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Neema Iyer Date

THE EFFECT OF PHYSICAL ACTIVITY AND LIFE STYLES (PALS) INTERVENTIONS ON WORK-RELATED OUTCOMES

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Master of Public Health

Global Epidemiology

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By

Neema Iyer

Bachelor of Arts
University of Arkansas
2009

Faculty Thesis Advisor: Julie A. Gazmararian, PhD, MPH

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A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University

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ABSTRACT

The Effect Of Physical Activity And Life Styles (Pals) Interventions On Work-Related Outcomes
By Neema Iyer

Objectives: The objective of this study is to evaluate the effect of the Physical Activity and Lifestyles (PALS) worksite physical activity intervention program conducted at Emory University, Atlanta on work-related outcomes.

Methods: Emory University employees (n=381) from 60 departments were randomized to one of five treatment groups: 1) Control, 2) Gym, 3) Education+Gym, 4) Time+Gym, or 5) Education+Time+Gym. Covariate-adjusted logistic mixed models were used to analyze the effect of the interventions on work-related outcomes and secondary analyses were performed to determine the effect of any treatment versus the control group on the work-related outcomes. Potential covariates include baseline age, ethnicity, gender, Body Mass Index, study block i.e. participants were divided into two groups to account for seasonality, presence of disease comorbidities, employment in facilities management and whether participant meets CDC recommended guidelines for physical activity.

Results: The covariate-adjusted analyses showed no significant effect of treatment on job satisfaction (p=0.4369), entire days missed due to physical health (p=0.6104), partial days missed due to physical health (p=0.6927), self-rated work performance (p=0.6233) and opinion of whether 'Emory is a Health Workplace' (p=0.5727). Contrasts of any treatment groups versus the control group also showed no significant association for all variables except agreement with the statement 'Emory is a Health Workplace', where the odds of reporting agreement with the statement was higher among the treatment group than the control group (OR= 1.82, 95% CI (1.04, 3.19) , p= 0.0373).

Conclusion: The analyses conducted showed no significant correlation between the PALS worksite intervention program and work-related outcomes. However, there was an increased agreement in the perception of Emory as a healthy place to work. Prior literature has shown a loose association between worksite interventions and sick absences. Further research is required to evaluate the association between physical activity and work outcomes by incorporating longer study periods, multifaceted interventions to increase physical activity levels and more sensitive instruments for detecting work outcomes changes in the participant populations.

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INTRODUCTION

According to the State Indicator Report on Physical Activity 2010survey conducted by the Center for Disease Control (CDC), 25.4% of the adult U.S population over the age of 18 were reported to partake in no leisure time physical activity (1). Benefits of physical activity reported by the Division of Nutrition, Physical Activity and Obesity, CDC include improving mental health, improved ability to perform daily life tasks, reduce falls and increases chances of living longer (2). Lack of physical activity puts an individual at an increased risk for cardiovascular disease, type 2 diabetes, metabolic disorders and cancer, increasing the health care burden. For example, the 2009 National Health Interview (NHI) survey conducted by the CDC reported that 12% of the adult U.S population over the age of 18 had been told by a doctor or health that they had heart disease and 24% had been told on two or more visits that they had hypertension (1). Also, cardiovascular disease accounted for 16.7 million, or 29.2% of total global deaths according to World Health Report 2003. However, risk of CVD as well as morbidity and overall mortality has been found to be reduced by even slightly increasing physical activity in an inactive adult population (3)

According to the *2008 Physical Activity Guidelines for Americans*, the CDC recommends the following:

i) Two hours and 30 minutes (150 minutes) of moderate-intensity aerobic activity (i.e., brisk walking) every week and muscle-strengthening activities on two or more days a week that work all major muscle groups (legs, hips, back, abdomen, chest, shoulders, and arms or,

ii) One hour and 15 minutes (75 minutes) of vigorous-intensity aerobic activity (i.e., jogging or running) every week and muscle-strengthening activities on 2 or more days a week that work all major muscle groups (legs, hips, back, abdomen, chest, shoulders, and arms) or,

iii) An equivalent mix of moderate- and vigorous-intensity aerobic activity and muscle-strengthening activities on two or more days a week that work all major muscle groups (legs, hips, back, abdomen, chest, shoulders, and arms).

When assessed for leisure time physical activity, i.e. moderate physical activity for at least 10 minutes, 33% of adults were considered inactive and 55% of adults never engaged in any form of vigorous physical activity lasting more than 10 minutes (1)

In addition, in terms of demographic differences, women who are older, less educated or of lower socioeconomic status tend to engage less in physical activity than their peers (1). However, southern states in the US report lesser leisure time physical activity than the northern states, with the highest rate of no leisure time physical activity (32%) occurring in Mississippi (1).

An initial needs assessment conducted at Emory University, Atlanta showed that 60% of the Emory population did not meet the CDC Healthy People 2010 guidelines and around 17% of the population were physically inactive. The Physical Activity and Life Styles (PALS) project at Emory University was initiated with an overall goal of creating a workplace physical activity intervention program to increase physical activity and in doing, to improve health outcomes and possibly, work outcomes.

Some of the interventions used in the PALS study at Emory University included paid time during the day to exercise, educational material, social support and gym memberships to eliminate any barriers towards increasing physical activity levels. Similar initiatives have been implemented at other universities and agencies such as the state of Arkansas, Cornell University and University of California Santa Barbara, that allows employees to take paid time during the workday for physical activity.

Based on studies that show improvements in physical and mental health when engaging in physical activity and the fact that most adults spend about half of their waking hours at the workplace, there has been a global interest in using the workplace as a venue of health promotion programs to bring about beneficial changes in lifestyles behaviors that lead to improve health and work outcomes (4). Workplace health promotion and weight loss programs have resulted in significant health outcomes such as decrease in blood pressure, abdominal fat and improved blood lipid concentrations (4). However, these programs have been shown to improve work outcomes such as decreased absenteeism, job stress and increased job satisfaction (5) and (6).

According to the NHI survey, employed adults 18 years and older experienced an average of four work-loss days per person due to a reported illness or injury over a period of 12 months, accounting for a total of approximately 571 million work-loss days. Furthermore, women were 1.5 times likely than men to experience a bed day, i.e. occupancy of a hospital bed for 24 hours. As such, the present study aims to evaluate the impact of increasing physical activity among employees through worksite health promotion programs in improving work-related outcomes. Work-related factors of interest in this study include productivity, motivation, interaction with peers and

superiors, work satisfaction, absenteeism and self-rated work performance. Several of these measures are self-reported by employees. These factors are becoming more important and relevant in time with rapidly changing global disease epidemiology, economics and work environments. The present trends of rising rates of chronic disease in both developed and developing countries such as cardiovascular disease, obesity and diabetes are placing a heavy burden on the health systems. Additionally, global economic downturns coupled with demanding jobs in fast-paced environments create stressful lifestyles with lowered health priorities.

