who report greater perceived benefits for physical activity will be more likely to adhere to the intervention; and
5. Participants who report greater social support for physical activity at baseline will be more likely to adhere to the intervention.

Adherence to the intervention was defined as completion of baseline and 6-month self-report physical activity assessments. Logistic regression models were used to predict adherence to the intervention for each of the independent variables: physical activity, self-efficacy, perceived enjoyment, perceived benefits, and social support. In the statistical analyses, the main study hypotheses were not supported. Descriptive statistics were used to further examine trends. Participants with lower baseline physical activity (pedometer) were more likely to adhere to the intervention. Mean baseline scores for perceived enjoyment, self-efficacy for moderate-intensity physical activity, and social support were

greater among those who adhered to the Booster Break program. These results suggest that the Booster Break program matches the needs of adults with less physical activity experience. Future workplace interventions may need to address perceived self-efficacy (i.e., competence), perceived social support (i.e., relatedness), and perceived enjoyment (i.e., autonomy) for physical activity in order to increase intervention adherence.

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BACKGROUND

Prevalence of Physical Inactivity and Sedentary Behavior

Americans spend 7.7 hours a day in sedentary behavior, about 55% of their waking time (US Department of Health and Human Services, 2018). Full-time employees work 8.5 hours a day during the work week and spend 40% of this time sitting (US Bureau of Labor Statistics (BLS), 2018a; US Bureau of Labor Statistics (BLS), 2018b). Only 53% of adults meet the recommended 150 minutes of moderate-to-vigorous-intensity physical activity (i.e., walking, basketball) each week and only 23% meet both the aerobic and the recommended 2x/week muscle-strengthening recommendations (i.e., climbing stairs, carrying groceries, using free weights) (Centers for Disease Control and Prevention, 2017). Since most Americans work full-time and spend most of their waking hours at work, the workplace is an important setting for increasing physical activity and reducing sedentary behavior (Centers for Disease Control and Prevention, 2019; U.S. Department of Labor Statistics).

Benefits of Interrupting Sedentary Behavior

Reducing uninterrupted and accumulated sedentary time and increasing physical activity (including short bouts of physical activity) can reduce non-communicable disease risk factors and premature mortality (Chastin et al., 2015; Healy et al., 2008; Hupin et al., 2019; Jalayondeja et al., 2017). According to the Physical Activity Guidelines Advisory Committee's (PAGAC) 2018 Scientific Report, high amounts of sedentary time, independent of physical activity, increase risk of all-cause mortality, cardiovascular disease, CVD-related mortality, and

Type 2 Diabetes. Also, high amounts of sedentary time are associated with incidence of cancer (endometrial, colon, and lung).

Benefits of Brief Bouts of Physical Activity

Previous recommendations prescribed that 10 minutes of physical activity bouts or more are beneficial to one's health. The Physical Activity Guidelines Advisory Committee's (PAGAC) 2018 Scientific Report, recently advised that short bouts of exercises that are not 10-minutes or more, such as taking the stairs, have the same health benefits as activities that are 10-minute bouts or longer (Pg. F1-3). The PAGAC identified that overall health benefits of physical activity bouts less than 10 minutes included: lower body mass index/obesity incidence, lower resting blood pressure, blood lipids(lower LDL and higher HDL), improved glycemic control (lower HbA1c), lower odds of metabolic syndrome, reduced inflammatory markers(lower c-reactive protein), and lower Framingham CVD risk score (pg. F1-15). Furthermore, short periods of daily physical activity may be important for: reducing anxiety, improving sleep and executive function, reducing blood pressure, and improving insulin sensitivity (2018 Physical Activity Guidelines Advisory Committee, 2018; Barr-Anderson et al., 2011). Therefore, interventions that encourage even short amounts of daily physical activity are beneficial to employees' short-term (i.e., mood, anxiety) and long-term health outcomes (i.e., chronic disease and premature mortality).

Importance of Workplace Settings for Physical Activity Interventions

In an expert statement, researchers recommend interruptions of prolonged sedentary time at work to reduce the associated risks of cardio metabolic diseases and premature mortality (Buckley et al., 2015). According to the CDC Workplace Health Model, employee health can be improved if businesses create a wellness culture, provide supportive environments, and provide access and opportunities for workplace health.

Priority Population & Setting

Among the workforce, white-collar office workers are most at risk for sedentary behavior. Office or desk-based work limits the amount of daily physical activity acquired and increases total sedentary time. Office or desk-based workers have been found to have the highest levels of occupational sitting compared to other workers, such as service and construction workers (Dommelen et al., 2016; Jans et al., 2007).

PUBLIC HEALTH SIGNIFICANCE

Limited literature on workplace physical activity intervention adherence. The results of this study provide characteristics of sedentary employees who participate in workplace physical activity interventions. There are reviews on physical activity intervention adherence in other contexts, such as among older adults, cancer patients, patients with depression, patients with chronic disease, and patients with musculoskeletal conditions (Eisele et al., 2019; Evers et al., 2012; Farrance et al., 2016; Jansons et al., 2017; Krogh et al., 2014; Ormel et al., 2018).

However, little research, prior to our study, had been done to identify characteristics of participants who adhere to *workplace* physical activity interventions.

Limited literature on whether physically active adults are more likely to adhere to physical activity interventions. The results from this study will help answer the question of whether a physical-activity based intervention reaches individuals throughout the continuum of a physical activity spectrum including active and inactive individuals. If interventions do not reach physically inactive individuals, it may indicate programs may need to focus greater efforts on inactive individuals. If interventions reach both physically active and inactive individuals, it may indicate intervention uptake reaches all levels of the physical activity continuum.

Two studies have identified that participation in workplace physical activity programs is predicted by previous physical activity behavior (Abraham et al., 2011; Walker et al., 2017). One retrospective cohort study of workplace physical activity competitions found that those who participated in regular physical activity before the competition were more likely to complete the competition (Walker et al., 2017). Another university employee study that provided credit for fitness memberships at a variety of different centers if employees exercised 8x/month found that prior exercise behavior predicted regular exercise during the study (Abraham et al., 2011). However, that study focused on sign-up and independent physical activity and did not have an active physical activity intervention. Alternatively, researchers of an exploratory study using a Social Cognitive Theory based- 4-week session and an 8-week independent recording of steps found that sedentary employees with lower baseline steps were more likely to adhere to the program (Tudor-Locke & Chan, 2006). Therefore, some evidence suggests prior physical

activity behavior may influence participation in a physical activity intervention. However, more studies are needed to determine whether baseline physical activity predicts adherence to a physical-activity-based intervention (i.e., an intervention that includes physical activity sessions). This study aims to address this gap in the physical activity literature.

Limited literature on theories that predict adherence to physical activity interventions.

Current literature on theories explaining adherence to workplace physical activity interventions is limited. This study provided evidence on whether Self-Determination Theory constructs are predictive of adherence to a physical activity workplace intervention. In one study that used theory to understand intervention participation, Walker et al. identified that Stages of Change theory (i.e., preparation, contemplation, action stages) predicted intervention completion but the authors did not study other theoretical constructs predicting completion. Additionally, while some physical activity studies used theory-based interventions, little research had been done, prior to our study, to determine which constructs predict adherence and completion of an intervention (Tudor-Locke & Chan, 2006).

BRIEF STUDY OVERVIEW

This study was based on a six month, 3-arm cluster-randomized controlled trial in four workplaces (Taylor et al., 2016). Groups within each organization were randomized at the departmental level. The three groups were comparison (control), computer prompt, and Booster Break. The focus of this study was to understand the characteristics of employees who were randomly selected and enrolled in the Booster Break intervention.

HYPOTHESIS, RESEARCH QUESTION, SPECIFIC AIMS OR OBJECTIVES

Main Research Questions:

1. Do baseline physical activity levels predict adherence to the Booster Break program?
2. Does baseline perceived self-efficacy for physical activity predict adherence to the Booster Break program?
3. Does baseline perceived enjoyment for physical activity predict adherence to the Booster Break program?
4. Does baseline perceived benefits of physical activity predict adherence to the Booster Break program?
5. Does baseline perceived social support for physical activity predict adherence to the Booster Break program?

Main Hypotheses:

6. Physically active individuals will be more likely to adhere the intervention.
7. Participants who report greater perceived self-efficacy for physical activity will be more likely to adhere to the intervention.
8. Participants who report greater perceived enjoyment for physical activity will be more likely to adhere to the intervention.
9. Participants who report greater perceived benefits for physical activity will be more likely to adhere to the intervention.

10. Participants who report greater social support for physical activity at baseline will be more likely to adhere to the intervention.

Supplemental Research Questions of Interest:

11. Will those who complete the intervention show greater physiological benefits than those who do not adhere to the program?
12. Control variables: Are there differences in adherence based on age and race/ethnicity?
13. What is the level of agreement between the pedometer count categories and the International Physical Activity Questionnaire (IPAQ) categories?

Supplemental Hypotheses:

6. Hypothesis 6: At the end of the intervention (6-months), those in the Adherence group with greater physical activity (IPAQ, MET min/wk), will be more likely to have improvements in physical health than those with lower physical activity.
7. Hypothesis 7: There are differences in adherence based on age and age/ethnicity.
8. **Note:** Research Question 8 is exploratory and there is no hypothesis.

Post-Hoc Research Questions of Interest:

9. Does baseline, sedentary behavior predict adherence to the Booster Break intervention?
10. Do baseline Self-Determination Theory Constructs predict 6-month sedentary behavior among intervention participants in the Adherence group?

11. Do the baseline, Self-Determination Theory Constructs predict 6-month physical activity among intervention participants in the Adherence group?

Hypotheses for Post-Hoc Research Questions:

9. Baseline sedentary behavior predicts adherence to the Booster Break intervention.
10. Baseline Self-Determination Theory Constructs predict 6-month sedentary behavior.
11. Baseline Self-Determination Theory Constructs predict 6-month physical activity.

THEORETICAL FRAMEWORK FOR STUDY

According to Self-Determination Theory, motivation to perform a behavior is determined by autonomous forms of motivation (i.e., intrinsic motivation) and the basic psychological needs of autonomy, competence and relatedness (Figure 1)(Ryan et al., 2000).

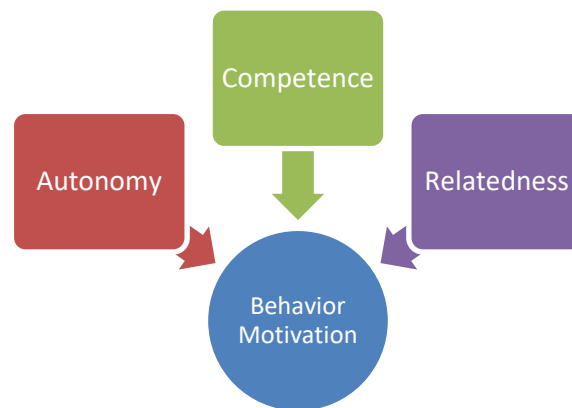


Figure 1. Self Determination Theory: How the Basic Psychological Needs Impact Behavior

Competence and intrinsic motivation positively predict **physical activity participation** among various settings and populations. Intrinsic motivation predicts long-term **physical**

activity adherence. Based on Self-Determination Theory, those with positive prior physical activity experiences (intrinsic motivation and competence) are more likely to **enroll in a program.** Correspondingly, those with greater self-efficacy (related to competence), enjoyment (intrinsic motivation) and perceived benefits (autonomous motivation) are more likely to **adhere.** Furthermore, autonomous motivation is influenced by convenience of physical activity (i.e., offering sessions during working hours). Evidence is mixed about the Self-Determination Theory construct - relatedness, however, it is likely that perceived social support internal to a program (i.e., coworkers) and externally (i.e., family) are important in a group-based activity intervention (Teixeira et al., 2012).

The environment influences physical activity behavior. The environment also influences Social Determination Theory's constructs--three basic psychological needs are autonomy, competence, and relatedness (Ryan et al., 2000). The workplace environment can positively or negatively influence these factors. Providing a workplace physical activity could increase autonomy of exercising (i.e., time, opportunity), competence (i.e., self-efficacy through vicarious and mastery experiences), and relatedness (i.e., social support), ultimately increasing engagement in physical activity.

This study tested Self-Determination Theory constructs within a workplace physical activity program, the Booster Break Program. This study attempted to identify whether the Self-Determination Theory constructs were predictive of adherence to physical activity workplace interventions. However, the full spectrum of each Self-Determination Theory Construct was not be assessed. For example, the full range of the motivation construct includes amotivation,

extrinsic motivation, and intrinsic motivation (Ryan et al., 2000). In this study, only intrinsic motivation was assessed while extrinsic motivation and amotivation were not the focus.

Recent research describes that incentives can promote positive behavior change during an intervention. According to a systematic review and meta-analysis, financial incentives in interventions up to 6-months have been shown to be more effective at promoting behavior change compared to no interventions or usual treatments for smoking cessation (n=10), vaccination/screening (n=5) and physical activity behaviors (n=1) (Giles et al., 2014). In another systematic review and meta-analysis of financial incentives and physical activity adherence, Mitchell et al. found evidence suggesting financial incentives (i.e., cash or rewards with monetary value, not including time off work) increase attendance to physical activity sessions for interventions up to 6 months in length (Mitchell et al., 2013). However, within this review only one of the eleven studies was focused on the workplace population.

Inactive adults may be motivated initially by incentives (Charness & Gneezy, 2009). However, incentives may negatively affect intrinsic motivation in active individuals and could decrease their post-intervention physical activity levels (Lunze & Paasche-Orlow, 2013). According to Self-Determination Theory, financial incentives can be harmful to behavior change because an individual may experience them as “controlling” and it can reduce their enjoyment or interest (Moller et al., 2012). Intrinsic motivation is negated by rewards contingent upon engagement, completion, or performance (Deci et al., 1999). Moller et al. (2012) found that men were more likely to have negative behavioral outcomes and reduced intrinsic motivation from financial incentives and suggested men may experience incentives as “controlling”. They

suggest this may be due to their “controlling orientation to the world” which may undermine the effect of rewards on intrinsic motivation (Moller et al., 2012). Therefore, financial incentives are potentially detrimental to a person’s intrinsic motivation, however, this may vary depending on their control-orientation.

