AN ABSTRACT OF THE DISSERTATION OF

Dal-Hyun Moon for the degree of Doctor of Philosophy in Exercise and Sport Science presented on May 2, 2013.

Title: Increasing Physical Activity in Adults: Identifying Mechanisms of Goal-Setting Theory.

Abstract approved:

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Joonkoo Yun

Walking is the most popular type of physical activity among the adult population in the United States including individuals with disabilities. Considering the popularity of the activity, walking-related physical activity should be a focus of health promotion campaigns among the adult population. Rhodes and Nigg (2011) suggested that employing theory-based interventions lead to a better understanding of physical activity behavior and to the development of effective interventions. The goal of this project is to provide an effective intervention strategy using goal-setting theory. Two studies were conducted to examine the effectiveness of goal-setting strategies to

increase physical activity behavior among middle-aged adults and to identify the specific mechanisms of goal-setting theory.

The first study examined the effects of different degrees of specific and difficult step goals on increasing physical activity, using a pedometer. A total of 96 adults were randomly assigned into five different goal groups: (a) easy, (b) difficult, (c) improbable, (d) do-your-best, and (e) no goal group. A 2 x 5 (time by group) repeated measures ANOVA revealed that there were significant time by group interactions. The increases in step counts in the difficult and improbable goal groups were greater than the remaining groups. In addition, there were no significant differences on the rates of goal achievement among specific and difficult goal groups. These findings suggest that when people have higher goals, they are more likely to increase their levels of physical activity. Future studies should examine the long-term effects of goal setting on physical activity.

The second study examined the effects of goal commitment on physical activity promotion. A total of 69 adults were randomly assigned into different goal groups and their performances were compared. Participants' level of goal commitment was collected by survey. Results from multiple regression analyses showed that goal and goal commitment had a direct effect on increasing daily step count. However, there was no evidence for the moderating effect of goal commitment on the relationship between goals and performance. Results of this study suggest that goal setting and goal commitment are important predictors of change in physical activity levels.

The results of this project suggest that physical activity promotion programs should use specific and difficult goals to increase a person's performance rather than vague and easily achievable goals. Also, it is important that participants make a commitment to achieve the goal. Future studies should examine the strategies for increasing goal commitment.

Increasing Physical Activity in Adults: Identifying Mechanisms of Goal-Setting Theory

by

Dal-Hyun Moon

A DISSERTATION

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APPROVED:

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Dean of the Graduate School

I understand that my dissertation will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my dissertation to any reader upon request.

Dal-Hyun Moon, Author

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CONTRIBUTION OF AUTHORS

Dal-Hyun Moon, M.S. conceptualized, collected data, data analysis and wrote the manuscripts.

Joonkoo Yun, Ph.D., helped in conceptualization, designing the study, assisted in analyzing data, and provided feedback on manuscript development.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

Chapter 1. General Introduction

Increasing Physical Activity in Adults: Identifying Mechanisms of Goal-Setting Theory

The positive effects of regular participation in physical activity have been well--documented and include decreased risks of breast cancer, coronary heart disease, high blood pressure, hypertension, and obesity (Nelson et al., 2007; Penedo & Dahn, 2005). In 2008, the U.S. Department of Health and Human Services (USDHHS) released a national guideline for physical activity, the *Physical Activity Guidelines for Americans*. These guidelines state that adults should participate in moderate-intensity aerobic activities for at least 150 minutes per week or vigorous-intensity activities for at least 75 minutes per week in conjunction with muscle-strengthening activities on two or more days per week (USDHHS, 2008). Although the importance of physical activity has been emphasized and despite the recommendations, most people in the U.S. remain sedentary or do not meet the recommended levels of daily physical activity (Crespo et al., 1996; Ham et al., 2005). A recent study by Carlson and colleagues (2010) surveyed the rate at which U.S. adults meet the 2008 guidelines. Their results indicated that only 18.2 % of U.S. adults met the criteria for both muscle strengthening and aerobic activities using the 2008 guidelines.

Research has shown that walking is the most common type of physical activity for U.S. adults including individuals with disabilities (Eyler et al., 2003; Raferty et al., 2002; Siegel et al., 1995; Stanish & Draheim, 2005; Weikert et al., 2011). Due to the popularity of walking, the promotion of walking as a physical activity can be effective. Step count using pedometers has often been used for promoting physical activity, specifically using the goal of "10, 000 steps a day". The slogan "10,000 daily steps"

has been suggested as a strategy to promote increased levels of physical activity (Hatano, 1993; Sidman et al., 2003; Wilde et al., 2001). While this step count has been widely promoted, the literature indicates that 10,000 daily steps are not typically achieved (Choi et al., 2007a; Hatano, 1993; Schneider et al., 2006; Sidman et al., 2003; Wilde et al., 2001). For example, Schneider and colleagues (2006) showed that only one third of participants could complete 10,000 daily steps. In addition, some researchers suggested that 10,000 steps may not be appropriate for certain individuals, such as older, obese adults and people with disabilities (Schneider et al., 2006; Tudor-Locke & Bassett, 2004; Tudor-Locke et al., 2011; Wilde et al., 2001). From those findings, some researchers recommend that those individuals should set a goal less than 10,000 steps per day. This suggestion, however, directly contradicts the theory of goal setting.