Prior research points towards positive outcomes from health promotion programs. However, several studies conducted aimed at evaluation the impact of physical activity on work productivity and absenteeism have proven to be inconclusive or weak. Some examples include studies where participants in a health promotion program for educators reported on average 1.25 days less absenteeism during the study period than non-participants (5). A study aimed at evaluation job satisfaction reported that health promotion programs had no impact on improving job satisfaction and that the job itself and psychosocial factors played a larger role in employee's perception of job satisfaction (7). Another large scale study in Finland showed a relationship between physical activity and decreased absenteeism when controlling for factors such as Body Mass Index and socioeconomic factors (8). Unlike health outcomes, there has been no conclusive evidence of the benefits of these programs on employee work outcomes. This has been attributed to factors such as small sample sizes, weak evaluation methodology and large loss to follow up.

Thus, this study is a rigorous evaluation of the impact of increasing physical activity on work-related outcomes by using a combination of physical activity intervention developing using the socio-cognitive theory. Eleven different work-related outcomes are examined over a period of nine months in a large cohort with relatively less loss to follow-up. This paper first discusses the global perspective on worksite health programs in bringing about improved health and work outcomes in light of current disease and economic trends. This study then examines the effect of the intervention groups on work outcomes controlling for important covariates such as gender, age, BMI status and disease comorbidities of interest. These programs have the potential to bring about wide ranging improvements in employee health and work status and as such, need to be better understood to develop sustainable and effective programs and interventions.

LITERATURE REVIEW

According the World Health Organization (WHO), the workplace has been recognized as one of the priority areas of health promotion for the 21st century based on the available infrastructure and ability to reach out to large audience to influence lifestyle behaviors (9). Private and public organizations could use this venue to impact morbidity and mortality arising from cardiovascular factors, hypertension and high blood cholesterol level. Worksite health promotion programs utilize a variety of interventions to improve desired outcomes. These include behavior modification such as reinforcement, cognitive behavior modification such as self-monitoring, health education, health risk assessment based on self-reports or health evaluations, exercise recommendations in terms of frequency, intensity etc. and lastly, a combination of any of these interventions (10). Several worksite health promotion programs have been conducted in the US and globally with varied results. While some produced significant differences in several health and work outcomes, others failed to show any improvements. However, there are various notable differences between program implementation, sample sizes and outcomes measures while may account for the different results. The following programmatic examples show the diversity and range of interventions and outcomes, both in terms of health outcomes as well as work outcomes.

Global worksite health promotion programs

A workplace weight loss program conducted in Australia that randomized 58 overweight men to a low fat diet and/or moderate exercise-induced weight loss interventions found that the interventions resulted in a reduction in systolic and diastolic

blood pressure as well as a decrease in LDL cholesterol and a rise in HDL cholesterol, when all interventions were analyzed together (5).

In Japan, a four day health promotion program was targeted at a group of 152 men who showed some abnormal finding at baseline of body mass index (BMI), systolic or diastolic blood pressure, total cholesterol or blood glucose level (4). The multi-component intervention focused on education on nutrition, physical activity, stress and CVD risk factors through counseling, practical training, lectures and group discussions. A follow-up program was held at three months intervals for a year that consisted of self-evaluations and blood chemistry measurements. Changes for BMI, systolic and diastolic blood pressure, total cholesterol and blood glucose were significantly greater for the intervention group.

In Malaysia, a pre post-test quasi-experimental study on 239 male security guards employed at two different locations was conducted over a two year period that involved interventions such as one-to-one counseling and team discussions focusing on topics such as nutrition, physical activity and risk factors for CVD (11). Investigators worked to provide encouragement, motivation and support to participants in the intervention group. Self-monitoring booklets were handed out to participants to track anthropometric and biochemical measurements. The intervention group showed a reduction in total cholesterol level and this trend continued with time, however the control group showed an increase in blood cholesterol level with increasing time. Investigators believe that this decrease in cholesterol may have been accountable more to diet than to the physical activity component of the intervention.

A large scale health promotion program was carried out among 2595 employees in the Northern Ireland Civil Service (NICS) during the period 1997 to 2000 (11). A baseline line pre-assessment questionnaire was used to collect lifestyle behaviors and physiological measurements and a follow-up questionnaire was mailed out 6-month after the initial assessment. The Lifestyle and Physical Activity Assessment (LAPAA) was a nurse-led program that aimed to attract employees >35 years of age with a sedentary lifestyle. Assessments were taken regularly on a full time basis. Lifestyle changes were recommended after baseline health assessments which include urine test, flexibility test, measurements of BMI and body fat. According to the study, lifestyle behaviors with the highest success rates included diet improvement, increased exercise and weight reduction.

A program conducted in Sweden used two interventions, physical activity and reduced work hours, in a group of women employed in the dentistry industry (12). A total of 177 women from six workplaces were randomized to two intervention groups, that included 2.5 hours of weekly, mandatory physical exercise of middle-to-high intensity to be performed during work hours, a reduction of work hours from 40 hours to 37.5 hours a week and one control group. Biomarkers and self-reported measures were taken at baseline, 6 months and 12 months after the intervention. All three groups showed an increase in physical activity, with the level being significantly greater for the physical activity intervention group. Repeated measures analysis showed significant interaction effects for glucose, waist-to-hip ratio, and work ability as well as trends for general symptoms and upper-extremity disorders. Another worksite intervention program to affect oxygen consumption in Norway among 131 participants found that VO_{2max}

increased significantly ($P<0.001$) with a significant ($P<0.001$) increase in the overall physical activity level (13) .

U.S Based health promotion programs

One program that encouraged walking, jogging or cycling about three times a week for 20-40 minutes for 24 weeks among 37 blue collar workers showed a significant effect on cardiovascular endurance (VO_{2max}) as well as body weight, but failed to show a significant effect on percentage of body fat and serum lipids (14). The Heart and Soul Physical Activity Program (HSPAP) was a faith-based intervention conducted in two rural communities in the Midwest to promote physical activity in 42 midlife women (15). Analysis showed a significant interaction for energy expenditure increasing by 1,010 kcals/week as well as a 75% increased VO_{2max} levels as compared to the comparison group. A flexibility program with an intervention of 30 minutes daily stretching for six months in a cohort of 469 firefighters showed a significant effect on flexibility but did not have a significant effect on incidence of joint injuries (16). Another program that focused on stretching and strengthening exercises for 60 minutes, three times a week for nine weeks among 1,504 police officers showed significant effects on fitness, general strength, flexibility and percentage on body fat but did not show significant effects on upper body strength (17).