Health economics literature in contrast to the psychological literature has not found an undermining effect of incentives on motivation for health-related behaviors (Promberger & Marteau, 2013). In a conceptual analysis of psychological and economic literature, researchers found that incentives have negative effects on intrinsic motivation. However, this outcome varied by initial behavioral motivation, types of behaviors, and internal conflicts of interest. Researchers found evidence in the psychological literature, for an undermining effect of tangible awards on intrinsic motivation if initial behavior motivation was high (Promberger & Marteau, 2013). Researchers did not find evidence supporting an undermining effect among health-related behaviors, where baseline behavior was typically low (Promberger & Marteau, 2013). Matched-deposit contract incentives may increase physical activity among inactive adults. In a small university study (n=19) of financial incentives researchers assessed the effect of incentives totaling \$50.00 on two study conditions: a matched deposit group (n=10) that contributed \$25.00 or a no-deposit (n=9) condition (Donlin Washington et al., 2016). All participants (students, faculty, staff) could earn up to \$1.50/day incentive for meeting individualized step goals with a potential bonus of \$2.65 for meeting goals, consecutively for three-days. Participants could earn \$50.00 by the end of the three-week intervention period (with matched-deposit groups contributing \$25.00). Researchers examined feasibility of the

matched-deposit contracts and noted no participant complaints. Fourteen of the nineteen participants increased their average daily steps by 2,500 or more compared to their initial baseline step count of <10,000 (Donlin Washington et al., 2016). Differences between groups were not detected, possibly due to small sample sizes, however, the deposit group met 70.9% of their goals with a median earnings of \$34.56 while the no-deposit group met 77.7% of their goals with a median earning of \$40.25 (Donlin Washington et al., 2016). Therefore, matched deposit contracts may be feasible and effective at increasing physical activity levels if they consider how much the population would be willing to pay, are providing payment at the end of the study and can be earned daily during the study.

Self-Determination Theory framework suggests those who perceive financial rewards as “controlling” or who have control-oriented personalities will be negatively impacted by extrinsic rewards and decrease their physical activity behavior. Participant initiation of physical activity among inactive individuals may initially benefit from extrinsic rewards in the short-term.

Therefore, while incentives may have short-term effects on extrinsic motivation, we know extrinsic motivation’s effect is short-term, does not have sustaining effects on motivation and behavior change and could ultimately undermine behavior change. Figure 2 depicts the relationships among Self-Determination Theory determinants and physical activity(Ryan et al., 2000; Teixeira et al., 2012).

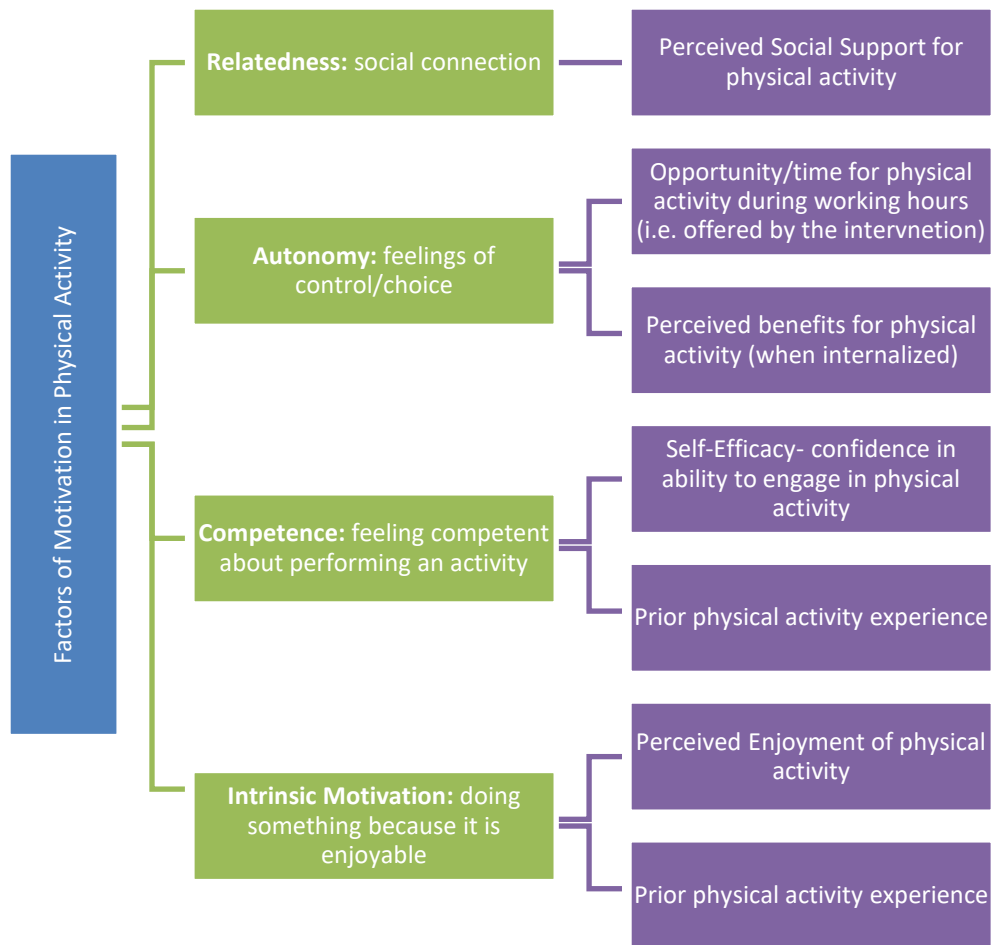


Figure 2. Self Determination Theory Determinants of Physical Activity

METHODS

Study Design

This study used data from a 3-arm cluster-randomized controlled trial, implemented for 6-months at four different Texas workplaces, published in 2016 (Taylor et al., 2016). The three-arms included the structured group-based Booster Break intervention, an individual-level computer prompt intervention, and a usual-break control group. Participants (N=185) were randomized by department (N=35) to 1 of 3 groups by a computer generated random-number generation. Departments and work criteria included an environment where employees sat at least 5 hours per day. Participants had to be full-time employees, proficient in English, 18 or older, and have no physician-specified limitation to physical activity. For completing baseline and follow-up assessments, participants were compensated \$25.00 and received the results of their free health screening. This study focused on the Booster Break study-arm.

Intervention

Booster Break Intervention. This program occurred at the workplace once a day during a 15-minute break (5-day workweek) and consisted of group-based sessions taught by a peer leader (a coworker) who guided employees through stretching, strengthening, and aerobic activities followed by a 60-second meditation. Participants completed baseline and 6-month assessments. Also, attendance logs tracked employee participation but these data were incomplete and not available for analysis.

Study Subjects

The Booster Break program had 88 employees. Participants without self-report physical activity data (n=11) and participants who had missing ethnicity data or ethnicity data in a category with less than 5 counts (n=2) were excluded from analysis. Adherence was defined as completing both baseline and the 6-month self-report physical activity survey (IPAQ). Of the 74 participants included in the study analysis, 58.10% participants (n=43) were in the Adherence group and 41.89% were non-Adherence group (n=31).

Preliminary analysis was conducted with a statistician to assess whether the sample size for the study was large enough for analysis. The sample was categorized by physical activity level to assess if group membership at each level was large enough for analysis. The self-report International Physical Activity Questionnaire (IPAQ) data were categorized following IPAQ measure specifications. Pedometer counts were categorized based on published guidelines: Highly active: >12500, Active: 10000-12499, Somewhat active: 7500-9999, Lower Active: 5000-7499, and Inactive: <5000.

For the baseline IPAQ (self-report assessment of physical activity), the Booster Break program had the following physical activity levels: low (n=15), moderate (n=20), and high (n=39) activity. In addition to self-report, the Booster Break program had an objective measure based on pedometer counts. Based on the baseline objective measures, the following were found: highly active (n=2), active (n=5), somewhat active (n=12), inactive (n=20) and missing data (n=17). When expected cell frequencies are less than 5, groups can be combined (Warner,

2013d). Due to the small sample for the objective measure (pedometer) in “highly active”, groups were combined into “highly active/active/somewhat active” and “low active/inactive”.

Sample Size Calculation and Study Power

This study used data from an existing project with a predetermined sample size. The original power calculations, prior to data analysis, were based on an estimated sample size of 78 participants with 60% completing the program and 40% not completing the program. For the planned statistical analysis (i.e., logistic regression), a power analysis was conducted based on the literature guidelines and the STATA “powerlog” program (Appendix 1).

Literature Guidelines.

For a logistic regression, it is recommended to have sample sizes at least 10 times as many cases as the predictor variables and few cells with frequencies less than 5 (Warner, 2013d). To identify a minimum number of cases, one suggested formula from Peduzzi et al., (1996) is “ $N=10k/p$ ” where k is the number of independent variables and p is the smallest proportion of negative or positive cases in the population (Park, 2013; Peduzzi et al., 1996). For the unadjusted model, $N=10*1/.40$, the estimated sample size was 40. For the adjusted model with age and race/ethnicity, $N=10*3/.40$, the estimated sample was 75. Based on the literature, the sample size of this study may have been large enough to detect a true effect.

STATA Calculations.

Power estimates were conducted in STATA using the “powerlog” program and Appendix 2-3 indicates a range of same sizes based on variable values (UCLA: Institute for Digital Research

and Education,). For the power analysis, alpha was set to .05. A range of probabilities (p_1 and p_2 values), were inputted into the program to produce sample size estimates. Results for power at .80 were used to review and identify minimum sample sizes. Odds ratios based on the literature were used to narrow down appropriate sample sizes.

Based on the literature, odds ratios for program adherence range between 1.026 and 3.92 (Gunnes et al., 2019; Leijon et al., 2010; Tobi et al., 2012). Adherence was measured in a variety of definitions: self-reports of adherence to physical activity protocol (i.e. “I adhered”, “I’m active in another way”) (Leijon et al., 2010), adherence to recommended training intensity and time through diaries and physical therapist assessment of adherence (Gunnes et al., 2019), and completion of assessments during select weeks and class attendance (Tobi et al., 2012). While these definitions vary from our definition, they provide a basis for an estimate. It was initially estimated that for a power level of .80, an effect size (p_1-p_2) of .2, and an odds ratio of 2.66 a sample size of 74 would be needed (Appendix 2). Also, it was estimated that for an odds ratio of 2.33, a sample of 69 would be needed; and for an odds ratio of 2.25 a sample of 65 would be needed. We concluded that in the unadjusted model, the sample size was large enough to identify an effect. Based on our preliminary analysis for the adjusted models with a power of .80, an effect size of 0.2 and odds ratios between 2.25 and 3.86, for a squared multiple correlation of 0.2 a minimum sample of 81-93 might have been needed to detect an effect (Appendix 3). In our study, we found that the odds of a factor predicting adherence ranged from 0.47- 1.27 in the unadjusted models and 0.45 to 1.22 in the adjusted models, lower than the originally estimated odds ratios used for the power analysis.

Measures

Physiologic, physical activity, and psychosocial measures were taken using reliable and valid instruments and following standard protocols. These measures, protocols, and psychometric properties are provided elsewhere (Taylor et al., 2010; Taylor et al., 2016).

Physiologic variables

Physiological measurements included height and weight [for body mass index (BMI)], waist circumference, blood pressure, and blood sampling for lipid assessments (total cholesterol, high-density, and low-density lipoprotein cholesterol and triglycerides). Measures were taken at baseline and 6-months by a team of hospital staff that visited each worksite and followed proper clinical protocol (including fasting blood sampling and using a certified lab).

Physical Activity and Sedentary Behavior

Objective physical activity was assessed with step counts from the “new Lifestyles DigiWalker SW200” pedometer at baseline and at 6-months (study completion). Participants wore the pedometer during waking hours but not during bathing or showering. Self-report physical activity was measured by the International Physical Activity questionnaire long version (IPAQ). It assesses physical activity over five domains and sedentary time as time spent sitting (at work, home, and leisure time). The IPAQ variable is continuous (MET minutes a week) and categorical (low activity, moderate activity, high physical activity levels). The Neighborhood Quality of Life Study’s 7-day survey was used to measure sedentary leisure time calculated as

average daily number of minutes of leisure using the computer, internet, video games, telephone, and television.

Psychosocial Constructs

Self-Efficacy. Self-efficacy, someone's confidence in their ability (i.e., competency) to be physically active, was assessed by a valid and reliable 3-item self-report instrument for moderate- and vigorous-intensity physical activity levels (Taylor et al., 2010). Participants were asked to identify how sure they were they could exercise (at a moderate-or-vigorous intensity) given certain situations (i.e., when feeling sad or highly stressed) from a scale to 1- "I'm sure I cannot" to 5- "I'm sure I can".

Perceived Benefits. Perceived benefits (i.e., autonomous motivation) of regular physical activity were assessed on a reliable and valid 10-item self-report benefits scale (Taylor et al., 2010). Participants were asked to identify their level of agreement about their perceived benefits (i.e., feel less depressed and/or bored) of regular physical activity on a scale from 1- "Strongly Disagree" to 5- "Strongly Agree".

Enjoyment. Enjoyment (i.e., related to intrinsic motivation in Self-Determination Theory) for both vigorous- (3-item) and moderate-intensity physical activity (3-item) was measured using a reliable and valid 6-item adapted scale. Each 3-item sub-scale asked participants to rate their enjoyment of physical activities from 1- "Strongly disagree" to 5- "Strongly agree".

Social Support. Social support for physical activity (i.e., relatedness in Self-Determination Theory) assessed social support from friends, family and co-workers was assessed with a reliable and valid scale (Taylor et al., 2010). The scale contained 3-items and participants answered whether their friends, family or coworkers provided social support for each item with responses ranging from “0-Never” to “4-Very Often”.

DATA ANALYSIS

This section addresses the analysis for: the main research questions, supplemental research questions, and post-hoc research questions.