Goal-setting theory is a framework that shows how goals are closely related to performance and behavior (Locke & Latham, 2002). A goal is defined as an "object, aim or endpoint of an action, or what an individual describes as an accomplishment being sought" (Bar-Eli, et al, 1997, p. 125). Goals are immediate regulators of human action, and individuals are self-motivated by the goal they want to achieve (Locke & Latham, 1990; Weinberg, 1994). The main premise of goal-setting theory is that specific and difficult goals lead to a higher performance than easy goals, do-your-best goals, or no goals at all (Locke & Latham, 1985; 1990; 2002). While the positive effects of specific and difficult goals have been shown in organization/laboratory settings, there is limited evidence of the effects of goal-setting in physical activity

settings (Kyllo & Landers, 1995; Locke & Latham, 1991; 2002; Smith et al., 1996; Weinberg et al., 1987; Weinberg et al., 1994). In addition, there is little attention paid to the effects of different degrees of specific and difficult step count goals in pedometer-based interventions.

The effectiveness of goal setting is not be solely explained by the difficulty levels of goals. Previous literature suggests that goal-setting effects may not be warranted when not accompanied by additional variables such as goal commitment and self-efficacy (Hollenbeck & Klein, 1987; Locke et al., 1988; Locke & Latham, 2002). Goal commitment is defined as "the determination to try for a goal" (Hollenbeck & Klein, 1987, p. 212). When goals are difficult, high levels of goal commitment are necessary in order to put forth sufficient effort toward goal achievement (Donovan & Radosevich, 1998). However, most previous goal-setting studies in physical activity settings overlook the measurement of goal commitment despite the importance of goal commitment to goal-setting theory having been suggested (Hollenbeck & Klein, 1987; Locke, 1991).

Effective physical activity interventions should be theory based (Brug, Oenema, & Ferreira, 2005; King et al., 2002; Rhodes & Nigg, 2011). Rhodes and Nigg (2011) reported that employing theory-based interventions allows researchers and practitioners to better understand physical activity behaviors and to guide the development of effective interventions. While the use of pedometry in goal setting has often been used for physical activity promotion, the effectiveness of different degrees of specific and difficult step count goals in pedometer-based interventions has not

been fully examined. In addition, to my knowledge, previous interventions have not measured goal commitment nor have they examined the role of goal commitment on performance. Therefore, the overall purpose of the current study was to identify the specific mechanisms of goal setting for the promotion of physical activity.

Research Purposes and Hypotheses for Manuscript 1

Purpose:

1. To examine the effects of different goal settings on physical activity promotion.
   Hypothesis 1: There are significant differences between different degrees of goals on daily step counts.
2. To examine the effects of different goal settings on goal achievement.
   Hypothesis 2: There are significant differences on the rates of goal achievement between different degrees of goals.

Research Purpose for Manuscript 2

Purpose:

1. To examine the effects of goal commitment on physical activity promotion.
   Hypothesis 1: Goal commitment is a moderator of the relationship between goal and daily step count.
   Hypothesis 2: Goal and goal commitment independently influence the increase in daily step count.

Assumptions

The following assumptions were made:

1. Pedometer step counts were representative of physical activity levels.
2. All participants wore pedometers as instructed.
3. Three days was a sufficient time to reduce reactivity.
4. All participants answered truthfully to the surveys.

Limitations

1. Non-ambulatory activities (i.e., lifting weight) and exercise machines (i.e., elliptical machines) were not accurately assessed as physical activity.

Delimitations

1. Participants were recruited from small cities in a Pacific Northwest State.
2. Participants were independently ambulatory and between 40 and 65 years of age.
3. The Omron HJ-720 ITC pedometer was used to measure participants' physical activity levels.
4. The Klein et al. (2001) goal commitment survey was used to measure participants' level of goal commitment to their assigned goals.
5. For estimating the levels of physical activity during both baseline and the goal-setting week, a minimum of five days with at least one weekend but no more than three weekend days) of pedometer data were used.

Operational Definitions

1. Physical activity: The number of steps measured by a pedometer.
2. Theory of goal setting: Performance is influenced by the goals that individuals want to achieve (Locke & Latham, 1985).
3. Goal specificity: Goal levels are quantified (Frost & Mahoney, 1976).
4. Goal difficulty: Goal levels are divided into different degrees of increase over baseline.
5. Goal commitment: A strong will to pursue a goal (Locke et al., 1988).
6. Reactivity: A change in physical activity because of wearing a pedometer (Matevey et al., 2006).
7. Mediator: "Variable that specifies how the association occurs between an independent variable and an outcome variable" (Bennett, 2000, p. 416).
8. Moderator: "An independent variable that affects the strength and/or direction of the association between another independent variable and an outcome variable" (Bennett, 2000, p. 416).

Chapter 2. Manuscript 1

Increasing Physical Activity Using a Pedometer: The Effects of Different Goal Settings

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Abstract

The purpose of this study was to examine the effects of different degrees of specific and difficult step goals on increasing physical activity using a pedometer. A total of 96 middle-aged adults (22 male and 74 female) were instructed to wear a pedometer for seven days to establish a baseline step-count. Participants were then randomly assigned into five different step goal groups: easy, difficult, improbable, do-your-best, and no goal. Each participant was asked to reach the assigned goal for the next seven days. A 2 x 5 (time by group) repeated measures ANOVA revealed significant interaction effects between time and group. Post hoc analyses indicated that the change in step count in the difficult and improbable goal groups were significantly greater than the remaining groups. In addition, there were no significant differences in the number of days of goal achievement among the easy, difficult, and improbable goal groups. The findings in the current study consistently support the effectiveness of specific and difficult goals in goal-setting theory. This study also suggests that the specific and high degree of difficult step goals would be more effective for physical activity promotion in the adult population.