A twelve week program among 350 navy marine corps that focused on circuit training three times a week showed no significant effects in physical or psychological factors (18). A program among 106 nurses and nursing aides with the intervention of strength and cardiovascular exercises for 45 minutes twice a week for eight weeks

showed no significant effects on VO_{2max} but did show increase in strength during exercise periods compared to reference periods (19). A study among 160 female home care workers conducted over a period of one year that focused on coordination, strength, aerobic activities and stretching for 60 minutes, twice a week showed no significant effects on VO_{2max}, health, body weight or low back disorders. These insignificant results may be due to low participation rate of 50% (20).

Role of worksite health promotion programs on work outcomes

Most health promotion programs focus on increasing physical activity, improving nutrition as well as health outcomes such as cardiovascular risk factors, hypertension, body fat and flexibility. Not much research has been conducted on how worksite physical activity programs affect work outcomes and productivity. These outcomes have the potential to be beneficial and cost-effective on the long run.

Absenteeism is described as a habitual failure to show up for work or one's duty. Absenteeism is often looked at through the lens economic loss, however, it can also be viewed as a sign of psychosocial or medical maladjusted in the workplace. Several studies show an inverse relationship between job satisfaction and absenteeism as well as productivity (21). A study in Japan reported an improvement in job satisfaction through a community-based health promotion program through stress coping mechanism developed as part of the program (6). Logistic analyses adjusted for several lifestyle and health factors showed that the acquirement of ways to cope with work stress was independently associate with improved job satisfaction. Thus, it is important to view job satisfaction, interaction with co-workers and supervisors, and opinions about the work environment as

a means to improving other work outcomes such as productivity, motivation, alertness and time required to complete tasks.

A comprehensive literature review of worksite health promotion programs was conducted to assess the effective of interventions on work-related outcomes (22) . The review focused on programs with randomized controlled or controlled trial, worksite intervention program and work-related outcomes. The outcomes measured were absenteeism, job satisfaction, job stress, productivity, and employee turnover. Results showed limited effect for absenteeism, were inconclusive for job satisfaction, job stress and employee turnover, and had no effect for productivity. The authors found that there were very few high-quality randomized control trials and methodological quality was general poor.

Some highlights of the review include a large scale health promotion program among employees of a school district in Texas. The authors analyzed absenteeism by using age, sex, ethnic group and previous year's absenteeism as covariates and showed that participants who completed the program had on average 1.25 days less absenteeism during the study period than non-participants (5). Furthermore, regression analyses showed that improvements in the physical activity and fitness were associated with less absenteeism. A study conducted in Finland in 2000-2002 among 6,465 individuals who were 40-60 year olds suggested that vigorous physical activity is associated with lowered sick absences when controlling for socioeconomic position, body mass index (BMI) and physical health functioning (8). In this study, the authors aimed to understand the association between the volume and intensity of physical activity and subsequent sickness absences. Baseline data was collected using surveys and absenteeism was

recorded using employers' registries with a mean follow up time of 3.9 years. The association of physical activity with absenteeism of greater than or less than 14 days was analyzed using poisson regressions. The analyses suggested weak associations which lost statistical significance when adjusted for other factors such as BMI. Another survey based study aimed at evaluating the effect of worksite health promotion programs on job satisfaction in 1283 employees found no association between involvement in the health promotion program and job satisfaction when controlling for factors such as education level, job classification and marital status (7).

The review by Proper et. al (22) emphasizes the need for a methodologically sound randomized trial program that focuses on a clear description of randomization, interventions, outcomes, inclusion or exclusion criteria and participation rates to adequately assess the effectiveness of worksite health promotion programs in affecting work-related outcomes. There is a lack of studies that focus on the temporal and longitudinal nature of work site physical activity programs with the aim of better understanding the effects on work-outcomes. While some studies have concentrated on absenteeism, information on other work outcomes such as job satisfaction, productivity, quality of interaction with peers and supervisors remains sparse. A meta-analysis conducted on eight studies showed that the evidence of the effect of worksite intervention programs was weak for absenteeism, inconclusive for job satisfaction and absent for productivity (23). As such, evidence of the effectiveness of worksite physical activity intervention programs on important work outcomes still remains limited. This study aims to understand the effect of physical activity interventions on a diverse range of work-related outcomes.

METHODS

Subjects

Study setting

The study was carried out at Emory University, located in metropolitan Atlanta, Georgia beginning in the summer of 2006. At the time of study, the Emory University employee population was 6,833.

Eligibility

Eligibility criteria for employees were determined by a web-based survey. Employees were deemed ineligible if they 1) met CDC guidelines for physical activity; 2) worked nights; 3) worked off campus; 4) were exempt (i.e., did not clock in and out for work; main study only); 5) expected to be absent from work for more than a month; or 6) worked less than 20 hours/week.

In addition, the following conditions rendered an employee ineligible: 1) no longer employed by the University, 2) currently on long-term leave or planned long-term leave during the study, 3) not comfortable speaking English, 4) physical impairment. Departments were considered ineligible if they had fewer than six non-exempt employees, if the majority of workers were employed by Emory University Hospital or if the department was not located on Emory's main campus (e.g. Oxford campus or Briarcliff campus). The study sample was so chosen as to provide an accurate representation of the University's population of on-campus non-exempt employees working at least twenty hours per week

Study participants

Sixty departments within the university agreed to participate in the intervention program. An invitation to participate was sent out to employees (n=1,104) within these departments. Out of these, 2% (n=27) of employees could not be contacted, 45% (n=497) were deemed ineligible, 16% (n=173) declined to participate, and 37% (n=410) agreed to participate.

Interventions

For the study, 410 eligible participants from the 60 participating departments at Emory University were randomized to five treatment groups: 1) Control – Participants received a gym membership to the Woodruff Physical Education Center on campus only at the end of the study period; 2) Control Gym – Participants received the gym membership at the start of the study; 3) Time+Gym – Participants received gym membership and were allowed to take "30 minutes during the workday" for exercise; 4) Education+Gym – Participants received gym membership and also provided a traditional physical activity education program that included brochures, walking route maps, PA tips, peer-led walking groups etc; and 5) Time+Education+Gym – Participants received gym membership, "30 minutes during the workday" and the education program described above.

The three main treatment interventions, Time, Gym and Education, are explained below.

Gym

Participants in all five treatment groups received free membership to the Woodruff Physical Education Center (WPEC) for a period of one calendar year. The gym

membership was provided in the form of a redeemable paper certification given to intervention group participants at the time of the first in-person interview and to control group participants at the time of their final follow-up interview. The WPEC facility includes weight and exercise equipment, swimming pool, indoor and outdoor track, athletic courts etc. At the time of the study, the fee for an annual gym membership for Emory employees as of August 1st 2008 was $180.