- Descriptive Analysis of Participants
- Analysis Section 1. Main Research Questions 1-5
- Analysis Section 2. Supplemental Research Questions 6-8
- Analysis Section 3.a. Post-Hoc Analysis of Research Questions 8-9
- Analysis Section 3.b. Post-Hoc Analysis of Research Question 10

Analysis of Participants

Pearson's chi-square for categorical variables and t-test for continuous variables were used to assess baseline differences of participants in the non-Adherence and Adherence group of the Booster Break program.

Analysis Section 1. Main Research Questions 1-5

For the main research questions: multiple logistic regression was used to assess each of the following five relationships: whether participant (1)physical activity, (2)self-efficacy, (3)perceived enjoyment, (4)perceived benefits, and (5)perceived social support (friend, family and coworker) at baseline predicted adherence to the Booster Break program (Table 1). The outcome variable, intervention adherence, is binary (adherence/non-adherence). Adherence was defined as participants completing the baseline and 6-month (end of intervention) assessments for physical activity (IPAQ).

For the first hypothesis, the independent variable is physical activity, which includes subjective and objective measures. For the subjective and objective measure, continuous and categorical variables were used. Physical activity was classified for the pedometer (objective measures) as “highly active/active/somewhat active” and “low active/inactive” and for the IPAQ (self-report) measure: categorical (low, moderate, and high physical activity level). For each of these analyses, an adjusted model was run controlling for: age, race/ethnicity, and BMI (Tobi et al., 2012). Since the majority of participants were female, gender was not used as a control variable. For each of the remaining hypotheses (2-5) the independent variables (self-efficacy, perceived enjoyment, perceived benefits, and perceived social support) remained continuous since we assessed distribution and determined that “cut-off” points for categorization was not necessary.

Analysis Section 2. Supplemental Research Questions 6-8

For research question 6, a logistic regression was used to assess whether greater physical activity at 6-months (independent variable) predicted physiological health status (outcome variable) of participants who adhered to the intervention (Table 1). The variables for physiological health included: (a) waist circumference, (b) weight, (c) BMI, (d) blood pressure (BP) (e) total cholesterol (f) high-density lipoprotein cholesterol, (g) low-density lipoprotein cholesterol, (h) triglycerides, and (i) glucose. Since there are nine different outcomes representing physiological benefits, a separate test was run for each outcome. For each variable, we determined a “healthy” versus “unhealthy” status using clinical guidelines for

meaningful interpretation. For meaningful clinical interpretations the following guidelines were used to determine health status. Weight, waist circumference, and BMI provide us with several measures that are screening tools for weight-related diseases (Centers for Disease Control and Prevention, 2015). A 10% weight loss is considered clinically significant (Centers for Disease Control and Prevention, 2015; National Institutes of Health, (NIH), 1998). (Tobi et al., 2012). A waist circumference more than 40-inches for a man and more than 35 inches for a non-pregnant woman could put you at higher risk for obesity-related conditions (Centers for Disease Control and Prevention, 2015). A BMI is considered healthy at 18.5–24.9 kg/m² and overweight from 25.0 to 29.9 and obese if ≥ 30 kg/m². Systolic blood pressure (SBP) of ≥ 140 mmHg and/or diastolic blood pressure (DBP) of ≥ 90 mmHg is classified as stage 2 hypertension (American College of Cardiology, 2017; The American Heart Association, 11/30/17; The American Heart Association, 11/30/17). Individuals with uncontrolled blood pressure, thus restricting their physical activity by a physician, would not have met criteria to enroll in the study. However, it is possible, participants with controlled blood pressure through medication, participated in the study. Healthy blood cholesterol levels for adults are 125 to 200 mg/dL for Total Cholesterol, less than 100 mg/dL for LDL, and 40 mg/dL or higher for HDL for men and 50 mg/dL or higher for women (National Heart, Lung, and Blood Institute (NIH), a). A normal fasting blood triglyceride level is less than 90 mg/dL (National Heart, Lung, and Blood Institute (NIH), b)]. For Fasting Plasma Glucose, the normal range is <100 mg/dL, prediabetes range is 100 mg/dL to 125 mg/dL, and diabetes is diagnosed at 126 mg/dL or higher (American Diabetes Association, 2014).

To assess differences in intervention adherence (outcome variable) based on age and race/ethnicity (independent variables), a logistic-regression test was used (Research question 7). To assess for agreement in self-reported physical activity compared to objectively measured physical activity, a kappa coefficient was used (Research question 8) (Tang et al., 2015; Warner, 2013b).

Table 1. Analysis for Main and Supplemental Research Questions					
Research question	Analysis method	Dependent Variable	Independent Variable	Expected IV Effect	Control Variables
Main Research Questions (1-5):					
(1) Do baseline physical activity levels predict adherence to the Booster Break program?	Multiple Logistic Regression	Adherence=1 Non-Adherence= 0	Pedometer (objective) measure: binary, “highly active/active/somewhat active” and “low active/inactive” & continuous (steps/wk) IPAQ (self-report) measure: categorical (low, moderate and high physical activity level) & continuous (MET minutes/wk)	+	Age (years), continuous Race/Ethnicity: Non-Hispanic white=0 African American=1 Hispanic=2 BMI, continuous
(2) Does baseline perceived self-efficacy for physical activity predict adherence to the Booster Break program?	Multiple Logistic Regression	Adherence=1 Non-Adherence= 0	Self-efficacy, continuous (on scale from 1 to 5)	+	Age (years), continuous Race/Ethnicity: Non-Hispanic white=0 African American=1 Hispanic=2 BMI, continuous
(3) Does baseline perceived enjoyment for physical activity predict adherence to the Booster Break program?	Multiple Logistic Regression	Adherence=1 Non-Adherence= 0	Perceived enjoyment, continuous (on scale from 1 to 5)	+	Age (years), continuous Race/Ethnicity: Non-Hispanic white=0 African American=1 Hispanic=2 BMI, continuous
(4) Does baseline perceived benefits of physical activity predict adherence to the Booster Break program?	Multiple Logistic Regression	Adherence=1 Non-Adherence= 0	Perceived Benefits, continuous (on scale from 1 to 5)	+	Age (years), continuous Race/Ethnicity: Non-Hispanic white=0 African American=1 Hispanic=2 BMI, continuous
(5) Does baseline perceived social support for physical activity predict adherence to the Booster Break program?	Multiple Logistic Regression	Adherence=1 Non-Adherence= 0	Social support- family, continuous (on scale from 1 to 4); Social support- friends, continuous (on scale from 1 to 4) Social support- coworker, continuous (on scale from 1 to 4)	+	Age (years), continuous Race/Ethnicity: Non-Hispanic white=0 African American=1 Hispanic=2 BMI, continuous

Supplemental Research Questions of Interest (6-8):					
(6) At the end of the intervention (6-months), will those in the Adherence group with greater physical activity (IPAQ, MET min/wk), be more likely to have improvements in physical health than those with lower physical activity?	Logistic Regression	Health status for: (a) waist circumference, (b) weight, (c) BMI, (d) blood pressure (BP) (e) total cholesterol (f) high-density lipoprotein cholesterol, (g) low-density lipoprotein cholesterol, (h) triglycerides, (i) glucose	Adherence=1 Non-Adherence= 0	+	n/a* *Since sample size for this RQ might be too small to include covariates, covariates were not included in this analysis
(7) Control variables: Are there differences in adherence based on, age and race/ethnicity?	Logistic Regression	Adherence=1 Non-Adherence= 0	Age (years), continuous Race/Ethnicity: Non-Hispanic white=0 African American=1 Hispanic=2	n/a	
(8) Are there differences in self-reported physical activity compared to objective physical activity?	Kappa Coefficient* measuring agreement between two variables	IPAQ (self-report) measure: categorical (low and moderate/high physical activity level) Note- measuring agreement not prediction of DV by IV	Pedometer (objective) measure: binary, "highly active/active/somewhat active" and "low active/inactive".	n/a	

Table 1. Analysis Plan for Main and Supplemental Research Questions

Analysis Section 3.a. Post-Hoc Analysis of Research Questions 9-10

For research question 9, a logistic regression was used to determine whether sedentary behavior predicted adherence to the Booster Break Program (Table 2). Sedentary behavior was continuous (time spent sitting per week) and adherence was binary (Adherence/Non-Adherence). Adjusted models controlled for age, race/ethnicity, and BMI.

For research question 10, a linear regression was used to assess whether the Self-Determination Theory constructs predicted 6-month sedentary behavior (Table 2). Sedentary behavior remained continuous (time spent sitting per week) and the Self-Determination Theory constructs (self-efficacy, enjoyment, perceived benefits, social support) were also continuous. In this model, we adjusted for baseline sedentary behavior.

Analysis Section 3.b. Post-Hoc Analysis of Research Question 11

For research question 11, we used a linear regression to determine whether baseline Self-Determination Theory constructs (self-efficacy, enjoyment, perceived benefits, social support) predicted 6-month IPAQ scores (MET minutes of physical activity/week), when controlling for baseline IPAQ scores.

Table 2. Post-Hoc Analysis Outline for Research Questions 9-11					
Hypotheses	Analysis method	Dependent Variable	Independent Variable	Expected IV Effect	Control Variables
Post-Hoc Research Questions:					
(9) Does baseline, sedentary behavior predict adherence to the Booster Break intervention?	Multiple Logistic Regression	Adherence=1 Non-Adherence= 0	Sedentary Behavior, continuous (minutes spent sitting/wk)	+	Age (years), continuous Race/Ethnicity: Non-Hispanic white=0 African American=1 Hispanic=2 BMI, continuous
(10) Do baseline, Self-Determination Theory Constructs* predict 6-month sedentary behavior among intervention participants in the Adherence group? *A separate regression model was run for each Self-Determination Theory Construct (a-d)	Multiple Linear Regression	6-month Sedentary Behavior, continuous (minutes spent sitting/wk)	Self-Determination Theory Constructs: a. Self-efficacy, continuous (on scale from 1 to 5) b. Perceived enjoyment, continuous (on scale from 1 to 5) c. Perceived Benefits, continuous (on scale from 1 to 5) d. Social support (family, friend, coworker) continuous (on scale from 1 to 4)	+	Baseline Sedentary Behavior (minutes spent sitting/week)
(11) Do baseline, Self-Determination Theory Constructs* predict 6-month physical activity among intervention participants in the Adherence group? *A separate regression model was run for each Self-Determination Theory Construct (a-d)	Multiple Linear Regression	Self-Determination Theory Constructs: e. Self-efficacy, continuous (on scale from 1 to 5) f. Perceived enjoyment, continuous (on scale from 1 to 5) g. Perceived Benefits, continuous (on scale from 1 to 5) Social support (family, friend, coworker) continuous (on scale from 1 to 4)	6-month IPAQ Scores, continuous (MET Minutes/wk)	+	Baseline IPAQ Scores (MET Minutes/wk)

Table 2. Post-Hoc Analysis for Research Questions 9-11

RESULTS

Results Section Overview

The results section is broken down into the following subsections:

- Descriptive Data of Participants
- Results Section 1. Main Study Hypotheses (1-5)
- Results Section 2. Supplementary Hypotheses (6-7) and Research Question 8
- Results Section 3.a. Post-Hoc Analysis (Hypotheses 9-10)
- Results Section 3.b. Post-Hoc Analysis (Hypothesis 11)
- Tables and Figures for Results Section
- Supplementary Tables for Results Section

Each section includes the results for each hypotheses/research question as well as a summary of the section findings. Results of the statistical analysis are presented first for each question. In cases where the results were not significant, we explored trends. Trends consisted of a descriptive analysis of whether means and frequencies were in a direction supporting the hypotheses. Since the sample size may have been too small to detect a statistical effect, trends supplement the results. However, trends only summarize the data and cannot be inferred to other populations (Chin & Lee, 2008).

Descriptive Data of Participants

The Booster Break program had 88 participants (Figure 3). Eleven participants did not have self-report physical activity data and were eliminated from analysis. One participant was excluded for missing ethnicity data and two participants of Asian American ethnicity were

excluded due to the small count in this category. Adherence was defined as completing the baseline and 6-month self-report physical activity survey (IPAQ). Analysis was conducted on 74 participants and of these, 58.10% participants (n=43) were in the Adherence group and 41.89% were non-Adherence group (n=31). The majority of participants, 83.78%, were female (n=62). For racial/ethnic identity, 31.08% participants (n=23) were non-Hispanic white, 40.54% were African American (n=30) and 28.37% were Hispanic (n=21). The mean age of participants was 45.18 years of age (Range: 42.49-47.88). The mean body mass index (BMI) at baseline was 31.95 kg/m² (Range: 29.91-33.99). There were no differences in adherence by baseline physical activity, age, BMI, sex, or ethnicity (Table 3). Participants with missing data at baseline (i.e., survey on social support) were excluded from those analyses (Supplementary Table 1-2).

RESULTS SECTION 1. MAIN STUDY HYPOTHESES (1-5)

Hypothesis 1: At baseline, physically active individuals will be more likely to adhere to the intervention.

Results for Hypothesis 1

Physical Activity. Hypothesis 1 was not supported in the unadjusted and adjusted logistic regression models (Table 4). In the adjusted model, adherence to the Booster Break program was not predicted by baseline IPAQ scores (p=.56), IPAQ levels (p=.65), pedometer steps (p=.71) and pedometer levels (p=.51). Although the statistical analyses were not significant, trends were examined (Tables 5-7). For the trends to support hypotheses 1, the Adherence group would have greater baseline values for: IPAQ, percent of participants in the “high” activity IPAQ

category, pedometer counts, and percent in the “high/active/somewhat active” pedometer category than the Non-Adherence group. This expectation was true for mean IPAQ scores and the percent of participants in the “high” activity IPAQ category.

Hypothesis 2: At baseline, participants who report greater perceived self-efficacy for physical activity will be more likely to adhere to the intervention.