Introduction

Walking is the most common type of physical activity (PA) for American adults including individuals with disabilities (Eyler et al., 2003; Raferty et al., 2002; Siegel et al., 1995; Stanish & Draheim, 2005; Weikert et al., 2011). As the popularity of walking has increased, many studies have used pedometers to promote walking as a form of recommended PA. Many pedometer-based interventions used goal setting as a strategy to increase PA. While the use of the 10,000-step goal has been widely promoted, many participants in previous studies failed to reach this goal (Sidman et al. 2003; Schneider et al., 2006; Wilde et al., 2001). Based on findings in the literature, some researchers suggest that a 10,000-step goal may be too high for certain populations such as sedentary adults (Sidman et al., 2003; Wilde et al., 2001), overweight and obese adults (Schneider et al., 2006), and individuals with disabilities (Tudor-Locke et al., 2011). Moreover, Sidman and colleagues (2003) hypothesized that easy goals are, in general, more appropriate. However, this suggestion might be contradictory to the hypothesis of the goal-setting theory model.

Goal-setting theory is a framework that shows how goals are closely related to performance and behavior (Locke & Latham, 2002). A goal is defined as an "object, aim or endpoint of an action, or what an individual describes as an accomplishment being sought" (Bar-Eli, et al., 1997, p. 125). Goals are immediate regulators of human action, and individuals are self-motivated by the goal they want to achieve (Locke & Latham, 1990; Weinberg, 1994). The main premise of goal-setting theory is that specific and difficult goals lead to higher performance than easy, do-your-best, or no

goals at all (Locke & Latham, 1985; 1990; 2002). While the positive effects of specific and difficult goals were consistently found in organization/laboratory settings, the effectiveness of goal setting in PA settings have not well been supported (Kyllo & Landers, 1995; Locke, 1991; Locke & Latham, 2002; Smith et al., 1996; Weinberg et al., 1987; Weinberg, 1994). For example, Weinberg et al. (1987) found no significant performance differences between participants that received specific and difficult goals and those that had easy goals on a sit-up task.

While goal-setting theory suggests the beneficial effects of specific and difficult goals rather than easy, do-your-best, and no goal, goal setting such as easy, do-your-best, etc, do not have enough evidence to support their use in pedometer-based interventions. Many pedometer-based studies included step goals, but these rarely included varying degrees of goals in terms of their specificity and difficulty including do-your-best and no goal. Rather, those studies often had either a universal type goal, such as 10,000 steps a day or the one absolute step count goal for all participants. For instance, Stovitz et al. (2005) gave all participants an incremental goal of 400 pedometer steps each week. As a result, the effect of goal specificity and difficulty on PA is unknown. Thus, there would be more empirical evidence on the effectiveness of different types of step count goals.

The success of goal-setting should not only be determined by improved performance but also by the achievement of the goals. Previous goal-setting studies often focused on the effects of certain goals by comparing performance between groups. If a goal encourages better performance, but a higher percentage of

participants experience failures while attempting to achieve the goal, then the goal still may not be considered as effective. Bravata et al. (2007) found that 23 pedometer studies used a step goal of 10,000 steps and some other types of step goal. Overall, those 23 studies found more than a 2,000 step increase from baseline. However, the number of participants in two out of the 23 studies only achieved their goals. Thus, it is important to examine goal achievement among different specific and difficult step count goals. Therefore, the purpose of the current study was to examine the effects of different goal settings on PA promotion in adults. In order to test this purpose, two specific hypotheses were examined: (1) specific and difficult step count goals result in greater increases in steps than in groups with easy, improbable, do-your-best and no goals (2) there are significant differences in the rate of goal achievement between goal groups with three different degrees of goal difficulty: easy, difficult, and improbable.

Methods

Participants

A total of 121 middle-aged adults were recruited from the resources the human subjects registry of the Center for Healthy Aging Research at Oregon State University. Participants were also recruited by postings around campus and some local business bulletin boards, and word of mouth. The inclusion criteria for participation were: (a) aged between 40 and 65 years; (b) ambulatory without assistance; and (c) wear a pedometer for seven days for baseline and for another seven days for goal-setting week. Ninety-six participants were included in the analysis of goal setting effects. For

my second purpose, the do-your best and no goal groups were eliminated because they did not have specific goals. Thus, their goal achievements could not be measured. For the second study purpose, 57 participants from the original 96 were included. Subject recruitment procedures are presented in Figure 2.1.