Education

Two treatment groups, "Education+Gym" and "Time+Education+Gym" received educational material related to physical activity. Focus groups were held with Emory employees to test out the material and the feedback from these discussions was incorporated into the final version of the materials. This material included: 1) a 12-page educational booklet *How to be More Active at Emory* which utilized photographs and simple text to address barriers to physical activity at Emory; 2) Physical Activity Log book that allowed participants to set short and long term physical activity goals and to track them; 3) a walking map of the Emory campus which highlighted 18 planned walking routes ranging from 0.25-1.5 miles; 4) a brochure of the WPEC gym facility; and 5) the PALS website that housed the printed educational material and included several physical activity resources for participants to access. Participants also received weekly PALS tips and reminders on adopting a more physically active lifestyle in the form of postcard or email reminders. In addition, peer-led walking groups that met on campus were held twice daily.

Time

Two treatment groups, "Time+Gym" and "Education+Gym", had the opportunity to take thirty minute breaks during the workday to exercise. Three methods of recording use of time were: 1) hard copy sheet of paper at their department; 2) hard copy sheet given to complete and mailed to PALS team or picked up by interviewer; or 3) secure, on-line website entry. The guidelines for the thirty minutes for physical activity included the following conditions: 1) employees had to clear the time with direct supervisors; 2) the "time" could only be used for physical activity as per the PALS program; 3) time required to prepare for the physical activity such as changing of clothing, had to be included within the thirty minutes allotted; 4) pending supervisor approval, the "time" could be used in addition to lunch or dinner but not before or after clocking in or clocking out; and 5) participants had to record their "time" using one of the three methods described above.

Objectives and Hypothesis

This thesis aims to study the effects of intervention strategies aimed at increasing physical activity on work outcomes that include productivity, alertness, motivation, interaction with co-workers and supervisors, decreased number of hours to complete work, job satisfaction, work absenteeism, personal work performance ratings and attitude about Emory being a healthy place to work.

The hypotheses for the study are:

1) Individuals within groups that received any interventions will experience improved work outcomes compared to groups that did not received any intervention (i.e. "Gym", "Education+Gym", "Time+Gym" and "Time+Gym+Education" in contrast to "Control

group")

2) Individuals within groups that received time to exercise during the day will experience improved work outcomes compared to groups that did not received time (i.e. "Time+Gym" and "Time+Education+Gym" compared to "Control", "Gym" and "Education+Gym")

3) Individuals within "Time+Gym" and "Time+Gym+Education" groups will experience an increased in work outcome impacts such as alertness, motivation etc. over the 9 month period.

4) Individuals within "Time+Gym+Education" treatment group will experience an increase in work-outcome impacts compared to the "Time+Gym" treatment group.

Data Measures

Five data collection points were used in the PALS study: a) Baseline A , submitted online or in hard copy format and Baseline B, interview conducted in person, b) follow up at 6 weeks, c) follow up at 3 months, d) follow up at 6 months and lastly e) follow up , submitted online or in hard copy format and interview conducted in person at 9 months.

For the purpose of the present study, only data collected at baseline and the 9 months point were used. This was done because the greatest amount of change in outcome variables was expected to be obtained from the largest time interval i.e., 9 months. Additionally, certain information such as 'Attitudes About Time During the Workday to Exercise' which include questions such as impact on alertness, motivation, productivity, interaction with coworkers and decreased hours required to complete tasks,

was only collected from the "Time+Gym" and "Time+Gym+Education" group and was only collected at the 9 month survey point.

Baseline interview was completed by 410 employees and up to 381 employees completed the nine-month follow-up interviews. The loss to follow-up in the nine month period was 7% (n=29) of participants.

Outcome Measures

Work outcomes were measured using WHO Health and Work Performance Questionnaire (24). Outcome measured examined include work satisfaction, entire days of work missed due to physical health in the last 28 days, partial days of work missed due to physical health in the last 28 days, self-rate work performance, agreement with the statement "Emory is a healthy place to work", increased alertness, increased productivity, decreased number of hours worked to complete tasks, increased motivation, increased quality of interaction with coworkers and increased quality of interaction with supervisors. The latter six variables are measured using survey questions with options "Improved (or Increased)", "Worsened (or Decreased)", "Refused to Answer" and "Don't Know". Outcomes measured of work satisfaction, missed days and attitudes about healthiness of Emory were measured with survey question with options "Strongly Agree", "Agree", "Neutral", "Disagree" and "Strongly Disagree". Self-rated work performance was recorded on a scale of 1 to 10.

In order to perform the analyses, several of the variables were recoded. As part of the analysis, variables that had agreement on a five level spectrum were re-coded as dichotomous variables. "Strongly Agree" and "Agree" were recoded into one category

i.e. “Agree”. “Strongly Disagree”, “Disagree” and “Neither Agree nor Disagree” were also coded into one category, i.e. “Disagree”. This was done so as to obtain a purely positive response to the questions. A similar strategy was used for measuring “increment” and “improvement” on a scale. “Increased” remained as is, but “Decreased”, “Refused to Answer” and “Don’t Know” were all coded as “Decreased”. “Improved” remained as is, but “Worsened”, “Refused to Answer” and “Don’t Know” were all coded as “Worsened”. Survey questions are presented in Appendix A.

Exposure Variable

The exposure variable in the study was treatment effect due to physical activity intervention. As such there are four treatment groups and one control group: “Gym”, “Education+Gym”, “Time+Gym” and “Time+Gym+Education” and “Control group”. These treatment groups have been described in the preceding sections.

Covariates

Covariates used in the analysis include Age (in years), Gender (Male and Female), Ethnic group (Black, White and Other) and Body Mass Index (Underweight, Normal, Overweight and Obese). Dichotomous variables (Yes and No) include Depression, Diabetes, Heart Disease, High Blood Pressure, Meets CDC Guideline for Exercise, Employment in Facilities Management and Facilities Management. Minutes of exercise of participants were recorded using self-reporting 7-day Physical Activity Recall. “30 minutes on the clock” (25). Demographic information was obtained from Emory University Human Resources department.

BMI was coded as follows: BMI of Less than 18.5kg/m^2 was considered underweight, 18.5 to 24.9kg/m^2 was normal, 25 to 29 kg/m^2 was overweight and a BMI of greater than 30kg/m^2 was obese. Races other than black and white such as Asian, Hispanic etc., were grouped under the category "Others". The variable 'meets CDC guideline for exercise' was determined based on the CDC guidelines in the *2008 Physical Activity Guidelines for Americans*.