Results for Hypothesis 2

Self-efficacy. Hypothesis 2 was not supported in the unadjusted and adjusted logistic regression models (Table 4). In the adjusted model, Adherence to the Booster Break program was not predicted by baseline perceived self-efficacy for moderate-intensity physical activity ($p=.84$) or baseline perceived self-efficacy for vigorous-intensity physical activity ($p=.16$). Although the statistical analyses were not significant, trends were examined (Table 7). For the trends to support hypotheses 2, the Adherence group would have greater mean scores for self-efficacy in moderate-intensity and vigorous-intensity physical activity. This expectation was true for moderate-intensity self-efficacy only.

Hypothesis 3: At baseline, participants who report greater perceived enjoyment for physical activity will be more likely to adhere to the intervention.

Results for Hypothesis 3

Perceived enjoyment. Hypothesis 3 was not supported in the unadjusted and adjusted logistic regression models. In the adjusted model, adherence to the Booster Break program was not

predicted by baseline perceived enjoyment for moderate-intensity physical activity ($p=.21$) or baseline perceived enjoyment for vigorous-intensity physical activity ($p=.99$) (Table 4). Although the statistical analyses were not significant, trends were examined (Table 7). For the trends to support hypotheses 3, the Adherence group would have greater mean scores for both enjoyment for moderate-intensity physical activity and enjoyment for vigorous-intensity physical activity. The trends support hypothesis 3.

Hypothesis 4: At baseline, participants who report greater perceived benefits for physical activity will be more likely to adhere to the intervention.

Results for Hypothesis 4

Perceived benefits. Hypothesis 4 was not supported in the unadjusted and adjusted logistic regression models. In the adjusted model, Adherence to the Booster Break program was not predicted by baseline perceived benefits ($p=.12$) (Table 4). Although the statistical analyses were not significant, the trend was examined (Table 7). For the trend to support hypotheses 4, the Adherence group would have greater mean scores for perceived benefits of physical activity than the non-Adherence group. This expectation was not observed.

Hypothesis 5: Participants who report greater social support for physical activity at baseline will be more likely to adhere to the intervention.

Results for Hypothesis 5

Social support. Hypothesis 5 was not supported in the unadjusted and adjusted logistic regression models (Table 4). In the adjusted model, adherence to the Booster Break program was not predicted by baseline perceived coworker social support ($p=.68$), perceived family social support ($p=.89$), or perceived friend social support ($p=.44$). Although the statistical analyses were not significant, trends were examined (Table 7). For the trends to support hypotheses 5, the Adherence group would have greater mean scores for Coworker Social Support, Friend Social Support, and Family Social Support. This expectation was true for both friend social support and family social support.

Summary of Results for Section 1: Hypothesis 1-5

In the statistical analyses, hypotheses 1-5 were not supported. The trends fully supported hypothesis 3 and the trends partially supported hypotheses 1,2, and 5. Hypothesis 4 was not supported by the trends.

RESULTS SECTION 2. SUPPLEMENTARY ANALYSIS OF HYPOTHESES 6-7 AND RESEARCH QUESTION 8.

Hypothesis 6: At the end of the intervention (6-months), those in the Adherence group with greater physical activity (IPAQ, MET minutes/week), will be more likely to have improvements in physical health than those with lower physical activity.

Results for Hypothesis 6

Physiological health. Hypothesis 6 was not supported in the multiple logistic regression models predicting physiological health by 6-month physical activity (IPAQ Scores) when controlling for baseline physical activity (Table 8). Physiological health was defined by ten variables: a. total cholesterol, b. LDL cholesterol, c. HDL cholesterol, d. waist, e. five-percent weight loss, f. body mass index (BMI), g. diastolic blood pressure (DBP), h. systolic blood pressure (SBP), i. triglycerides, and j. glucose. Statistical significance was established for total cholesterol (a) in the opposite direction of that hypothesized (Odds Ratio=0.99, $p=0.04$, 95%CI; 0.99-0.99). The odds of having healthy total cholesterol at 6-months was 0.99 for a 1-point increase in IPAQ scores. Although the statistical analyses were not significant, trends were examined (Table 9). For the trends to support hypotheses 6, there would need to be a greater percent of highly active participants with healthy levels of each of the ten physiological variables (a-j) than unhealthy levels. This expectation was true for total cholesterol (a), HDL cholesterol (c), DBP (g), SBP (h), and glucose (j).

Hypothesis 7: There are differences in adherence based on age and age/ethnicity.

Results for Hypothesis 7

Age and Ethnicity. Hypothesis 7 was not supported in the logistic regression models. Neither age ($p=.71$) nor ethnicity ($p=.07$) predicted adherence to the Booster Break program (Table 10). Although the statistical analysis was not significant, trends were examined (Table 3). For trends to support hypothesis 7, there would need to be a difference in (a) mean age and (b) percentage in each racial/ethnic category, between the Adherence and Non-Adherence group. This expectation was true.

Research Question 8: What is the level of agreement between pedometer count categories and physical activity IPAQ categories?

Results for Research Question 8

Physical Activity Measures. Cohen's kappa was used for measuring agreement (Table 11)(Tang et al., 2015; Warner, 2013b). A kappa of 1 indicates complete agreement and a value of 0 indicates no agreement other than what would be expected by chance. The kappa statistic revealed low levels of agreement between pedometer and IPAQ physical activity categories (Kappa=0.17).

Summary of Results Section 2. Supplementary Analysis of Hypotheses 6-7 and Research Question 8.

In the statistical hypotheses 6-7 were not supported. The results for research question 8 were statistically significant. Trends supported hypotheses 7 and partially supported hypothesis 6.

RESULTS SECTION 3.A. POST-HOC ANALYSIS (HYPOTHESES 9-10)

Hypothesis 9: At baseline, sedentary behavior predicts adherence to the Booster Break intervention.

Results for Hypothesis 9

Baseline sedentary behavior. Hypothesis 9 was not supported in the unadjusted and adjusted logistic regression model. In the adjusted model, baseline sedentary behavior did not predict adherence to the Booster Break program ($p=.26$). Although the statistical analyses were not significant, the trend was examined (Table 7). For the trend to support hypotheses 9, baseline sedentary behavior would be greater in the non-Adherence group. The trends support hypothesis 9.

Hypothesis 10: At baseline, Self-Determination Theory Constructs predict 6-month sedentary behavior.

Results for Hypothesis 10

6-month sedentary behavior. Hypothesis 10 was not supported in the linear regression model (Table 12). In the model controlling for baseline sitting behavior, 6-month sitting was not predicted by: self-efficacy for vigorous-intensity physical activity ($p=.28$), self-efficacy for moderate-intensity physical activity ($p=.83$), enjoyment for vigorous-intensity physical activity ($p=.28$), enjoyment for moderate-intensity physical activity ($p=.87$), perceived benefits of physical activity ($p=.057$, overall model $p=.13$), family social support ($p=.63$), friend social support ($p=.42$), and co-worker social support ($p=.31$). Although the statistical analysis was not

significant, trends were examined (Table 13). For trends to support hypothesis 10, baseline self-efficacy for vigorous-intensity physical activity, self-efficacy for moderate-intensity physical activity, perceived benefits of physical activity, enjoyment for moderate-intensity physical activity, enjoyment for vigorous-intensity physical activity, family social support, friend social support, and co-worker social support would have greater means for those with the lowest hours of sedentary time. Trends supported this relationship for: baseline self-efficacy for vigorous-intensity physical activity, self-efficacy for moderate-intensity physical activity, perceived benefits of physical activity, enjoyment for moderate-intensity physical activity, enjoyment for vigorous-intensity physical activity, friend social support, and co-worker social support. Trends did not support coworker social support.

Summary of Results Section 3.a. Supplementary Analysis of Hypotheses 9-10.

In the statistical analyses, hypotheses 9-10 were not supported. The trends support hypothesis 9. The trends partially supported hypotheses 10.

RESULTS SECTION 3.B. POST-HOC ANALYSIS (HYPOTHESIS 11)

Hypothesis 11: At baseline, Self-Determination Theory Constructs predict 6-month physical activity among adherers to the intervention.

Results for Hypothesis 11

6-month physical activity. Hypothesis 11 was not supported in the multiple linear regression models predicting 6-month IPAQ scores from each baseline Self-Determination Theory construct, when controlling for baseline IPAQ scores (Table 14). In the model, the following Self-Determination Theory predictors were not statistically significant: self-efficacy for moderate-intensity physical activity ($p=.23$), self-efficacy for vigorous-intensity physical activity ($p=.74$), enjoyment for moderate-intensity physical activity ($p=.06$), enjoyment for vigorous-intensity physical activity ($p=.11$), perceived benefits of physical activity ($p=.39$), co-work social support for physical activity ($p=.64$), and friend social support for physical activity ($p=.91$). In the model, family social support was significant in the opposite direction of the hypothesis ($p=.03$, overall model $p=.0006$). For every one-point increase in family social support, IPAQ scores decreased by -1,730.97 MET min/wk. Although the statistical analysis was not significant, trends were examined (Table 15). For trends to support hypothesis 11, baseline self-efficacy for vigorous-intensity physical activity, self-efficacy for moderate-intensity physical activity, perceived benefits of physical activity, enjoyment for moderate-intensity physical activity, enjoyment for vigorous-intensity physical activity, family social support, friend social support, and co-worker social support would have greater means for those with in “high” physical activity intensity categories compared to “low”. Trends supported this relationship for: baseline

self-efficacy for vigorous-intensity physical activity, enjoyment for moderate-intensity physical activity, enjoyment for vigorous-intensity physical activity, and co-worker social support.

Summary of Results Section 3.b. Supplementary Analysis of Hypotheses 11

In the statistical analyses, hypothesis 11 was not supported. The trends partially supported hypothesis 11.

RESULTS SECTION: TABLES AND FIGURES

Figure 3: Participant flow for analysis

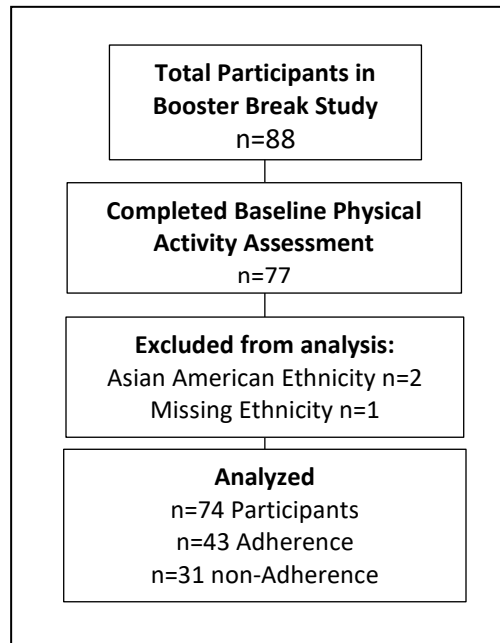


Table 3. Baseline Differences by Adherence to the Booster Break Intervention			
Variable	Non-Adherence (n=31)	Adherence(n=43)	p-value ^a
Baseline IPAQ (MET min/wk)	6,378.94	6,980.64	.79
Baseline Pedometer Counts (steps/wk)	46,240.77	43,810.06	.68
BMI kg/m ²	31.25	32.47	.56
Age (y)	44.61	45.60	.72
Gender (%)			.98
Male	41.67	58.33	
Female	41.94	58.06	
Ethnicity (%)			.07
White Non-Hispanic	26.09	73.91	
African American	56.67	43.33	
Hispanic	38.10	61.90	

a. Pearson's chi-square for categorical variables; t-test for continuous variables

Table 3. Baseline Differences by Adherence to the Booster Break Intervention

Table 4. Un-adjusted and Adjusted Logistic Regression Models Predicting Adherence									
Model:	Un-Adjusted Model				Adjusted Model				
Group:	Adherence Group				Adherence Group				
Variable	OR	95% CI	p-value	n	OR	95% CI	p-value	Overall p-value	n
Physical Activity Variables (Hypothesis 1)									
IPAQ (MET Min/wk)	1.00	0.99-1.00	0.79	74	1.00	0.99-1.00	0.56	0.25	73
IPAQ Category (reference is low)			0.75	74			0.65	0.31	73
Moderate	0.66	0.17-2.58			0.70	0.16-2.96			
High	1.06	0.31-3.60			1.17	0.31-4.43			
Pedometer (counts/wk)	0.99	0.99-1.00	0.67	64	0.99	0.99-1.00	0.71	0.20	63
Pedometer level (reference is low)	0.78	0.26-2.30	0.66	64	0.66	0.18-2.30	0.51	0.18	63
Self-Determination Theory Constructs (Hypotheses 2-5)									
Self-efficacy (moderate-intensity physical activity)	1.01	0.59-1.73	0.95	74	1.06	0.57-1.96	0.84	0.27	73
Self-efficacy (vigorous-intensity physical activity)	.70	.42-1.15	0.15	73	0.66	0.37-1.17	0.16	0.17	72
Perceived enjoyment (moderate-intensity physical activity)	1.27	0.71-2.27	0.39	74	1.22	0.65-2.27	0.21	0.24	73
Perceived enjoyment (vigorous-intensity physical activity)	1.00	0.64-1.57	0.98	73	0.99	0.61-1.60	0.99	0.34	72
Perceived Benefits	0.47	0.19-1.18	0.10	74	0.45	0.16-1.23	0.12	0.10	73
Social Support-Coworker	0.92	0.64-1.31	0.64	70	.92	0.62-1.36	0.68	0.53	69
Social Support- Friend	1.05	0.70-1.57	0.78	71	0.96	0.59-1.56	0.89	0.49	70
Social Support-Family	1.15	0.75-1.74	0.50	73	1.19	0.75-1.87	0.44	0.26	72
Sedentary Behavior (Hypothesis 9)									
Sitting (min/wk)	0.99	0.99-1.00	0.30	74	0.99	0.99-1.00	0.26	0.16	73
Reference=non-adherence, Adjusted model= adjusted for age, ethnicity, and BMI									
OR=odds ratio, CI=confidence interval, n=sample size, Min=minutes, wk=week									
*significance p<.05									