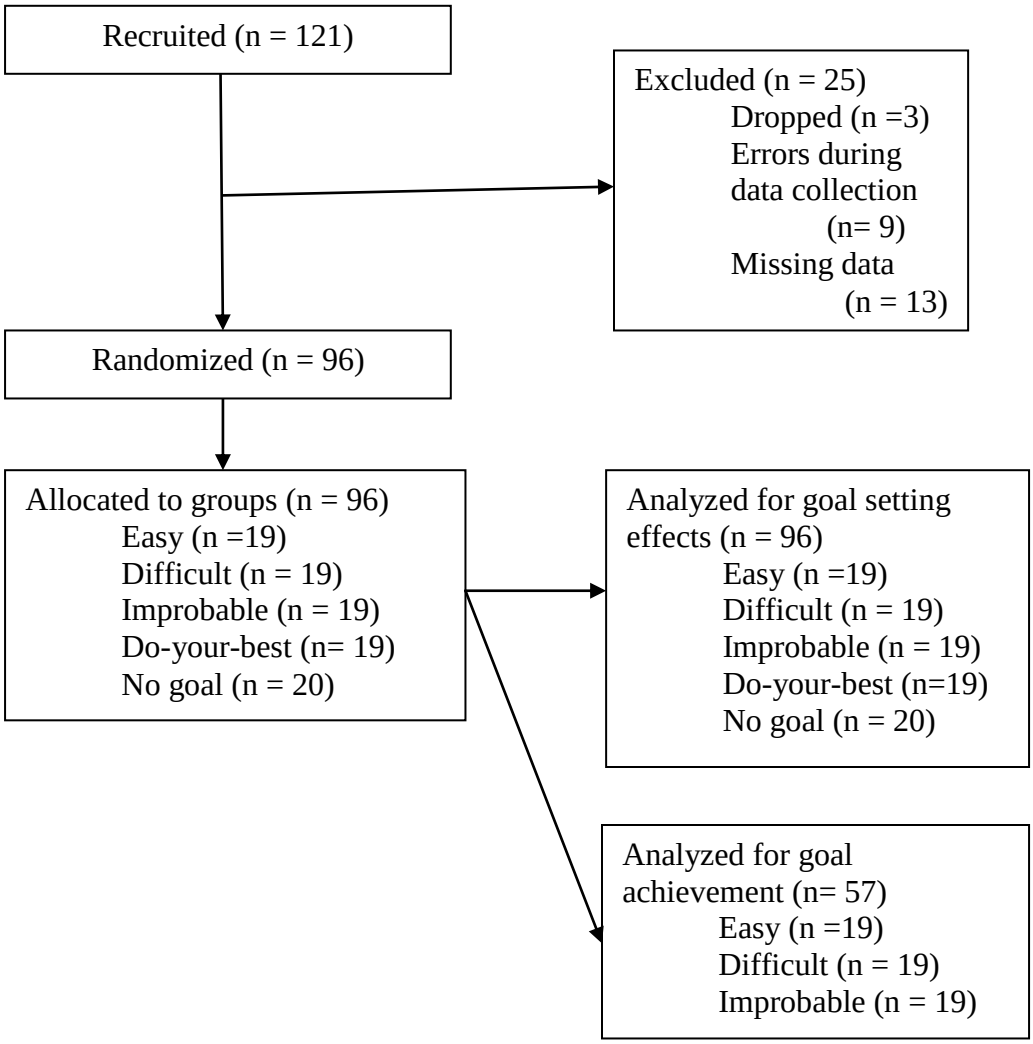


Figure 2.1. Subject recruitment procedures

Participants' demographic information is described in Table 2.1. Written consent was obtained from all participants during the first visit in accordance with Institutional Review Board approval at Oregon State University.

Table 2.1. Participant characteristics (n = 96)

	Age	**Sex (M/F)**	**Height (cm)**	**Weight (kg)**	**BMI**
Easy	54.89±6.30	7/12	169.49±8.69	73.84± 3.28	25.74±4.53
Difficult	54.10±6.17	7/12	168.90±12.58	77.93±20.90	26.97±5.21
Improbable	54.78±6.17	0/19	163.03 ± 5.97	71.12±16.89	26.75±6.23
Do-best	53.42±6.53	3/16	164.13 ± 9.36	82.30±25.31	28.42±9.82
No goal	55.54±5.98	5/15	164.80±9.75	71.96±16.27	26.52±5.95
Mean	**54.54±5.98**		**166.06±9.68**	**75.39±19.03**	**26.88±6.53**

Instruments

The primary outcome in this study was the number of steps taken by each individual, which was measured by the Omron HJ-720 ITC pedometer (Bannockburn, IL, USA). The Omron pedometer is a piezoelectric type and records acceleration at the hip, the same mechanism as accelerometers (Tudor-Locke et al., 2011). The piezoelectric pedometers have been found to be more accurate than spring-levered pedometers especially for obese individuals and individuals with slow walking speeds (Pitchford & Yun, 2010; Tudor-Locke et al., 2011). The accuracy of several locations for pedometer placement has been found; the pedometer in this study was worn on the waistband in line with the middle of the thigh. The unit has a memory that stores

activity data for up to 41 days. In order to check the calibration of the pedometers as recommended by Vincent and Sidman (2003), all pedometers were shake-tested by the researcher and assistants. Pedometers with error rates of 5 % or less were used in the study.

Procedure

A total of three meetings were required to participate in the study. During the first meeting, participants' demographic information was collected. The researcher demonstrated how to attach the pedometer and all participants were instructed to wear the pedometer from the time they woke up until they went to bed (except during water-related activities) for approximately the next ten days beginning the day after the first meeting. Two types of visual reminders (key carabineer & door hanger) to wear the pedometer were offered to participants. Approximately ten days after the first meeting, a second meeting was held. During this meeting, the average step counts from the past seven days were used to establish baseline step-counts. Matevey et al. (2006) suggest that people may change behavior when they wear objective monitoring tools. This phenomenon is called reactivity. The first three days of step-data after the first meeting were excluded in order to control for reactivity. To be included for calculating the baseline, participants had to have at least five week days and two weekend days of pedometer data. Then, participants were randomly assigned into one of five different groups using a permutation of five. Degrees of goal difficulty are

established based on suggestions from the literature (Bar-Eli et al., 1997; Morgan & Pangrazi, 2003; Stovitz et al., 2005). Goal groups were as follows:

Easy goal: A 10 % increase in additional steps from the average step count over the past seven days.