Data Analysis

Descriptive Statistics

Simple univariate procedures were run to frequency measures on gender, mean age, age range, race, mean BMI and BMI range, BMI status, comorbidities such as high blood pressure, heart disease, depression and whether participants meet the CDC recommended guidelines of physical acitivity for each of the five treatment groups. The total counts as well as counts and percentages of each variable per treatment group were recorded for categorical variables. For continuous variables, means and ranges were recorded. In addition, frequency measures were obtained for all the work outcomes of interest by treatment group.

Odds Ratio Measures

Analyses were conducted to determine any difference in treatment effect for treatment groups with the "Time" intervention, paid time during the work day for physical activity. Odds ratios and confidence intervals for work productivity, motivation, alertness, decreased hours required to complete tasks, improved interaction with

coworkers and improved interaction with supervisors were obtained using frequency procedures.

Multi Covariate-Adjusted Models

Logistic regression modeling was used to evaluate the effectiveness of the different treatment interventions on job satisfaction, partial missed days of work, entire missed days of work, self-rated job performance and belief in the fact that Emory is a healthy work environment. Models were controlled for baseline levels of outcome variable and covariates. Repeated measures analysis was performed (Appendix C). A separate model was run for each outcome. Covariates used in the models include Age, Ethnic group(White, Black and Other), Body Mass Index, Body Mass Status, Disease Comorbidites and whether participant meets CDC Guideline for Exercise (Appendix B). Backward elimination was performed to determine the best model. Tests for confounding were not performed because all covariates were treated as exposure variables. Covariates that caused the model to fail, were non-significant predictors with high p-values or with significant correlation were dropped from the models. As such, BMI was dropped from the model. Goodness-of-Fit analyses were conducted to determine the fit of the models and chi-square statistics for these tests were obtained.

The Emory Institutional Review Board deemed the study exempt. All statistical operations were run on SAS 9.2 (SAS Institute Inc., Cary, NC).

RESULTS

Descriptive Statistics at Baseline

At baseline, 410 participants were enrolled in the study with a distribution of 17%

in the control group, 17.6% in the gym group, 26% in the Gym+Education group, 17.8% in the Time+Education group and 21.7% in the Time+Gym+Education group. Table 1 shows that 62% percent of participants in the program were female. The mean age of the participants was 41.7 years with an age range of 21-73 years. African-Americans accounted for 57.3% of subjects and whites accounted for 36.1%. Mean body mass index among program participants was 30kg/m^2 with a range of 14.6-67.2 kg/m^2. In terms of comorbidities, depression, heart disease and high blood pressure was prevalent among 11%, 6% and 26.3% of participants respectively. In addition, only 16.8% of participants met the CDC recommended guideline for exercise and physical activity.

Table 2 shows the baseline and 9 month frequencies of five work outcomes: work satisfaction, participants that missed entire and partial days of work due to physical and mental illness in the last 4 weeks, agreement with the statement "Emory is a healthy place to work" and mean self-rated job performance. For each group, there was some loss to follow-up from baseline to 9 months. Overall job satisfaction dropped from 76% to 73%. Entire days of work missed dropped from 38% to 31% from baseline to 9 months and partial days of work dropped from 28% to 22%. Agreement with whether Emory is a healthy work place increased from 62% to 70%. Lastly, mean self-rate work performance increased from 8.38 to 8.50.

Attitudes about Time During the Workday to Exercise for 2 treatment groups at 9 Months

Table 3 shows an overall increase in alertness within the two group with72.1% of participants reporting that their alertness had increased. An increase in productivity was reported by 55% of participants. Decreased number of hours needed to complete tasks

was reported by 14% of participants. Increase in motivation to work was recorded by 62% of participants. Improved interaction with co-workers was described by 47% of participants whereas 31% of participants described an improved interaction with supervisors.

Odds Ratios of Attitudes Related to Work-Outcomes for Two Treatment Groups

Secondary analyses to determine any difference in treatment effect between "Time+Gym" and "Time+Education+Gym" groups showed no significant differences between the two groups. Analyses conducted to determine the effect of "Time+Gym" versus "Time+Education+Gym" on the proportion of participants reporting increased alertness showed no significant result (OR=1.39, 95% CI (0.55, 3.52)). Similarly, the analysis for increased productivity and increased motivation showed non-significant results, (OR=1.50, 95% CI (0.65, 3.44)) and (OR=1.14, 95%CI (0.48, 2.68)) respectively. Increased quality of interaction with coworkers and supervisors both showed negative outcomes, however these results were shown to be non-significant (OR=0.92, 95% CI (0.40, 2.08)) and (OR=1.3710, 95% CI (0.5564, 3.3779)). Lastly, the low proportion of participants who reported decreased number of hours required to do work was also found to be non-significant (OR=2.63, 95% CI (0.89, 7.66)).

Treatment Effects on Work Outcomes

Job Satisfaction

The proportion of participants that "Agreed" or "Strongly Agreed" with the statement, "All in all, I am satisfied with my job" decreased for all groups except the control group, with the largest decrease among "Gym" group (79% to 67%) and the

smallest decrease among the “Gym+Time” group (76% to 74%). The “Control” group increased from 73% to 74% (Table 2). The covariate-adjusted analysis showed no significant effect of treatment on this outcome (p=0.4369). In addition, an analysis of the effect of any treatment to the control group indicated a similar non-significant result (OR=1.00, 95% CI (0.49, 2.02)).

Participants that missed entire days of work due to physical or mental health in last 4 weeks

An overall increase in number of entire days of work missed due to physical or mental health in the last 4 week was reported between baseline and 9 months follow-up. The largest increase of entire missed days was in the “Control” group (19% to 37%) and the smallest decrease was present in the “Time+Gym+Education” group (22% to 28%). The covariate-adjusted analysis indicated no significant effect of treatment on this outcomes (p=0.6104) and the secondary analysis of the effect of treatment versus control groups was not significant (OR=0.70, 95% CI (0.39, 1.25)).

Participants that missed partial days of work due to physical or mental health in last 4 weeks

Two groups reported a decreased number of partial days of work missed due to physical or mental health in the last 4 weeks i.e. “Control” group which showed a reduction of 21% to 18% and “Time+Education+Gym” group which showed a decrease from 23% to 19%. The “Gym+Education” group remained the same at 28% and the other treatment groups showed an increase. The covariate-adjusted analysis showed no significant treatment effect on absenteeism outcome (p=0.6927). An analysis of the odd-ratios also showed no significant results (OR=1.33, (0.66, 2.68)).

Mean self-rated work performance

The proportion of participants who had an increase in self-rated work performance on a scale from 1 to 10 increased across all groups with the greatest increase evident in the "Time+Gym+Education" group (8.29 to 8.46) and the smallest increase reported in the "Time+Gym" group (8.50 to 8.55). The covariate-adjusted analysis performed showed that this increase was non-significant (p=0.6233). Secondary analysis for effect of any treatment versus control group was not significant (OR=0.93, 95% CI (0.63, 1.38)).