Table 4. Unadjusted and Adjusted Logistic Regression Models Predicting Adherence

Table 5. Baseline IPAQ Physical Activity Level by Adherence				
	Baseline Physical Activity Level			
Group	Low (%)	Moderate (%)	High (%)	Total
Non-Adherence	6 (40.0)	10 (50.00)	15 (38.46)	32
Adherence	9 (60.00)	10 (50.00)	24 (61.54)	43

Table 5. Baseline IPAQ Physical Activity Level by Adherence

Table 6. Baseline Pedometer Level by Adherence			
	Level		
Group	Inactive/Low (%)	High/Active/Somewhat Active (%)	Total
Non-Adherence	21 (46.67)	10 (52.63)	31
Adherence	24 (53.33)	9 (47.37)	33

Table 6. Baseline Pedometer Level by Adherence

Table 7. Descriptive Statistics of Physical Activity and Self-Determination Theory Variables at Baseline by Adherence				
	Non-Adherence (n=31)		Adherence(n=43)	
Variable at Baseline	Mean	Range	Mean	Range
IPAQ Scores (MET min/wk)	6,980.64	3,994.72-9,966.56	6,378.99	2,878.44-9,616.13
Baseline pedometer counts	46,240.77	37,411.36-55,070.18	43,810.06	35,897.21-51,725.33
Self-Efficacy for moderate-intensity physical activity	4.01	3.65-4.37	4.02	3.78-4.25
Self-Efficacy for vigorous-intensity physical activity	3.81	3.41-4.20	3.48	3.20-3.76
Enjoyment of moderate-intensity physical activity	4.2	3.84-4.55	4.36	4.16-4.56
Enjoyment of vigorous-intensity physical activity	3.85	3.40-4.31	3.86	3.59 -4.12
Benefits of physical activity	4.48	4.29-4.66	4.24	4.04-4.44
Coworker social support	1.42	0.95-1.89	1.27	0.83-1.71
Family social support	1.50	1.08-1.92	1.68	1.33-2.02
Friend social support	1.16	0.77-1.54	1.23	0.83-1.64
Sitting time (min/wk)	4,4438.71	2,540.11-6,337.30	3,473.25	2,811.82- 4,134.68

Table 7. Descriptive Statistics of Physical Activity and Self-Determination Theory Variables at Baseline by Adherence

Table 8. Multiple Logistic Regression Models Predicting Physiological Health from 6-month IPAQ Scores when Controlling for Baseline IPAQ Scores					
IPAQ Scores at 6-months for each Physiological Health Variable at 6-months	Healthy Level				
	OR	SE	95% CI	p-value	n
Total Cholesterol: 6-month IPAQ	0.99981	<.000009	0.9996-0.9999	0.04*	40
LDL Cholesterol: 6-month IPAQ	1.00003	<.000057	0.9999-1.0001	0.52	40
HDL Cholesterol: 6-month IPAQ	0.99990	<.000064	0.9997-1.0000	0.13	40
Waist: 6-month IPAQ	0.99989	<.000069	0.9997-1.0000	0.11	38
Weight Loss (5%): 6-month IPAQ	0.99999	<.000104	0.9997-1.0001	0.95	41
BMI (kg/m ²): 6-month IPAQ	0.99995	<.000079	0.9997-1.0006	0.56	40
DBP ^a : 6-month IPAQ					
SBP: 6-month IPAQ	1.00020	<.000208	0.9997-1.0006	0.32	39
Triglycerides: 6-month IPAQ	0.99996	<.000055	0.9998-1.0000	0.55	40
Glucose: 6-month IPAQ	0.99994	<.000056	0.9998-1.0000	0.33	40
Reference=unhealthy level					
OR=odds ratio, SE=standard error CI=confidence interval, n=sample size, Min=minutes, wk=week					
*significance p<.05, ^a category containing n<5 excluded form analysis					

Table 8. Multiple Logistic Regression Models Predicting Physiological Health from 6-month IPAQ Scores

Table 9. Physiological Improvements at 6-months by Activity Level at 6-months				
Measure	6 months physical activity level (IPAQ)			
	Low n (%)	Moderate n(%)	High n (%)	Total
Total Cholesterol				
Unhealthy	0 (0)	6 (42.86)	8 (34.78)	14
Healthy	3 (100)	8 (57.14)	15 (65.22)	26
Total	3	14	23	40
LDL Cholesterol				
Unhealthy	2 (66.67)	10 (71.43)	13 (56.52)	14
Healthy	1 (33.33)	4 (28.57)	10 (43.48)	26
Total	3	14	23	40
HDL Cholesterol				
Unhealthy	0 (0)	3 (21.43)	11 (47.83)	14
Healthy	3 (100)	11 (78.57)	12 (52.17)	26
Total	3	14	23	40
Healthy Waist				
Unhealthy	1 (33.33)	8 (66.67)	13 (56.52)	22
Healthy	2 (66.67)	4 (33.33)	10 (43.48)	16
Total	3	12	23	38
Weight Loss 5%				
No	3 (75.00)	12 (85.71)	21 (91.30)	36
Yes	1 (25.00)	2 (14.29)	2 (8.70)	5
Total	4	14	23	41
BMI				
Unhealthy	2 (50.00)	12 (85.71)	19 (86.36)	33
Healthy	2 (50.00)	2 (14.29)	3 (13.64)	7
Total	4	14	22	40
DBP				
Worsened	0 (0)	42(15.38)	0 (0.00)	2
Stayed Healthy	3 (100)	11 (84.62)	23 (100)	37
Total	3	13	23	40
SBP				
Unhealthy	0 (0)	3 (23.08)	2 (8.70)	5
Healthy	3 (100)	10 (76.92)	21 (91.30)	34
Total	3	13	23	39
Triglycerides				
Unhealthy	1 (33.33)	9 (64.29)	12 (52.17)	22
Healthy	2 (66.67)	5 (35.71)	11 (47.83)	18
Total	3	14	23	40
Glucose				
Not Improved	0 (0)	6 (42.86)	10 (43.48)	16
Stayed Healthy	3 (100)	4 (28.57)	7 (30.43)	14
Improved	0 (0)	4 (28.57)	6 (26.09)	10
Total	3	14	23	40

Table 9. Physiological Improvements at 6-months by Physical Activity Level at 6-months

Table 10. Logistic Regression Model: Age and Ethnicity Predicting Adherence			
	Adherence (n=74)		
Demographics	OR	95% CI	p-value
Age	1.00	0.96-1.04	.71
Ethnicity (reference is non-Hispanic White)			.07
African American	0.26	0.08-0.87	.02
Hispanic	0.57	0.15-2.06	.40
Reference=non-adherence			
OR=odds ratio, CI=confidence interval, n=sample size, Min=minutes, wk=week			
*significance p<.05			

Table 10. Logistic Regression Model: Age and Race/Ethnicity Predicting Adherence

Table 11. Agreement between Objective and Subjective Physical Activity Measures					
Agreement	Expected Agreement	Kappa	Std. Err.	Z	p-value
49.23%	38.82%	0.17	0.07	2.19	.01

Table 11. Agreement Between Objective and Subjective Physical Activity Measures

Table 12. Linear Regression Models^a Predicting Sedentary Behavior from Self-Determination Theory Constructs					
Self-Determination Theory Construct	6-month sitting (min/wk)				
	Coef.	SE	95% CI	p-value	n
Self-efficacy (moderate-intensity physical activity)	-68.95	337.54	-742.00-604.09	0.83	74
Self-efficacy (vigorous-intensity physical activity)	-319.40	297.69	-913.14-274.33	0.28	73
Perceived enjoyment (moderate-intensity physical activity)	57.24	365.43	-671.41-785.89	0.87	74
Perceived enjoyment (vigorous-intensity physical activity)	-301.95	282.89	-866.17-262.26	0.28	73
Perceived Benefits	-902.20	466.46	-1832-27.68	0.057	74
Social Support-Coworker	-232.47	227.75	-687.07-222.11	0.31	70
Social Support- Friend	-202.54	250.14	-701.70-296.60	0.42	71
Social Support-Family	123.71	262.19	-399.21-646.64	0.63	73
Coef=coefficient, SE=standard error CI=confidence interval, n=sample size, Min=minutes, wk=week, a=controlling for baseline sitting					
*significance p<.05,					

Table 12. Linear Regression Models of Self-Determination Theory Predicting Sedentary Behavior

Table 13. Descriptive Statistics of Sedentary Behavior and Self-Determination Theory Variables at Baseline						
Sitting Time	Less than 4 Hours		4 to 8 hours		More than 8 hours	
Variable at Baseline	Mean	Range	Mean	Range	Mean	Range
Self-Efficacy for moderate-intensity physical activity	4.46	4.01-4.92	4.12	3.84-4.39	3.61	3.05-4.1
Self-Efficacy for vigorous-intensity physical activity	4.33	3.90-4.75	3.41	3.02-3.80	3.26	2.77-3.75
Enjoyment of moderate-intensity physical activity	4.86	4.59-5.13	4.30	4.03-4.57	4.30	3.90-4.70
Enjoyment of vigorous-intensity physical activity	4.86	4.70-5.03	3.81	3.48-4.14	3.61	3.04-4.17
Benefits of physical activity	4.52	4.14-4.89	4.27	3.95-4.59	4.13	3.90-4.36
Coworker social support	2.06	0.50-3.62	1.26	0.67-1.84	1.08	0.30-1.86

Family social support	1.2	0.38-2.01	1.73	1.31-2.16	1.75	0.90-2.59
Friend social support	2.4	0.79-4.01	1.11	0.57-1.64	1.11	0.52-1.69

Table 13. Descriptive Statistics of Sedentary Behavior and Self-Determination Theory Variables

Table 14. Linear Regression Models^a Predicting Physical Activity Behavior from Self-Determination Theory Constructs					
Self-Determination Theory Variable	6-month IPAQ Score (MET min/wk)				
	Coef.	SE	95% CI	p-value	n
Self-efficacy (moderate-intensity physical activity)	1457.32	1208.53	-985.22-3899.87	0.23	43
Self-efficacy (vigorous-intensity physical activity)	338.97	1029.40	-1741.54-2419.48	0.74	43
Perceived enjoyment (moderate-intensity physical activity)	2559.10	1345.57	-160.39-5278.60	0.06	43
Perceived enjoyment (vigorous-intensity physical activity)	1647.48	1020.83	-415.70-3710.67	0.11	43
Perceived benefits	1180	1385.42	-1619.18-3980.93	0.39	43
Social Support-Coworker	319.55	678.31	-1053.62-1692.73	0.64	41
Social Support- Friend	-80.62	718.85	-1534.64-1373.39	0.91	42
Social Support-Family	-1730.97	787.89	-3324.65- -137.30	0.03*	42
Coef=coefficient, SE=standard error CI=confidence interval, n=sample size, Min=minutes, wk=week					
*significance p<.05, a=controlling for baseline physical activity					

Table 14. Linear Regression Models Predicting Physical Activity Behavior from Self-Determination Theory Constructs

Table 15. Descriptive Statistics of 6-month Physical Activity (IPAQ Score) and Self-Determination Theory Variables at Baseline						
6-month IPAQ Category:	Low Intensity		Moderate Intensity		High Intensity	
Variable at Baseline	Mean	Range	Mean	Range	Mean	Range
Self-Efficacy for moderate-intensity physical activity	4.44	3.85-5.03	3.77	3.40-4.13	4.12	3.76-4.47
Self-Efficacy for vigorous-intensity physical activity	3.55	1.98-5.12	3.64	3.14-4.14	3.98	3.66-4.30
Enjoyment of moderate-intensity physical activity	4.22	3.99-4.44	4.22	3.88-4.57	4.42	4.12-4.71
Enjoyment of vigorous-intensity physical activity	3.55	1.98-5.12	3.64	3.14-4.14	3.98	3.66-4.30
Benefits of physical activity	4.26	3.51-5.01	4.21	3.98-4.44	4.24	3.89-4.59
Coworker social support	0.88	0.29-2.48	1.14	0.34-1.94	1.42	0.83-2.01
Family social support	2	0.83-3.16	1.97	1.42-2.53	1.45	0.95-1.95
Friend social support	1.55	-0.016-3.12	1.22	0.47-1.98	1.16	0.62-1.70

Table 15. Descriptive Statistics of 6-month Physical Activity (IPAQ) and Self-Determination Theory Variables

RESULTS SECTION: SUPPLEMENTARY TABLES AND FIGURES

Supplementary Table 1. Missing Data for Covariates and Main Independent Variables		
Variable	Non-Adherence (n=31)	Adherence(n=43)
Baseline pedometer counts	0	10
BMI	0	1
Age	0	0
Ethnicity	0	0
Self-Efficacy for vigorous-intensity physical activity	1	0
Self-Efficacy for moderate-intensity physical activity	0	0
Enjoyment of vigorous-intensity physical activity	1	0
Enjoyment of moderate-intensity physical activity	0	0
Benefits of physical activity	0	0
Coworker social Support	2	2
Family social support	0	1
Friend social support	2	1

Supplementary Table 1. Missing Data for Covariates and Main Independent Variables

Supplementary Table 2. Data for Physiological Variables		
Variable	Missing (n)	Total (n)
Total Cholesterol	3	40
LDL Cholesterol	3	40
HDL Cholesterol	3	40
Waist	5	38
Weight	2	41
BMI	3	40
DBP	4	39
SBP	4	39
Triglycerides	3	40
Glucose	3	40

Supplementary Table 2. Data for Physiological Variables

DISCUSSION

Purpose of Study

The purpose of this study was to identify characteristics of participants in a workplace physical activity intervention using Self-Determination Theory.

Summary of Findings

In the statistical analysis, Hypotheses 1-11 were not supported (Table 4). In the descriptive analysis, trends were examined for relevant hypotheses. Of these ten hypotheses, three (30%) were fully supported (Hypotheses 3,7, & 9) and six (60%) were partially supported (Hypotheses 1-2, 5-6, 10-11). Hypothesis 4 was not supported by the trends (10%).