Difficult goal: A 20 % increase in additional steps from the average step count over the past seven days.

Improbable goal: A 40 % increase in additional steps from the average step count over the past seven days.

Do-your-best goal: Participants were asked to increase step counts as much as possible.

No goal: No goal is given

After explaining the assigned goal, participants were asked to wear the pedometer and to reach their assigned goal for the next seven days. Then, another three types of visual reminders (key carabineer, door hanger, and bathroom reminder) were offered to every participant. Approximately seven days after the second visit, the last meeting was held during which the pedometer was collected. Participants were also asked if they had set their own separate goals in addition to the assigned goal. All participants received a gift card in compensation for participation in the study.

Statistical analyses

Descriptive statistics were used to describe the participants' characteristics and average step counts from baseline and after goal-setting by group. To test the main

purpose of the current study A 2 x 5 (time x group) repeated measures analysis of variance (ANOVA) was used to compare average step counts between baseline and after goal setting by different groups. As post-hoc analysis, one-way ANOVA was performed to determine significant differences of change in step counts when an interaction was present. The number of days of goal achievement among easy, difficult, and improbable goal groups was compared using one-way ANOVA. Of a total of 96 participants, 39 were excluded to test the secondary hypothesis for comparing the different rates of goal achievement between easy, difficult, and improbable goal groups. The no goal and do-your-best goal groups were excluded from the testing of the secondary hypothesis, because it was impossible to measure their rates of achievement given that they had no specific goals. All analyses were performed using the SPSS statistical program version 16.0 for Windows (SPSS Inc., Chicago, IL, USA) and the alpha level was set .05.

Results

Participants had an average of 8243 daily steps (*SD* = 3013) during baseline, and 10343 (*SD* = 4151) during the goal-setting week (Table 2.2 and Figures 2.2.). A 2 x 5 (time x group) repeated measures ANOVA indicated that an interaction effect of goal group and time was significant, F (4, 91) = 5.11, $p < 0.01$, partial η^2=0.18. The main effect on time was also significant, F (1, 91) = 97.96, $p < 0.01$, partial η^2=0.52. The interaction between group and time accounted for 18 % of the total variability in the daily step averages. The group-by-time interaction is described in Figure 2.1.

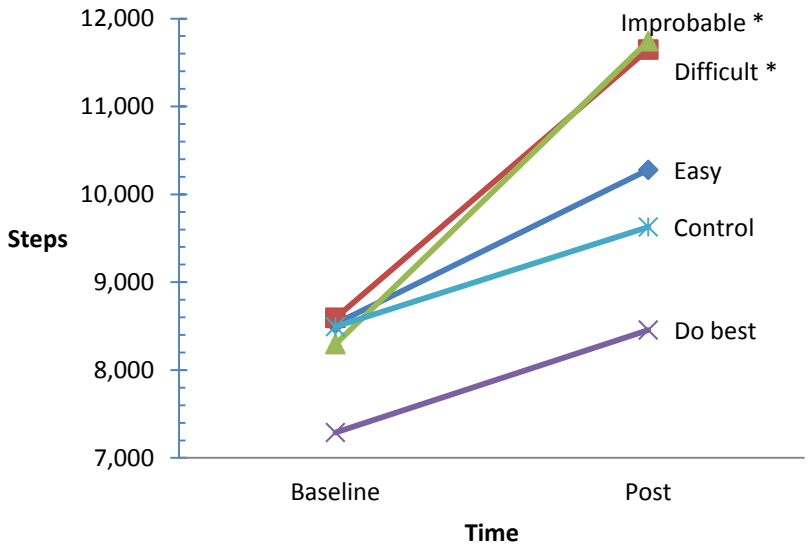
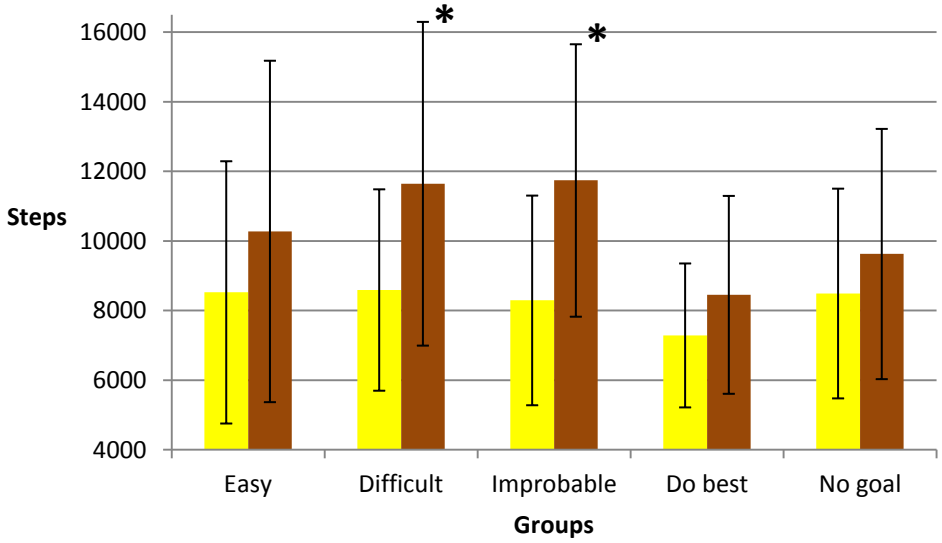