Agreement with statement "Emory is a health workplace"

The proportion of participants that "Agreed" or "Strongly Agreed" with the statement "Emory is a healthy workplace" increased across all groups with the largest increase visible in the "Time+Gym+Education" group (55% to 70%). The covariate-adjusted analysis, however, showed that this increase was not significant (p=0.5727). Secondary analysis to determine differences between any treatment group and control group did, in fact, show a significant result (OR= 1.82, 95% CI (1.04, 3.19)).

DISCUSSION

The analyses conducted in this study have shown that there is no significant relationship between the PALS worksite intervention program and work-outcomes of the participants such as absenteeism, job satisfaction and alertness. While the worksite interventions showed some increase in self-rated work performance, opinion that Emory is a healthy workplace as well as increased alertness, motivation to work and productivity, these increases were shown to be not significant. However, the secondary

analysis indicated that the effect of any treatment group versus the control group yielded significant results for the self-rate performance measure.

The results of this study corresponds with other studies conducted in the field of work site physical activities intervention such as a survey based study that found vigorous physical activity to be only loosely correlated with sickness absence (Lahti, J., M. Laaksonen, et al, 2010). It also the reflects the inconclusiveness of the effect of worksite physical activity intervention programs on job satisfaction and productivty (Proper et al., 2003). In addition, similar to a multicentered randomized controlled trial in women, there was no statistically significant results between the intervention groups and control group for job satisfaction, work ability index and sick absences (Nurminen et al., 2002). The inability of the study to show significant outcomes may be related to some of the study weaknesses listed below.

Strengths

There are at least four strengths that can be identified in this study. First, work-outcome related data obtained from the PALS program were collected at five different points over the 9 month course of the study, creating a large database of important participant information. Second, the study is longitudinal in contrast to a cross sectional study in which data may only be collected at one time period. The nature of this study allows us to study various trends in the cohort throughout the period of the physical activity program and to make causal inferences. Third, the PALS program was unique in that it created several different treatments groups that included providing paid time during the work day to exercise at a nearby on-campus facility or to be a part of walking groups as well as provided the necessary education to increase physical activity. Fourth,

the dropout rate experience at the 9 month follow-up is low compared to several other worksite physical activity programs. As such, missing values in the dataset do not affect the outcomes significantly.

Weaknesses

While many strengths were identified in the study, there were at least six weaknesses were identified in the study. First, the results obtained from the study did not indicate significant improvements in work-related outcomes. Second, the study period of 9 months may not have been long enough to observe the impacts of the program. Third, even though number of minutes of physical activity increased overall throughout the course of the study, this increase might not have been adequate enough to meet the CDC guideline for physical activity. As such, the positive benefits that result from physical activity may not have been observed as expected. Fourth, selection bias is likely to have played a role in the overall results obtained. Participants who were less likely to increase physical activity or improve work outcomes may have been more likely to drop out of the study. Fifth, healthy worker effect may have affected the study outcomes. This is a form of sampling bias where it is likely that participants who enrolled in the study were more likely to be healthy or exhibited better work-outcomes that those who chose not to participate. Employees with negative work attitudes or lack of time would be less inclined to participate in such a program. Sixth, some level of aggregation of data was performed. This may have led to loss of power in the analysis. For example, people who ‘neither agreed nor disagreed’ were considered as ‘disagreed’ because a true positive reaction to the questions was required for the analyses conducted. Thus, in several instances, five responses for a question were grouped into only two responses.

Further research is needed to develop more effective interventions that could increase average participant physical activity to that of the CDC recommended guideline. In addition, survey tools that are more appropriate in detecting smaller changes in health and work-outcomes might be required to obtain significant results from the work-outcomes analyses described above. It is possible that a longer study period may lead to more detectable and observable changes in the study population.

Public Health Implications

With a rise in global trend of worksite health promotion programs, the implications of such interventions in improving productivity, motivation and reducing absenteeism is appealing to both employers and employees. While several of the data analyses were not significant for improvements in work-related outcomes, prior literature shows that there is potential for work-site targeted physical activity programs to positively impact health and work outcomes. With a world-wide increase in chronic disease rates, the current economic situation and ever demanding fast-paced work environments, it is important to determine the impact of these interventions on the target population. Further research in required in the evaluation of programs aimed at improving work-related outcomes through physical activity interventions so as to develop comprehensive and sustainable programs through integrated health management.

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LIST OF TABLES

Table1. Baseline characteristics of PALS participants based on univariate analysis results of frequencies[1]						
	Total	Control	Gym	Education+Gym	Time+Gym	Education+Time+Gym
Number of Participants (%)[2]	410 (100)	70 (17)	72 (17)	106 (25)	73 (17)	89 (21)
Gender						
Male(%)	156 (38)	23 (32)	34 (47)	29 (27)	40 (54)	30 (33)
Female(%)	254 (61)	47 (67)	38 (53)	77 (72)	33 (45)	59 (66)
Age (in years)						
Range	21-73	22-71	21-73	22-68	23-65	22-69
Mean	41.7	41.2	39.7	44.8	40.8	40.8
Race						
White (%)	148 (36)	26 (37)	15 (20)	36 (33)	31 (42)	40 (44)
Black (%)	235 (57)	36 (51)	52 (72)	64 (60)	37 (50)	46 (51)
Other (%)	25 (6)	8 (11)	5 (6)	5 (4)	4 (5)	3 (3)
Body Mass Index in kg/m2						
Range	14.6-67.2	18.9-56.4	20.0-48.0	14.6-67.2	18.0-49.0	16.7-53.8
Mean	30	31	30.2	30.6	27.9	30.4
BMI Status[3] (%)						
Underweight	3 (0.7)	0 (0)	0 (0)	1 (1)	1 (1)	1 (1)
Normal	103 (25)	17 (24)	17 (23)	26 (25)	24 (33)	19 (21)
Overweight	126 (30)	21 (30)	24 (33)	28 (26)	27 (37)	26 (29)
Obese	178 (43)	32 (45)	31 (43)	51 (48)	21 (29)	43 (48)
Comorbidities						
High Blood Pressure (%)	108 (26)	18 (25)	22 (30)	24 (22)	19 (26)	25 (28)
Heart Disease (%)	6 (1)	1 (1)	2 (3)	0 (0)	0 (0)	3 (4)
Depression (%)	45 (10)	4 (5)	7 (10)	13 (12)	8 (10)	13 (15)
Meets CDC guidelines for exercise						
Yes (%)	69 (17)	13 (19)	20 (27)	10 (9)	14 (19)	12 (13)
No (%)	314 (83)	57 (81)	52 (72)	96 (91)	59 (81)	77 (87)