Findings Explained

Levels of Agreement between Pedometer and Self-Reported Physical Activity (Research Question 8)

The results of this research question are interesting. We found low levels of agreement between pedometer and self-reported physical activity measures (Table 9). The authors of the original study, expected the different measures of physical activity to have similar results (Taylor et al., 2016). Preliminary research guiding Taylor et al. (2016) identified the Digi-walker pedometer to have moderate correlations with energy expenditure (Welk et al., 2000). Our finding of a difference in measures is similar to a later systematic review that found that in seven out of eight studies, participants reported greater physical activity by self-report

compared to what was measured by their pedometer, in essence, low levels of agreement between pedometer and self-reported measures of physical activity (Jill et al., 2008).

Intervention Adherence and Physical Activity (Hypotheses 1)

The most interesting findings include the results as to whether physically active individuals at baseline will be more likely to adhere to an intervention. We found that the average baseline self-reported physical activity was greater among those in the Adherence group. In contrast, baseline pedometer counts were greater in the non-Adherence group.

This pedometer finding is similar to an earlier study that found that participants with lower baseline steps were more likely to complete an exercise program (Tudor-Locke & Chan, 2006). This discrepancy may be because individuals who have lower physical activity before starting a workplace intervention may be at a lower fitness level and thus, more open to engaging in a short, peer-led class. Previous research reported that if the intensity of the physical activity class exceeded their fitness level thus too challenging or too difficult for their fitness level, they were more likely to drop out (Genin et al., 2018). However, the format of the Booster Break program may have met the needs of participants with lower baseline physical activity levels as measured by pedometer.

Another explanation, is that participants in the non-Adherence group, who engaged in greater amounts of physical activity at baseline, continued to be active outside of the intervention. However, they may not have found the 15-minute program challenging enough and therefore, had lower adherence rates. For example, if some employees exercised before

work, they may not have perceived the class as challenging enough given their current physical activity level. Since we do not know physical activity levels at 6-months for the non-Adherence group, we do not know if their physical activity increased, decreased, or remained the same.

Our findings were not fully consistent with Self-Determination Theory constructs of competence and intrinsic motivation, when defined solely by previous physical activity behavior which should predict physical activity (Teixeira et al., 2012). However, competence and intrinsic motivation may be predictive through other forms including relatedness and self-efficacy. In addition, competence may be a stronger predictor when it matches the prior physical-activity level of individuals (i.e., participants with less physical activity may be more likely to participate in a lower-intensity intervention). It may mean these constructs do not predict adherence to a 15-minute workplace intervention. Feedback from the non-Adherence group about their reasons for non-adherence would be helpful in understanding this relationship (Genin et al., 2018).

Intervention Adherence and Self-Efficacy (Hypothesis 2)

In this study, we found an interesting relationship between baseline self-efficacy and intervention adherence. Baseline self-efficacy in vigorous-intensity physical activity was greater for the non-Adherence group, also this group had greater pedometer counts than the Adherence group. Baseline self-efficacy in moderate-intensity physical activity was nearly the same in both groups. In contrast, to our results, a systematic review on Self-Determination Theory and physical activity articles between 1960 and 2011, found that in the multivariate

analysis, competence (i.e., self-efficacy) was positively associated with physical activity in 56% of samples and in the correlational analyses, 92% found positive associations (Teixeira et al., 2012). Also, earlier research identified self-efficacy as an important determinant for physical activity (Trost et al., 2002). However, limited research is available on self-efficacy predicting adherence to a structured physical activity intervention in the workplace.

A possible explanation for our finding may be the Booster Break program was not challenging enough for participants with greater baseline self-efficacy for vigorous-intensity physical activity. For example, participants who had greater self-efficacy for vigorous-intensity physical activity may have preferred a more-challenging class.

Another possible explanation is that self-efficacy for physical activity, a measure of competence in Self-Determination Theory, is not always an accurate predictor of adherence. Two recent studies, on physical activity intervention adherence had similar results to our findings. A randomized controlled trial among older women in Germany who participated in three 90-minute exercise training sessions a week for 6-months, assessed continued participation in the sessions, found no significant association with one type of self-efficacy (maintenance) and adherence (Evers et al., 2012). Additionally, in a randomized controlled trial among breast cancer patients who attended two supervised 1-hour/week aerobic and resistance exercise sessions for 18-weeks, the researchers found that those with greater self-efficacy, were less likely to comply with the sessions (Witlox et al., 2019). However, one problem the authors identified was that the measure of self-efficacy was about beliefs related to attending sessions, not following specific aerobic exercises. Therefore, the measure of self-

efficacy may need to be defined in terms of the exercise program offered rather than physical activity in general. The workplace Booster Break program adds to the literature on self-efficacy and intervention adherence because previous studies were limited to a community setting.

Intervention Adherence and Enjoyment (Hypothesis 3)

Our results indicate that baseline perceived enjoyment, a measure of intrinsic motivation, was related to participant adherence in the Booster Break program. We found that enjoyment for moderate- and vigorous-intensity physical activity was greater among the Adherence group, indicating that enjoyment of physical activity may be important for intervention adherence. In a systematic review on Self-Determination Theory and Physical Activity, intrinsic motives, including enjoyment, were positively associated with physical activity (8 studies) (Teixeira et al., 2012).

A recent study reported results similar to our findings and the systematic review. In a group-based high-intensity functional training and moderate-intensity aerobic and resistance training program among overweight and obese adults at a gym, dropouts of the program had lower baseline exercise enjoyment than those who adhered to the program (Heinrich et al., 2014; Roy et al., 2018). Our study adds to this evidence base, specifically supporting enjoyment of physical activity as an important factor for intrinsic motivation and adherence in a workplace setting (Thøgersen-Ntoumani et al., 2016).

Intervention Adherence and Social Support (Hypothesis 5)

In this study, we found that certain types of social support at baseline were related to intervention adherence. The Booster Break study indicated that the Adherence group had greater social support from friends and family at baseline. Participants' initial social support from their family and friends may have encouraged them to participate in the program.

Also, we found an interesting development, while the Adherence group had a lower mean baseline measure for coworker social support, this measure increased after the 6-month Booster Break program. A systematic review of Self-Determination Theory and physical activity, found an inconsistent relationship between relatedness (i.e., social support) and physical activity (Teixeira et al., 2012). A more recent systematic review on the relationship between social support and adult physical activity reported inconsistent findings but found an overall small positive association between friend social support and future physical activity (Scarapicchia et al., 2017). Our study is novel in that it adds to the literature on the relationship between social support and adherence to a workplace intervention.

Limitations

A limitation of the study is that the full spectrum of each Self-Determination Theory construct was not assessed. For example, the full range of motivation constructs include amotivation, extrinsic motivation, and intrinsic motivation (Ryan et al., 2000). In the Booster Break study, only intrinsic motivation was assessed with measures of enjoyment. Extrinsic motivation and amotivation were not assessed. In addition, these constructs were measured by

self-report. This method can introduce social desirability bias if participants respond to questions in ways they think are socially approved rather than indicating their true beliefs (Warner, 2013c).

Another limitation is the small sample size when controlling for demographic variables, which diminishes power of the study. In addition, this study assessed whether baseline variables increase participant likelihood of adherence to the intervention, but it is inappropriate to infer causality. In addition, the testing of multiple hypotheses with the same data can inflate the risk of Type I error (Warner, 2013e). Therefore, the reported p values are likely an underestimate of the true risk of Type I error. Another limitation is that adherence is defined as completion of physical activity assessments at baseline and the intervention completion (6-months); we did not capture patterns of change in physical activity at different stages during the six-month period.

The results of this study described characteristics of participants who chose to participate in a workplace physical activity intervention. The results of this study may be generalizable to a population with similar characteristics: office workers, obese/overweight, middle-aged, and diverse racial and ethnic backgrounds (i.e., non-Hispanic White, African American, and Hispanic females).

In addition, the theoretical constructs were not specific to the Booster Break program because the original study was a randomized controlled trial and the participants and researchers did not know which arm each person would be assigned. Therefore, the constructs

were about physical activity in general. For theoretical constructs that are program specific, the expectation would be greater predictability.

Strengths

This study was a sub-analysis of a cluster-randomized controlled trial, focusing on the Booster Break intervention. This study was unique for a workplace setting with a 6-month on-site intervention during the 8-hour workday with a racially and ethnically diverse population. The outcomes assessed were physiological (including a blood draw), behavioral, and psychological, a comprehensive evaluation for a workplace intervention.

An important feature of this study was the setting. There is limited literature addressing workplace physical activity using Self-Determination Theory (M. Pedersen et al., 2013; Teixeira et al., 2012). For example, in a 2012 systematic review of physical activity and Self-Determination Theory, the number of workplace studies accounted for only five of 66 studies: one cross-sectional study of office workers in the United Kingdom (2008), one cross-sectional study of university employees in the United Kingdom (1998), one cross-sectional study in New Zealand (2009), one three-month prospective study of Government employees in the United Kingdom (1998), and one ten-week prospective study of university employees in the United States (1997) (Teixeira et al., 2012). A more recent study (after the systematic review was published), a cluster randomized controlled trial in Norway, consisted of a 16-week intervention for manual laborers and assessed their self-reported physical activity (Pedersen et al., 2018). Of the previous six studies on Self-Determination Theory and Physical Activity in the workplace,

only one of the six studies was in the United States. Based on the systematic review and updated literature, the majority of comparable studies reported were cross-sectional or 4-months long or shorter. Therefore, the unique feature of the Booster Break is that it was a 6-month intervention. The majority of other identified studies were cross-sectional or had shorter time-frames (C. Pedersen et al., 2018; Teixeira et al., 2012).

We found no other studies examining whether Self-Determination theory constructs were predictive of physical activity in a workplace intervention. For example, many studies provided education or access to a gym membership. The Booster Break program was offered at the workplace during an employee's 15-minute break. Therefore, the Booster Break program can positively impact the workplace environment and organizational culture (Taylor et al., 2018). According to Self-Determination theory, the environment influences the three basic psychological needs which are autonomy, competence, and relatedness (Ryan et al., 2000). The Booster Break program may have increased participant autonomy of exercising (i.e., time, opportunity), competence for participating in physical activity (i.e., self-efficacy through vicarious and mastery experiences), and relatedness (i.e., coworker social support).

Another strength of this study is that it used both objective and subjective measures of physical activity. Self-report measures are subject to social-desirability bias and recall bias (M. Pedersen et al., 2013; Sallis & Saelens, 2000). Due to the feasibility and availability of step counts (i.e., wearable technology, physical activity trackers), the Physical Activity Guidelines Advisory Committee emphasized that objective measures providing step counts (such as pedometers) are an important physical activity measure for researchers and the public. Based

on our findings of self-reported and pedometer-measured physical activity, we are able to describe the physical activity of our participants more comprehensively and add to the literature on objective versus self-reported physical activity measures.

Also, the Booster Break program has several other strengths: a racially and ethnically diverse population with four different organizations representing a variety of industries. This composition is important because the U.S. workforce is predicted to become more racially and ethnically diverse, demonstrating a need for future studies to include more racially and ethnically diverse groups to be truly representative of the future workforce (Perez & Hirschman, 2009).

Implications

Based on these findings, future workplace interventions should address perceived self-efficacy (i.e., competence), perceived social support (i.e., relatedness), and perceived enjoyment (i.e., autonomy) for physical activity (Kinnaifick et al., 2014; Ryan et al., 2000; Teixeira et al., 2012).

Our finding that perceived enjoyment was greater among those who adhered, suggests that fostering participant enjoyment for physical activity prior to an intervention may be important for intervention adherence. Enjoyment increases intrinsic motivation, thus, making it more likely a behavior will occur (Ryan et al., 2000). Future research should focus on ways to enhance enjoyment prior to the start of a physical activity program in order to increase participant adherence to the program (Ryan et al., 2000).

Our finding that self-efficacy for moderate-intensity, but not vigorous-intensity, physical activity was greater among the Adherence group suggests self-efficacy may be important for intervention adherence if it matches the intervention. Previous literature about the role of self-efficacy (i.e., competence) and workplace physical activity have reported mixed findings (Evers et al., 2012; Teixeira et al., 2012; Witlox et al., 2019). Future research is needed to better understand the relationship between self-efficacy and adherence, especially as it relates to the intensity level of the intervention.

Recent literature indicates inconsistencies between social support and physical activity (Scarapicchia et al., 2017). Based on our results that baseline friend and family social support were greater among those who adhered, suggests that future workplace interventions should address participants level of friend and family support prior to an intervention. Our finding that co-worker social support increased among those who adhered, suggests the Booster Break program facilitated coworker social support. Considering the program format of a group-based, peer-led class at work, relatedness is a key element of the intervention and this component may have increased coworker social support (Sarkar et al., 2016; Teixeira et al., 2012). Future research of similar interventions may want to explore how coworker social support changes throughout an intervention.

Our finding that participants were not motivated by their perceived benefits of physical activity indicates perceived benefits may not be an accurate predictor or incentive for physical activity adherence. According to Self-Determination Theory, perceived benefits are important to autonomous motivation when they are internalized (Ryan et al., 2000). However, it is

possible that participants' perceived benefits were not internalized and therefore, not a motivating factor for their adherence (Ryan et al., 2000). Researchers may need to develop a method for assessing internalization of perceived benefits.

In addition, the Booster Break program's structure, at the workplace, makes physical activity convenient and has the potential to impact the basic psychological needs of autonomy, competence, and relatedness (Ryan et al., 2000). A cross-sectional study on the built environment and Self-Determination Theory found that perceptions of convenience of physical activity improved the relationship between physical activity and the Self-Determination Theory constructs of competence, relatedness, and autonomy (Gay et al., 2011). We found a connection between the Booster Break program and improvements in relatedness (i.e., coworker social support). Future studies may want to consider how similar on-site workplace interventions impact other Self-Determination Theory constructs.

Based on our result that participants with less pedometer steps at baseline were more likely to adhere, future research should explore possible explanations for this finding. According to Self-Determination Theory, previous experience with physical activity should increase competence and intrinsic motivation to perform a behavior.