Figure 2.2 Goal-by-time interactions



Note. *p<0.05, yellow bar (light): baseline, and brown bar (dark): post

Figure 2.3 Average steps at baseline and goal-setting week

All participants had an average increase of 2,099 steps (*SD* = 2,262); participants in easy, difficult, improbable, do-your-best, and no goal groups had an average increase of 1,751 steps (*SD* = 1,951); 3,052 steps (*SD* = 2,496); 3,446 steps (*SD* = 1,722); 1,166 steps (*SD* = 2,351); 2,099 steps (*SD* = 2,262), respectively (Table 2.2). Post hoc comparisons using the Tukey HSD revealed that change in steps in both the difficult and improbable goal groups were significantly different from the do-your-best and no goal groups (Figure 2.2). No other significant differences were found between, the easy, do-your-best and no goal groups, but changes in step counts in the easy goal group were the highest compared to the do-your-best and no goal groups.

Table 2.2 Means and standard deviations (SD) in step counts

Group	Baseline	Post	Change in steps
Easy	8,526 ± 3768	10,278 ± 4905	1,751 ± 1951
Difficult	8,595 ± 2893	11,647 ± 4651	3,052 ± 2496*
Improbable	8,296 ± 3012	11,742 ± 3914	3,446 ± 1772*
Do-your-best	7,290 ± 2068	8,456 ± 2842	1,166 ± 2351
No goal	8,494 ± 3188	9,628 ± 3594	1,134 ± 1825
Mean	**8,243 ± 3012**	**10,343 ±4150**	**2,099 ± 2262**

*Note. *: P*<.05

All participants reached their goals in an average of 4.82 days. Participants in the easy, difficult and improbable goal groups reached their goals in an average of

4.84 days (*SD* = 1.77); 5 days (*SD* = 2.02); and 4.64 days (*SD* = 2.24), respectively (Table 2.3). However, results indicated that no significant differences in the rate of goal achievement between easy, difficult, and improbable goal groups were found F (2, 54) = 0.159, $p > .05$ partial $\eta^2=0.006$.

Table 2.3 Means and SD in goal achievement

Group	**Number of days reaching goal**
Easy	4.84 ± 1.77
Difficult	5.00 ± 2.03
Improbable	4.63 ± 2.24
Mean	**4.82 ± 1.99**

Note. $p>.05$

Discussion

The current study was sought to examine the effects of different step goals on PA level in middle-aged adults. Also, the relationship between the rates of achievement in the different degrees of difficulty of the goals examined. To achieve these purposes, it was expected that (a) specific and difficult step goals resulted in higher increases in PA levels than other goal groups; and (b) in terms of the rate of goal achievement, there would be significant differences among easy, difficult, and improbable goal conditions. The findings in the present study demonstrated that the first hypothesis was supported, but the second hypothesis was not supported.

Results in this study showed that there are significant interactions between goal groups and time. These interactions indicate that the effects of goal setting on

performance are not the same for different levels of specific and difficult goals. Participants in both difficult and improbable goal groups had greater step increases than the do-your-best and no goal groups.

The main finding indicates that increases in step counts in both difficult and improbable goal groups are significantly greater than easy, do-your-best, and no goal groups. Even if there were no significant changes in step differences between difficult (3052 steps) and improbable goal groups (3446 steps), higher step change were still found in an improbable goal condition. Even though participants in the improbable goal group anecdotally reported that their goal was perceived as extremely difficult to reach when assigned, a higher performance was still observed in this group. The findings in this study suggest that specific and difficult goals are effective. Moreover, even goals with an improbable degree of difficulty increase PA more so than in groups with goals of moderate difficulty.

In this study, step increases in the easy goal condition were not significantly different from the do-your-best and no goal groups. This finding is in line with the suggestion of Locke (1991) that specific goals should be difficult to assure goal-setting effects. A ten percent increment above baseline was established as an easy goal in the current study because previous literature suggests that a ten percent increase in steps over baseline is realistic and achievable (Morgan et al., 2003; Sugden et al., 2008). Anecdotal evidence in the current study indicates that the level of difficulty for the easy goal condition felt very easy, and was not challenging enough to motivate participants in that group to become more physically active.

In addition, no significant differences in step increments were observed between do-your-best and no goal groups. This finding may be explained by ambiguity of do-your-best goal. Participants in this group anecdotally reported that the goal was perceived as arbitrary. Many do-your-best participants told the researcher that they did not know how much effort they should put forward to meet the goal. Accordingly, participants may not make a maximum effort when a do-your-best goal is given. Another possible explanation may be existence of spontaneous goals. Participants in do-your-best and no goal groups in previous studies often set spontaneous goals even if no specific goals were assigned. For example, Weinberg et al. (1985) found that 83 % of the do-your-best participants set specific goals. In the current study, all the participants were asked if they had set any goals beside the goal that was assigned. Results showed that 68 % of the do-your-best participants and 75 % of the no goal participants set their own specific goals compared to 21, 26, and 42 % of the easy, difficult, and improbable goal participants, respectively. Participants may set specific goals when feedback is given (Locke, 1991). Instant feedback from using a pedometer in the present study may contribute to the findings that both the do-your-best and no goal groups set spontaneous goals.