[1] Participants at baseline

[2] Percentages provided are per treatment group

[3] Underweight <18.5kg/m2, Normal 18.5-24.9kg/m2, Overweight 25-29kg/m2, Obese >=30kg/m2

Table 2. Work-related characteristics of PALS participants at baseline and 9 months based on univariate analysis results of frequencies

	Overall Participants (N)	Total (n)	Control	Gym	Education+Gym	Time+Gym	Education+Time+Gym
Work Satisfaction Agreement (number of participants who agree and % of participants per trt group)							
Baseline	374	287 (76%)	49 (73%)	53 (79%)	75 (75%)	46 (76%)	64 (80%)
9 Months	364	264 (73%)	47 (75%)	42 (67%)	65 (71%)	50 (74%)	60 (74%)
Participants that missed entire days of work due to physical or mental health in last 4 weeks (number of participants and % of participants per trt group)							
Baseline	398	153 (38%)	30 (19%)	28 (18%)	41 (26%)	20 (13%)	34 (22%)
9 Months	366	114 (31%)	24 (37%)	20 (32%)	29 (31%)	18 (26%)	23 (28%)
Participants that missed part days of work due to physical or mental health in last 4 weeks (number of participants and % of participants per trt group)							
Baseline	399	113 (28%)	24 (21%)	17 (15%)	32 (28%)	13 (11%)	27 (23%)
9 Months	366	81 (22%)	12 (18%)	15 (24%)	26 (28%)	12 (17%)	16 (19%)
Agreement with statement "Emory is a healthy place to work" (number of participants who agree and % of participants per trt group)							
Baseline	399	248 (62%)	38 (54%)	53 (74%)	66 (63%)	43 (64%)	48 (55%)
9 Months	365	254 (70%)	38 (59%)	47 (77%)	63 (68%)	49 (73%)	57 (70)
Mean Self-rated job performance (on a scale of 1 to 10)							
Baseline	398	8.38	8.55	8.35	8.28	8.50	8.29
9 Months	360	8.50	8.65	8.63	8.33	8.55	8.46

Table 3. Attitudes about Time During the Workday to Exercise and Comparison of Treatment on attitudes for treatment groups "Time+Gym" and "Time+Education+Gym" at 9 Months based on odds ratio measures

	Overall (n=111)	Time+Gym (n=61)	Education+Time+Gym (n=50)	Odd Ratio (95% CI)	P-value
Increased Alertness (%)	80 (72%)	46 (75%)	34 (68%)	1.3959 (0.55, 3.53)	0.4826
Increased Motivation to work (%)	69 (62%)	39 (64%)	30 (60%)	1.1384 (0.48,2.68)	0.0873
Increase Productivity (%)	61 (559%)	35 (57%)	26 (52%)	1.5000 (0.65, 3.44)	0.3404
Increased Quality of Interaction with Coworkers (%)	52 (47%)	28 (46%)	24 (48%)	0.9158 (0.40, 2.08)	0.8347
Increased Quality of Interaction with Supervisors (%)	45 (31%)	21 (34%)	14 (29%)	1.3710 (0.56, 3.38)	0.4945
Decreased number of hours worked to complete tasks (%)	15 (14%)	10 (16%)	5 (10%)	2.6263 (0.89, 7.67)	0.0730

Table 4. Effect of Treatment on work-related characteristics based on multivariate adjusted analyses results using Logistic Regression Final Models

	Test of Treatment	
Outcome	**Chi-Square Value**	**P-Value**
Work Satisfaction Agreement [a]	3.78	0.4369
Participants that missed entire days of work due to physical or mental health in last 4 weeks [b]	2.69	0.6104
Participants that missed partial days of work due to physical or mental health in last 4 weeks [c]	2.23	0.6927
Mean self-rated work performance [d]	2.62	0.6233
Agreement with statement "Emory is a healthy place to work" [e]	2.91	0.5727

[a] Adjusted for baseline job satisfaction, age, diabetes and depression
[b] Adjusted for baseline entire days missed and depression
[c] Adjusted for baseline partial days missed and depression
[d] Adjusted for baseline self-rated work performance, ethnicity, meets CDC guidelines and depression
[e] Adjusted for baseline agreement with statement and depression

Table 5. Effect of Treatment on work-related characteristics based on multivariate adjusted analyses results using Logistic Regression Final Models : Contrast of Treatment Groups to Control Group

	Contrast of Treatment Groups versus Control Group		
Outcome	**Odds Ratio**	**95% Confidence Interval**	**P-Value**
Work Satisfaction Agreement [a]	1.00	(0.49, 2.02)	0.9903
Participants that missed entire days of work due to physical or mental health in last 4 weeks [b]	0.70	(0.39, 1.25)	0.2294
Participants that missed partial days of work due to physical or mental health in last 4 weeks [c]	1.33	(0.66, 2.68)	0.4213
Mean self-rated work performance [d]	0.93	(0.63, 1.38)	0.7267
Agreement with statement "Emory is a healthy place to work" [e]	1.82	(1.04, 3.19)	0.0373

[a] Adjusted for baseline job satisfaction, age, diabetes and depression
[b] Adjusted for baseline entire days missed and depression
[c] Adjusted for baseline partial days missed and depression
[d] Adjusted for baseline self-rated work performance, ethnicity, meets CDC guidelines and depression
[e] Adjusted for baseline agreement with statement and depression

APPENDIX A

Survey Questions

1. Job Satisfaction:
   All in all, I am satisfied with my job.
   a) Strongly Disagree
   b) Disagree
   c) Neither Agree nor Disagree
   d) Agree
   e) Strongly Agree

2. Over the past 4 weeks (28 days), how many days did you miss an entire day of work because of problems with your physical or mental health? (Please include only days missed for your own health, not someone else's health)
   _____ Days

3. Over the past 4 weeks (28 days), how many days did you miss PART of a day of work because of problems with your physical or mental health? (Please include only days missed for your own health, not someone else's health)
   _____ Days

4. On a scale of 0-to-10 where 0 is the worst job performance anyone could have at your job and 10 is the performance of a top worker, how would you rate your overall job performance on the days you worked during the past 4 weeks (28 days)?
   Worst Performance Top Performance

   ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

5. How strongly do you agree or disagree with this statement: Emory is a healthy place to work.
   a) Strongly Disagree
   b) Disagree
   c) Neither Agree nor Disagree
   d) Agree
   e) Strongly Agree

6. What impact did exercising during the workday have on the following aspects of your work?

	Increased	Decreased	Remained the Same	Don't Know	Refused
a) Alertness					
b) Productivity					
c) Number of hours worked to complete tasks					
d) Motivation to work					
e) Quality of Interaction with Coworkers					
f) Quality of Interaction with supervisor(s)					

APPENDIX B

Criteria for Inclusion/Exclusion of Covariates

Potential Covariates:

- Age
- Gender
- Ethnic group: Black, White and Other
- Body Mass Index
- Body Mass Status
- Depression
- Heart Disease
- High Blood Pressure
- Meets CDC Guideline for Exercise
- Facilities Management
- Number of minutes of physical activity per week

Reasoning:

1. Any covariate that caused the model to fail was dropped.
2. In cases where two or more covariates had significant collinearity or correlation, the least significant was dropped.
3. Any covariate with a high p-value in a test of association ($p>0.25$) was dropped.