Conclusions

Previous researchers questioned whether workplace interventions only reach already active individuals (Genin et al., 2018; Walker et al., 2017), but our study found different results in that previously physically inactive individuals participated. We identified trends from

objective measures of physical activity indicating that participants with lower baseline physical activity were more likely to adhere to the intervention. This finding may mean that the Booster Break program matches the needs of participants with lower levels of physical activity.

This study did not find Self-Determination Theory constructs as statistically significant predictors of adherence to a physical activity workplace intervention. However, trends identified several constructs such as perceived enjoyment, self-efficacy for moderate-intensity physical activity, and social support greater among those who adhered compared to non-adherers. In addition, the Booster Break program may have enhanced relatedness (i.e., social support), competence (i.e., self-efficacy), and autonomy (i.e., enjoyment, convenience) by its peer led group-based structure and its convenience during the workday. Thus, the Booster Break program appears to be promising for improving motivation and participation in physical activity at the workplace. Future Booster Break studies should aim for a larger sample size to account for lack of adherence at follow-up. To further understand motivations to participate in workplace interventions, researchers should assess: reasons for lack of adherence and detailed attendance data (days and minutes of activity). Employee participation and adherence to workplace physical activity programs are important to accomplish the objective of improving the health of sedentary employees.

APPENDIX 1. STATA POWER CALCULATIONS

Power Estimates.

The power estimates in a logistic regression consider several components:

- **Power**- probability of correctly rejecting the null hypotheses when it is in fact false; a reasonable level for researchers is .80.
- **Alpha**- significance level; probability of rejecting the null when it is true (i.e., false positive); usually set at .05.
- **p1**- the probability that the response variable equals 1 when the predictor is at the mean.
- **p2**- the probability that the response variable equals 1 when the predictor is one standard deviation above the mean.
- **rsq**- the squared multiple correlation between the predictor variable and all other variables in the model.

For the power analysis, alpha was set to .05. A range of probabilities (p1 and p2 values), were inputted into the program to produce sample size estimates. Results for power at .80 were used to review and identify minimum sample sizes. Odds ratios based on the literature were used to narrow down appropriate sample sizes. The most appropriate p1 and p2 values were selected based on the proportion of the outcome and are highlighted in dark blue. Details are provided below.

Odds ratios.

A few studies identified odds for adhering to physical activity or interventions. In prospective 18-month study of Norwegian stroke patients (n=186), the odds of adhering to

physical activity (30 minutes a day) after a coaching intervention was 1.026 (95% CI 1.014-1.037) (Gunnes et al., 2019). In another exercise intervention in the United Kingdom, the odds of adherence (completion of all assessments) increased with 10 years increase in age (OR 1.02, CI 1.00 to 1.04) (Tobi et al., 2012). In a prospective study in Sweden, participants who were active prior to the intervention (5-7 out of 7 days using a 7 day recall), had an odds ratio of 2.14 (95% CI: 1.60 to 2.87) for adhering to physical activity prescriptions at 3 months (Leijon et al., 2010). Participants who were active 3-4 days out of the 7, had an odds ratio of 3.92 (Leijon et al., 2010). Based on the literature, odds ratios for program adherence and completion may range between 1.026 and 3.92. However, there are some limitations to this estimate. The authors of the following articles define adherence/completion with varying definitions (i.e., attendance of sessions, following recommendations). Additionally, the odds ratios presented above do not address all the specific predictors in our study but were used as preliminary evidence for the power analysis.

Probabilities.

For the p_1 value, it was expected that the probability of not completing the intervention ($x=0$) when the predictor (i.e., self-efficacy, perceived enjoyment) is at the mean to be between 0.2 and 0.4. For the p_2 value, it was estimated that the probability of completing the intervention ($x=1$) when the predictor (i.e., self-efficacy, perceived enjoyment) is one standard deviation about the mean is between 0.4 and 0.6. It was estimated that the difference between p_1 and p_2 would be about 20%. Since it was unlikely that p_2 would be less than p_1 and that p_1

would be less than 0.1, sample sizes within these parameters were considered (highlighted blue in the table 1).

Potential Sample Size.

In Table 1, estimates with the initially estimated odds ratios (between 1.02 and 3.92) and p1 values between 0.2 and 0.4 are highlighted in light blue, additionally cells with p1-p2 values of .2 are highlighted in dark blue.

It was initially estimated that for a power level of .80, an effect size (p1-p2) of .2, and an odds ratio of 2.66 a sample size of 74 would be needed. It was also estimated that for an odds ratio of 2.33, a sample of 69 would be needed; and for an odds ratio of 2.25 a sample of 65 would be needed. We concluded that in the unadjusted model, the sample size was large enough to identify an effect.

Appendix 2. Table of Power Estimates for Unadjusted Logistic Regression						
Power	Sample Size	P1	P2	alpha	Odds Ratio	rsq
.80	128	.1	.2	.05	2.25	0
.80	117	.1	.3	.05	3.85	0
.80	424	.1	.4	.05	6.00	0
.80	2801	.1	.5	.05	9.00	0
.80	161	.2	.3	.05	1.71	0
.80	74	.2	.4	.05	2.66	0
.80	113	.2	.5	.05	4	0
.80	418	.2	.6	.05	6.00	0
.80	182	.3	.4	.05	1.55	0
.80	69	.3	.5	.05	2.33	0
.80	82	.3	.6	.05	3.5	0
.80	415	.4	.1	.05	.16	0
.80	60	.4	.2	.05	.37	0
.80	156	.4	.3	.05	.64	0
.80	182	.4	.5	.05	1.5	0
.80	65	.4	.6	.05	2.25	0
p1 -- the probability that the response variable equals 1 when the predictor is at the mean p2 -- the probability that the response variable equals 1 when the predictor is one standard deviation above the mean rsq -- the squared multiple correlation between the predictor variable and all other variables in the model						

Appendix 2: Table of Power Estimates for Unadjusted Logistic Regression

However, based on our preliminary analysis for the adjusted models with a power of .80, an effect size of 0.2 and odds ratios between 2.25 and 3.86, for a squared multiple correlation of 0.2 a minimum sample of 81-93 might have been needed to detect an effect (Table 2).

The squared multiple correlation (rsq) indicates the proportion of variation in the outcome caused by the independent variables (Warner, 2013a). The higher the squared multiple correlation, the higher the variance of the outcome that can be predicted by all variables in the model. If the model was highly predictive and the rsq value was higher, a larger sample size may have been needed for the adjusted model.

Appendix 3. Table of Power Estimates for Adjusted Multivariate Logistic Regression						
Power	Sample Size	P1	P2	alpha	Odds Ratio	rsq
.80	160	.1	.2	.05	2.25	.2
.80	183	.1	.2	.05	2.25	.3
.80	214	.1	.2	.05	2.25	.4
.80	321	.1	.2	.05	2.25	.6
.80	146	.1	.3	.05	3.86	.2
.80	167	.1	.3	.05	3.86	.3
.80	195	.1	.3	.05	3.86	.4
.80	292	.1	.3	.05	3.86	.6
.80	93	.2	.4	.05	2.66	.2
.80	106	.2	.4	.05	2.66	.3
.80	124	.2	.4	.05	2.66	.4
.80	149	.2	.4	.05	2.66	.5
.80	186	.2	.4	.05	2.66	.6
.80	87	.3	.5	.05	2.33	.2
.80	99	.3	.5	.05	2.33	.3
.80	115	.3	.5	.05	2.33	.4
.80	138	.3	.5	.05	2.33	.5
.80	173	.3	.5	.05	2.33	.6
.80	81	.4	.6	.05	2.25	.2
.80	93	.4	.6	.05	2.25	.3
.80	108	.4	.6	.05	2.25	.4
.80	130	.4	.6	.05	2.25	.5
.80	162	.4	.6	.05	2.25	.6
.80	76	.4	.2	.05	.37	.2
.80	86	.4	.2	.05	.37	.3
.80	101	.4	.2	.05	.37	.4
.80	121	.4	.2	.05	.37	.5
.80	151	.4	.2	.05	.37	.6
p1 -- the probability that the response variable equals 1 when the predictor is at the mean p2 -- the probability that the response variable equals 1 when the predictor is one standard deviation above the mean rsq -- the squared multiple correlation between the predictor variable and all other variables in the model						

Appendix 3. Table of Power Estimates for Adjusted Multivariate Logistic Regression

REFERENCES

- 2018 Physical Activity Guidelines Advisory Committee. (2018). *2018 physical activity guidelines advisory committee scientific report*. https://health.gov/paguidelines/second-edition/report/pdf/02_A_Executive_Summary.pdf
- Abraham, J. M., Feldman, R., Nyman, J. A., & Barleen, N. (2011). What factors influence participation in an exercise-focused, employer-based wellness program? *Inquiry: The Journal of Health Care Organization, Provision, and Financing*, 48(3), 221-241. https://doi.org/10.5034/inquiryjrnl_48.03.01
- American College of Cardiology. (2017). *New ACC/AHA high blood pressure guidelines lower definition of hypertension*. <https://www.acc.org/latest-in-cardiology/articles/2017/11/08/11/47/mon-5pm-bp-guideline-aha-2017>
- American Diabetes Association. (2014). *Diagnosing diabetes and learning about prediabetes*. <http://www.diabetes.org/diabetes-basics/diagnosis/>
- Barr-Anderson, D., AuYoung, M., Whitt-Glover, M., Glenn, B. A., & Yancey, A. K. (2011). Integration of short bouts of physical activity into organizational routine: A systematic review of the literature. *American Journal of Preventive Medicine*, 40(1), 76-93. <https://doi.org/10.1016/j.amepre.2010.09.033>

- Buckley, J. P., Hedge, A., Yates, T. E., Copeland, R. J., Loosemore, M., Hamer, M., Bradley, G., & Dunstan, D. W. (2015). The sedentary office: An expert statement on the growing case for change towards better health and productivity. *British Journal of Sports Medicine*, 49(21). <https://doi.org/10.1136/bjsports-2015-094618>
- Centers for Disease Control and Prevention. (2015). *Healthy weight: Assessing your weight*. <https://www.cdc.gov/healthyweight/assessing/index.html>
- Centers for Disease Control and Prevention. (2017). *Early release of selected estimates based on data from the 2017 national health interview survey, data tables for figures 7.1,7.5*. <https://www.cdc.gov/nchs/fastats/exercise.htm>
- Centers for Disease Control and Prevention. (2019). *Workplace health promotion*. <https://www.cdc.gov/workplacehealthpromotion/index.html>
- Charness, G., & Gneezy, U. (2009). Incentives to exercise. *Econometrica*, 77(3), 909-931. <https://doi.org/10.3982/ECTA7416>
- Chastin, S. F. M., Egerton, T., Leask, C., & Stamatakis, E. (2015). Meta-analysis of the relationship between breaks in sedentary behavior and cardiometabolic health. *Obesity*, 23(9), 1800-1810. <https://doi.org/10.1002/oby.21180>
- Chin, R., & Lee, B. Y. (2008). *Chapter 3 - introduction to clinical trial statistics*. Elsevier Inc. <https://doi.org/10.1016/B978-0-12-373695-6.00003-X>

- Deci, E. L., Koestner, R., & Ryan, R. M. (1999). A meta-analytic review of experiments examining the effects of extrinsic rewards on intrinsic motivation. *Psychological Bulletin*, 125(6), 627. <https://doi.org/10.1037/0033-2909.125.6.627>
- Dommelen, P. v., Coffeng, J. K., P van der Ploeg, J van der Beek, Cécile R L Boot, & Ingrid J M Hendriksen. (2016). Objectively measured total and occupational sedentary time in three work settings. *PLoS One*, 11(3). <https://doi.org/10.1371/journal.pone.0149951>
- Donlin Washington, W., McMullen, D., Devoto, A., Kenkel, M. B. (., & Silverman, K. (. (2016). A matched deposit contract intervention to increase physical activity in underactive and sedentary adults. *Translational Issues in Psychological Science*, 2(2), 101-115. <https://doi.org/10.1037/tps0000069>
- Eisele, A., Schagg, D., Krämer, L. V., Bengel, J., & Göhner, W. (2019). Behaviour change techniques applied in interventions to enhance physical activity adherence in patients with chronic musculoskeletal conditions: A systematic review and meta-analysis. *Patient Education and Counseling*, 102(1), 25-36. <https://doi.org/10.1016/j.pec.2018.09.018>
- Evers, A., Klusmann, V., Schwarzer, R., Heuser, I., & Evers, A. (2012). Adherence to physical and mental activity interventions: Coping plans as a mediator and prior adherence as a moderator. *British Journal of Health Psychology*, 17(3), 477-491. <https://doi.org/10.1111/j.2044-8287.2011.02049.x>

- Farrance, C., Tsofliou, F., & Clark, C. (2016). Adherence to community based group exercise interventions for older people: A mixed-methods systematic review. *Preventive Medicine*, 87, 155-166. <https://doi.org/10.1016/j.ypmed.2016.02.037>
- Genin, P. M., Pereira, B., Thivel, D., Duclos, M., & Genin, P. M. (2018). Employees' adherence to worksite physical activity programs: Profiles of compliers versus non-compliers. *Work*, 60(3), 507-510. <https://doi.org/10.3233/WOR-182745>
- Giles, E., Robalino, S., Mccoll, E., Sniehotta, F., & Adams, J. (2014). The effectiveness of financial incentives for health behaviour change: Systematic review and meta-analysis. *PLoS One*, 9(3), e90347. <https://doi.org/10.1371/journal.pone.0090347>
- Gunnes, M., Langhammer, B., Aamot, I. L., Lydersen, S., Ihle-Hansen, H., Indredavik, B., Reneflot, K. H., Schroeter, W., Askim, T., & LAST Collaboration group. (2019). Adherence to a long-term physical activity and exercise program after stroke applied in a randomized controlled trial. *Physical Therapy*, 99(1), 74-85. <https://doi.org/10.1093/ptj/pzy126>
- Healy, G. N., Dunstan, D. W., Salmon, J., Cerin, E., Shaw, J. E., Zimmet, P. Z., & Owen, N. (2008). Breaks in sedentary time: Beneficial associations with metabolic risk. *Diabetes Care*, 31(4), 661-666. <https://doi.org/10.2337/dc07-2046>
- Heinrich, K. M., Patel, P. M., O'Neal, J.,L., & Heinrich, B. S. (2014). High-intensity compared to moderate-intensity training for exercise initiation, enjoyment, adherence, and intentions: An intervention study. *BMC Public Health*, 14(1). <https://doi.org/10.1186/1471-2458-14-789>

Hupin, D., Raffin, J., Barth, N., Berger, M., Garet, M., Stampone, K., Celle, S., Pichot, V., Bongue, B., Barthelemy, J., & Roche, F. (2019). Even a previous light-active physical activity at work still reduces late myocardial infarction and stroke in retired adults aged >65 years by 32%: The PROOF cohort study. *Frontiers in Public Health*, 7. <https://doi.org/10.3389/fpubh.2019.00051>

Jalayondeja, C., Jalayondeja, W., Mekhora, K., Bhuanantanondh, P., Asadang Dusadi-Isariyavong, & Upiriyasakul, R. (2017). Break in sedentary behavior reduces the risk of noncommunicable diseases and cardiometabolic risk factors among workers in a petroleum company. *International Journal of Environmental Research and Public Health*, 14(5), 501. <https://doi.org/10.3390/ijerph14050501>

Jans, M. P., Proper, K. I., & Hildebrandt, V. H. (2007). Sedentary behavior in Dutch workers: Differences between occupations and business sectors. *American Journal of Preventive Medicine*, 33(6), 450-454.