The study also examined goal achievability in easy, difficult, and improbable goals by comparing the number of days of goal achievement. It was predicted that the rate of goal achievement among these goals would be different. Specifically, the rate of goal achievement in the improbable goal group would be the lower than in the easy and difficult goal groups. Results demonstrated, however, that there were no

significant differences in the number of days of goal achievement among groups. A number of explanations could be accounted for this finding. First, the level of goal difficulty in an improbable condition may not have been unrealistically high for the current study participants. Degrees of goal difficulty in this study were established based upon a review of literature, but those levels of difficulty may not have been perceived as in previous studies.

Second, the task in the current study might be viewed as a more preferable activity for participants. Locke and Latham (2002) suggest that the complexity of a task may also affect goal-setting effects. The main outcome in the current study was of PA level as measured by pedometer step count. A number of previous goal-setting studies examined the effects of goal setting on different types of PA, such as sit-up (Bar-Eli ea al., 1997; Hall & Byrne, 1988; Smith et al., 1996; Weinberg et al., 1991) and grip endurance tasks (Hall et al., 1987). In contrast to previous studies, the current study did not control the mode of PA. Since walking is the most common type of PA among adults, goal-related tasks to walking in the present study might not have been viewed as difficult by the study population.

Lastly, the duration of this study may be relatively short compared to previous studies in the literature. For example, previous goal-setting studies have used five- (Weinberg et al., 1987; Weinberg et al., 1991) and 12-week durations (Sugden et al., 2008). Compared to these studies, a one-week duration might be not enough to examine true goal effects. The current study results suggest that the greater the

difficulty of a goal, even if it is considered as extremely difficult or unattainable, leads to a better performance.

Despite its strengths, the current study has a few limitations. First, participants in the current study may have already been highly motivated to change their behavior. The average step count for participants during baseline was 8,200 steps per day, which is higher than the average for the general adult population (Bassett et al. 2010). Thus, the current study participants may not be truly representative of the adult population. A second limitation was that participants were not blinded. When participants know the purpose of the intervention, they may have a tendency to perform in a certain way because they know what results are expected. That bias may have influenced the study results besides any potential treatment effect.

The most significant findings from the current study consistently support the main premise of goal-setting theory in that specific and difficult goals result in better performance compared to easy, do-your-best and no goal at all. Particularly, the results suggest that the more difficult goals are more effective at increasing PA. Thus, these findings may be important in providing guidance for the design of effective pedometer-based interventions using goal-setting theory. Since the current study only had a one-week long intervention, follow up should be examined whether goal can continue to be achieved in the future studies. Also, the effectiveness of different degrees of specific and difficult goals should be examined in more diverse populations including individuals with disabilities.

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Chapter 3. Manuscript 2

Effects of Goal Commitment on Physical Activity in Adults

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Abstract

The purposes of this study were to examine: (a) the effects of goals and goal commitment on increasing physical activity levels; and (b) whether goal commitment moderates the relationship between goals and increases in physical activity levels. A total of 69 middle-aged adults were asked to wear a pedometer and to maintain their daily routine minimum five days for a baseline assessment of physical activity. Participants were then assigned into groups based on different degrees of specific and difficult walking goals and were asked to reach the assigned goal for the following week. After the goals were assigned, participants' levels of goal commitment to the assigned goals were measured. Results from a multiple regression analysis showed that goal and goal commitment were significant predictors of increasing daily step counts. However, there was no significant interaction between goal commitment and goal on performance. With these findings, this study suggests that goal commitment is an independently important predictor for increasing physical activity in adults.

Introduction

The importance of regular participation in physical activity (PA) has been emphasized both in media and research, but most Americans still do not meet the recommended PA guidelines (Carlson et al., 2010). Lack of PA participation is related with the increasing rate of obesity, which is a significant health concern (Nelson et al., 2007). Research suggests that effective PA interventions should be theory-based (Brug, Oenema, & Ferreira, 2005; King et al., 2002; Rhodes & Nigg, 2011). Rhodes and Nigg (2011) reported that employing theory-based interventions facilitates a better understanding of PA behaviors and helps to guide the development of effective interventions. However, many PA-related interventions do not adopt a theoretical framework. For example, many pedometer-based interventions often incorporate a goal-setting strategy to promote PA, but rarely do they include a specific component of goal-setting theory including the measurement of additional variables (Bravata et al., 2007).

Goal-setting theory is a motivational theory that states that difficult goals motivate individuals to increase performance (Locke & Latham, 2002). While previous literature suggests that an improvement in personal performance relates to the specificity and difficulty of the goal being set, the effectiveness of difficult goals may not be solely explained by the level of difficulty of the goal (Locke & Latham, 2002). Research suggests that additional factors may influence goal-setting effects such as goal commitment (Hollenbeck & Klein, 1987; Kyllo & Landers, 1995; Locke, Latham & Erez, 1988; Locke & Latham, 2002; Locke & Latham, 2006). Goal commitment is

defined as “the determination to try for a goal” (Hollenbeck & Klein, 1987, p. 212) and is considered important for the effectiveness of difficult goals. For example, Locke et al. (1988) stated “it is virtually axiomatic that if there is no commitment to goals, then goal setting does not work” (p. 23). In other words, when the goals are difficult, high levels of goal commitment are necessary in order to put forth sufficient effort toward goal achievement (Donovan & Radosevich, 1998).

The literature proposes goal commitment as a moderator of the relationship between goal and performance, but many previous goal-setting studies in PA settings overlooked the importance of goal commitment (Hollenbeck & Klein, 1987; Locke, 1991). Hollenbeck and Klein (1987) reported that goal commitment was rarely measured and the role of goal commitment in goal-setting research was not discussed. Much of the previous goal-setting research was focused on the effects of goal setting by comparing the performance between goal groups against control groups rather than understanding the mechanisms of the theory.