APPENDIX C

Finals Models used in Analysis

1. Entire Days of work missed due to physical or mental health in last 4 week

   Marginal Model

   Logit P (EntireMissed=1) = $\beta_0 + \beta_1(TRT1_{ij}) + \beta_2(TRT2_{ij}) + \beta_3(TRT3_{ij}) + \beta_4(TRT4_{ij})\ \beta_5$

   $(DEPRESSION_{ij})$ + + β_6(I_EntireMissed) + b_{ij}

   i= 1 to 60

   j= 1 to 27

Where EntireMissed =1 if Entire Missed Days>1, 0 otherwise

Trt1=1 if Treatment= “Gym”, 0 otherwise

Trt2=1 if Treatment= “Gym+Education”, 0 otherwise

Trt3=1 if Treatment= “Gym+Time”, 0 otherwise

Trt4=1 if Treatment= “Gym+Education+Time”, 0 otherwise

Depression =1 if Disease Present i.e Yes, 0 otherwise

I_EntireMissed =1 if Baseline Entire Missed Days>1, 0 otherwise

Accounted for correlation using the GENMOD procedure with a REPEATED statement

2. Partial Days of work missed due to physical or mental health in the last 4 weeks

Marginal Model

Logit P (PartialMissed=1) = $\beta_0 + \beta_1(TRT1_{ij}) + \beta_2(TRT2_{ij}) + \beta_3(TRT3_{ij}) + \beta_4(TRT4_{ij}) + \beta_5$ $(DEPRESSION_{ij})$ + + β_6(I_PartialMissed) + b_{ij}

i= 1 to

j= 1 to

Where PartialMissed =1 if Partial Missed Days>1, 0 otherwise

Trt1=1 if Treatment= “Gym”, 0 otherwise

Trt2=1 if Treatment= “Gym+Education”, 0 otherwise

Trt3=1 if Treatment= “Gym+Time”, 0 otherwise

Trt4=1 if Treatment= “Gym+Education+Time”, 0 otherwise

Depression =1 if Disease Present i.e Yes, 0 otherwise

I_PartialMissed =1 if Baseline Partial Missed Days>1, 0 otherwise

Accounted for correlation using the GENMOD procedure with a REPEATED statement

3. Mean Self-Rated Job Performace

Marginal Model

Logit P (Performance=1) = $\beta_0 + \beta_1(TRT1_{ij}) + \beta_2(TRT2_{ij}) + \beta_3(TRT3_{ij}) + \beta_4(TRT4_{ij}) + \beta_5$ (ETHNICITYij) + β_6 ($DEPRESSION_{ij}$) + $\beta_7(CDC_{ij})$ + β_8 (I_Performance) + b_{ij}

i= 1 to 60

j= 1 to 27

Where Performance =1 if Job Performance>8.5 (Mean), 0 otherwise

Trt1=1 if Treatment= “Gym”, 0 otherwise

Trt2=1 if Treatment= “Gym+Education”, 0 otherwise

Trt3=1 if Treatment= “Gym+Time”, 0 otherwise

Trt4=1 if Treatment= “Gym+Education+Time”, 0 otherwise

Ethnicity= 1 if White, 0 if Other

Depression =1 if Disease Present i.e Yes, 0 otherwise

CDC=1 if Meet Recommended Guidelines for Physical Activity, 0 otherwise

I_Performance =1 if Baseline Job Performance>8.5, 0 otherwise

Accounted for correlation using the GENMOD procedure with a REPEATED statement

4. Job Satisfaction
   Mixed Model with Random Intercept

Logit P (JobSatisfaction=1| b_{0i}) = β_0 + $\beta_1(TRT1_{ij})$ + $\beta_2(TRT2_{ij})$ + $\beta_3(TRT3_{ij})$ + $\beta_4(TRT4_{ij})$ +

$\beta_5(AGE_{ij})$ + β_6 ($DEPRESSION_{ij}$) + β_7 (DIABETES) + β_8 (I_JOBSATISFACTION) + b_{ij}

i= 1 to 60

j= 1 to 27

Where JobSatisfaction=1 if JobSatisfaction=”Agree” or “Strongly Agree”, 0 otherwise

Trt1=1 if Treatment= “Gym”, 0 otherwise

Trt2=1 if Treatment= “Gym+Education”, 0 otherwise

Trt3=1 if Treatment= “Gym+Time”, 0 otherwise

Trt4=1 if Treatment= “Gym+Education+Time”, 0 otherwise

Age=Age at Baseline

Diabetes, Depression =1 if Disease Present i.e Yes, 0 otherwise

I_JobSatisfaction=1 if Baseline JobSatisfaction=”Agree” or “Strongly Agree”, 0 otherwise

Accounted for correlation using the GENMOD procedure with a REPEATED statement

5. Agreement with statement " Emory is a healthy place to work"
   Mixed Model with Random Intercept

Logit P (HealthyWork=1| b_{0i}) = β_0 + $\beta_1(TRT1_{ij})$ + $\beta_2(TRT2_{ij})$ + $\beta_3(TRT3_{ij})$ + $\beta_4(TRT4_{ij})$ + β_5 ($DEPRESSION_{ij}$) +$\beta_6(I\_HealthyWork_{ij})$ + b_{ij}

i= 1 to 60

j= 1 to 27

Where HealthyWork=1 if Healthy Workplace Opinion="Agree" or "Strongly Agree", 0 otherwise

Trt1=1 if Treatment= "Gym", 0 otherwise

Trt2=1 if Treatment= "Gym+Education", 0 otherwise

Trt3=1 if Treatment= "Gym+Time", 0 otherwise

Trt4=1 if Treatment= "Gym+Education+Time", 0 otherwise

Depression =1 if Disease Present i.e Yes, 0 otherwise

I_HealthyWork=1 if BaslineHealthy Workplace Opinion="Agree" or "Strongly Agree", 0 otherwise

Accounted for correlation using the GENMOD procedure with a REPEATED statement