Jansons, P. S., Haines, T. P., & O'brien, L. (2017). Interventions to achieve ongoing exercise adherence for adults with chronic health conditions who have completed a supervised exercise program: Systematic review and meta-analysis. *Clinical Rehabilitation*, 31(4), 465-477. <https://doi.org/10.1177/0269215516653995>

Jill, H., Hamel Meghan, E., Adamo Kristi, B., Prince Stéphanie, A., Sarah, G., & Mark, T. (2008). A comparison of direct versus self-report measures for assessing physical activity in

adults: A systematic review. *International Journal of Behavioral Nutrition and Physical Activity*, 5(1), 56. <https://doi.org/10.1186/1479-5868-5-56>

Kinnaefick, F., Thøgersen-Ntoumani, C., & Duda, J. L. (2014). Physical activity adoption to adherence, lapse, and dropout: A self-determination theory perspective. *Qualitative Health Research*, 24(5), 706-718. <https://doi.org/10.1177/1049732314528811>

Krogh, J., Lorentzen, A. K., Subhi, Y., & Nordentoft, M. (2014). Predictors of adherence to exercise interventions in patients with clinical depression – A pooled analysis from two clinical trials. *Mental Health and Physical Activity*, 7(1), 50-54.
<https://doi.org/10.1016/j.mhpa.2014.01.003>

Leijon, M. E., Bendtsen, P., Ståhle, A., Ekberg, K., Festin, K., Nilsen, P., & Stahle, A. (2010). Factors associated with patients self-reported adherence to prescribed physical activity in routine primary health care. *BMC Family Practice*, 11(38). <https://doi.org/10.1186/1471-2296-11-38>

Lunze, K., & Paasche-Orlow, M. (2013). Financial incentives for healthy behavior: Ethical safeguards for behavioral economics. *American Journal of Preventive Medicine*, 44(6), 659.
<https://doi.org/10.1016/j.amepre.2013.01.035>

Mitchell, M. S., Goodman, J. M., Alter, D. A., John, L. K., Oh, P. I., Pakosh, M. T., & Faulkner, G. E. (2013). Financial incentives for exercise adherence in adults: Systematic review and meta-analysis: Systematic review and meta-analysis. *American Journal of Preventive*

Medicine; American Journal of Preventive Medicine, 45(5), 658-667.

<https://doi.org/10.1016/j.amepre.2013.06.017>

Moller, A. C., McFadden, H. G., Hedeker, D., & Spring, B. (2012). Financial motivation undermines maintenance in an intensive diet and activity intervention. *Journal of Obesity*.
<https://doi.org/10.1155/2012/740519>

National Heart, Lung, and Blood Institute (NIH). (a). *High blood cholesterol*.
<https://www.nhlbi.nih.gov/health-topics/high-blood-cholesterol>

National Heart, Lung, and Blood Institute (NIH). (b). *High blood triglycerides*.
<https://www.nhlbi.nih.gov/health-topics/high-blood-triglycerides>

National Institutes of Health, (NIH). (1998). *Clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults*.
https://www.nhlbi.nih.gov/files/docs/guidelines/ob_gdlns.pdf

Ormel, H. L., Schoot, G. G. F., Sluiter, W. J., Jalving, M., Gietema, J. A., & Walenkamp, A. M. E. (2018). Predictors of adherence to exercise interventions during and after cancer treatment: A systematic review. *Psychooncology*. 27(3), 713-724.
<https://doi.org/10.1002/pon.4612>

Park, H. (2013). An introduction to logistic regression: From basic concepts to interpretation with particular attention to nursing domain. *Journal of Korean Academy of Nursing*, 32(2), 154-164. <https://doi.org/http://dx.doi.org/10.4040/jkan.2013.43.2.154>

- Pedersen, C., Halvari, H., & Williams, G. C. (2018). Worksite intervention effects on motivation, physical activity, and health: A cluster randomized controlled trial. *Psychology of Sport & Exercise*, 35, 171-180. <https://doi.org/10.1016/j.psychsport.2017.11.004>
- Pedersen, M., Zebis, M., Langberg, H., Poulsen, O., Mortensen, O., Jensen, J., Sjøgaard, G., Bredahl, T., & Andersen, L. (2013). Influence of self-efficacy on compliance to workplace exercise. *International Journal of Behavioral Medicine*, 20(3), 365-370. <https://doi.org/10.1007/s12529-012-9239-0>
- Peduzzi, P., Concato, J., Kemper, E., Holford, T. R., & Feinstein, A. R. (1996). A simulation study of the number of events per variable in logistic regression analysis. *Journal of Clinical Epidemiology*, 49(12), 1373-1379. [https://doi.org/10.1016/S0895-4356\(96\)00236-3](https://doi.org/10.1016/S0895-4356(96)00236-3)
- Perez, A. D., & Hirschman, C. (2009). The changing racial and ethnic composition of the US population: Emerging American identities. *Population and Development Review*, 35(1), 1-51. <https://doi.org/10.1111/j.1728-4457.2009.00260.x>
- Promberger, M., & Marteau, T. M. (2013). When do financial incentives reduce intrinsic motivation? comparing behaviors studied in psychological and economic literatures. *Health Psychology*, 32(9), 950. <https://doi.org/10.1037/a0032727>
- Roy, M., M., Williams, C., S., Brown, A., R., Meredith-Jones, W., Osborne, W., H., Jospe, W., M., & Taylor, W., R. (2018). High-intensity interval training in the real world: Outcomes from a 12-month intervention in overweight adults. *Medicine & Science in Sports & Exercise*, 50(9), 1818-1826. <https://doi.org/10.1249/MSS.0000000000001642>

Ryan, R. M., Deci, E. L., Fowler, R. D. (., Seligman, Martin E. P. (editor), & Csikszentmihalyi, M. (. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, 55(1), 68-78.

<https://doi.org/10.1037/0003-066X.55.1.68>

Sallis, J. F., & Saelens, B. E. (2000). Assessment of physical activity by self-report: Status, limitations, and future directions. *Research Quarterly for Exercise and Sport*, 71(2 Suppl), 1. <https://doi.org/10.1080/02701367.2000.11082780>

Sarkar, S., Taylor, W., Lai, D., Shegog, R., & Paxton, R. (2016). Social support for physical activity: Comparison of family, friends, and coworkers. *Work*. 55(4), 893-899.

<https://doi.org/10.3233/WOR-162459>

Scarapicchia, T. M. F., Amireault, S., Faulkner, G., & Sabiston, C. M. (2017). Social support and physical activity participation among healthy adults: A systematic review of prospective studies. *International Review of Sport and Exercise Psychology*. 50-83.

<https://doi.org/10.1080/1750984X.2016.1183222>

Tang, W., Hu, J., Zhang, H., Wu, P., & He, H. (2015). Kappa coefficient: A popular measure of rater agreement. *Shanghai Archives of Psychiatry*, 27(1), 62.

<https://doi.org/10.11919/j.issn.1002-0829.215010>

Taylor, W. C., Paxton, R. J., Shegog, R., Coan, S. P., Dubin, A., Page, T. F., & Rempel, D. M. (2016). Impact of Booster Breaks and computer prompts on physical activity and sedentary

behavior among desk-based workers: A cluster-randomized controlled trial. *Preventing Chronic Disease*, 13. <https://doi.org/10.5888/pcd13.160231>

Taylor, W. C., Shegog, R., Chen, V., Rempel, D. M., Baun, M. P., Bush, C. L., Green, T., & Hare-Everline, N. (2010). The Booster Break program: Description and feasibility test of a worksite physical activity daily practice. *Work*, 37(4), 433.

Taylor, W. C., Suminski, R. R., Das, B. M., Paxton, R. J., & Craig, D. W. (2018). Organizational culture and implications for workplace interventions to reduce sitting time among office-based workers: A systematic review. *Frontiers in Public Health*, 6. <https://doi.org/10.3389/fpubh.2018.00263>

Teixeira, P. J., Carraça, E. V., Markland, D., Silva, M. N., Ryan, R. M., & Teixeira, P. J. (2012). Exercise, physical activity, and self-determination theory: A systematic review. *International Journal of Behavioral Nutrition and Physical Activity*, 9(78). <https://doi.org/10.1186/1479-5868-9-78>

The American Heart Association. (11/30/17). *The facts about high blood pressure*. <https://www.heart.org/en/health-topics/high-blood-pressure/the-facts-about-high-blood-pressure>

Thøgersen-Ntoumani, C., Shepherd, S. O., Ntoumanis, N., Wagenmakers, A. J. M., & Shaw, C. S. (2016). Intrinsic motivation in two exercise interventions: Associations with fitness and body composition. *Health Psychology*, 35(2), 195-198. <https://doi.org/10.1037/hea0000260>

- Tobi, P., Estacio, E. V., Yu, G., Renton, A., & Foster, N. (2012). Who stays, who drops out? biosocial predictors of longer-term adherence in participants attending an exercise referral scheme in the UK. *BMC Public Health*, 12, 347. <https://doi.org/10.1186/1471-2458-12-347>
- Trost, S. G., Owen, N., Bauman, A. E., Sallis, J. F., & Brown, W. (2002). Correlates of adults' participation in physical activity: Review and update. *Medicine and Science in Sports and Exercise*, 34(12), 1996-2001. <https://doi.org/10.1097/00005768-200212000-00020>
- Tudor-Locke, C., & Chan, C. B. (2006). An exploratory analysis of adherence patterns and program completion of a pedometer-based physical activity intervention. *Journal of Physical Activity & Health*, 3(2), 210. <https://doi.org/10.1123/jpah.3.2.210>
- U.S. Department of Labor Statistics. *American time use survey-2015*. ().
- UCLA: Institute for Digital Research and Education. *Logistic regression power analysis / Stata data analysis examples*. <https://stats.idre.ucla.edu/stata/dae/logistic-regression-power-analysis/>
- US Bureau of Labor Statistics (BLS). (2018a). *American time use survey*. <https://www.bls.gov/charts/american-time-use/emp-by-ftpt-job-edu-h.htm>
- US Bureau of Labor Statistics (BLS). (2018b). *Occupational requirements survey (ORS)*. <https://beta.bls.gov/dataViewer/view/timeseries/ORUP10000000000000997>

- US Department of Health and Human Services. (2018). *Physical activity guidelines for Americans 2nd edition*. https://health.gov/paguidelines/second-edition/pdf/Physical_Activity_Guidelines_2nd_edition.pdf
- Walker, T. J., Tullar, J. M., Taylor, W. C., Román, R., & Amick, B. C. (2017). How do stages of change for physical activity relate to employee sign-up for and completion of a worksite physical activity competition? *Health Promotion Practice, 18*(1), 93.
<https://doi.org/10.1177/1524839916659846>
- Warner, R. (2013a). Effect size/partition of variance in bivariate regression (chapter 9.9). *Applied statistics, from bivariate through multivariate techniques* (pp. 590-592). SAGE Publications, Inc.
- Warner, R. (2013b). Interobserver reliability assessment for scores on a categorical variable (chapter 21.3.3). *Applied statistics, from bivariate through multivariate techniques* (pp. 1448-1449). SAGE Publications, Inc.
- Warner, R. (2013c). Quality control during data collection (chapter 4.2). *Applied statistics, from bivariate through multivariate techniques* (pp. 228-229). SAGE Publications, Inc.
- Warner, R. (2013d). Screening data for bivariate analysis (chapter 4.8). *Applied statistics, from bivariate through multivariate techniques* (pp. 285-286). SAGE Publications, Inc.
- Warner, R. (2013e). Strategies to limit risk of type I error (chapter 3.5). *Applied statistics, from bivariate through multivariate techniques* (pp. 185-187). SAGE Publications, Inc.

Welk, J., G., Differding, A., J., Thompson, W., R., Blair, N., S., Dziura, N., J., & Hart, N., P.

(2000). The utility of the Digi-Walker step counter to assess daily physical activity patterns.

Medicine & Science in Sports & Exercise, 32(9), S481-S488.

Witlox, L., Velthuis, M. J., Boer, J. H., Steins Bisschop, C. N., Wall, E. v. d., Meulen, Wout J. T.

M. van der, Schroder, C. D., Peeters, P. H. M., & May, A. M. (2019). Attendance and

compliance with an exercise program during localized breast cancer treatment in a

randomized controlled trial: The PACT study. *PLoS ONE*, 14(5).

<https://doi.org/10.1371/journal.pone.0215517>