In addition, there are inconsistent results on the moderating effects of goal commitment to the relationship between goal and performance. For example, Seijts and Latham (2011) found supportive evidence for goal commitment as a moderator of the relationship between learning goal level and performance in undergraduate students. However, Dodd and Anderson (1996) found that goal commitment did not moderate the relationship between a difficult goal and academic performance. With these inconsistent results and lack of attempts to measure goal commitment in

previous goal-setting research, the role of goal commitment as a moderator of goal and goal commitment is unknown.

To identify the role of goal commitment in goal-setting effects, the purposes of the current study were to examine the effects of goal commitment, goals, and moderating effects of the relationship between goal commitment and goals on PA level. The hypotheses of this study were: (a) goals and goal commitment independently influence an increase in daily step count; and (b) goal commitment moderates the relationship between goals and increase the number of daily steps. The proposed framework of the relationship between goal and goal commitment on performance is presented in Figure 3.1.

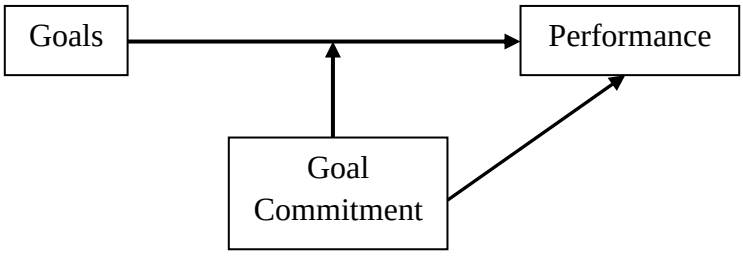

Figure 3.1 A conceptual model of goal, goal commitment and performance

Methods

Participants

Sixty-nine participants (16 male and 53 female) were included in the analysis of this study. Participants were recruited from the resources the human subjects registry of the Center for Healthy Aging Research at Oregon State University.

Participants were also recruited by postings around campus and some local business bulletin boards, and word of mouth. Inclusion criteria for participation included: (a) aged between 40 and 65 years; (b) ambulatory without assistance; and (c) wear a pedometer for at least five days for baseline and at least six days for goal-setting week. To account for the small sample size, only participants that wore a pedometer at least five days for baseline and for at least 6 days for the goal-setting week were included. The demographic information of participants is described in Table 3.1. The study was approved by the Institutional Review Board. Written informed consent was obtained from all participants before the start of data collection.

Table 3.1. Participant characteristics (n = 69)

Characteristic	**Male (n = 16)**	**Female (n = 53)**	**Total (n = 69)**
Age (years)	54.13 ± 6.45	54.38 ± 6.15	54.31 ± 6.17
Height (cm)	179. 40 ± 6.32	162.62 ± 6.03	166.51 ± 9.35
Weight (kg)	87.55± 15.89	72.53 ± 17.50	76.01 ± 18.18
BMI (kg/m^2)	27.15 ± 4.52	27.40 ± 6.30	27.33 ± 5.90

Instruments

Pedometer. The Omron HJ-720 ITC pedometer (Bannockburn, IL, USA) was used to measure PA in this study. This relatively new model is a piezoelectric pedometer (Tudor-Locke et al., 2011) and is more accurate than spring-levered pedometers especially for obese individuals and individuals with slow walking speeds (Pitchford & Yun, 2010; Tudor-Locke et al., 2011). The accuracy of several locations for pedometer placement has been found; the pedometer in this study was worn on the

waistband in line with the middle of the thigh. The unit has a memory that can store activity data for up to 41 days. In order to maintain the accuracy of all pedometers, a shake-test was performed by the researcher and assistants as suggested by Vincent and Sidman (2003). Pedometers with error rates of 5 % or less were used in the study.

Goal commitment. Participants' level of goal commitment to the assigned goal was measured by questionnaires developed by Klein et al. (2001). The items are presented in Table 3.2. This measure has five items with a Likert scale (1 = "strongly agree" to 5 = "strongly disagree"). Higher scores indicate a greater commitment to the goal. A response of "strongly agree" to items 3 and 5 indicates a high commitment level whereas a response of "strongly disagree" indicates a low commitment level. Items 1, 2, and 4 are reverse-scored before statistical analysis. According to Klein et al. (2001), factor loadings for this five-item measure ranged from 0.65 to 0.74. In the current study, the Cronbach alpha reliability coefficient for the five goal commitment items was 0.79.

Table 3.2. Goal commitment items Hollenbeck et al. (2001)

1.	It's hard to take this goal seriously. (R)
2.	Quite frankly, I don't care if I achieve this goal or not. (R)
3.	I am strongly committed to pursuing this goal.
4.	It wouldn't take much to make me abandon this goal. (R)
5.	I think this a good goal to shoot for.

Note. Items followed by (R) means that the item should be reverse-scored.

Procedure

Participants were required to have a total of three meetings. At the first meeting, the researcher met all participants and collected demographic information

including height and weight. The researcher also instructed participants on how to wear the pedometer. Participants were asked to wear the pedometer from the time they woke up until they went to bed (except during water-related activities) for the next ten days beginning the day after the first meeting. Two types of visual reminders (key carabineer & door hanger) for wearing the pedometer were offered to all participants. Approximately ten days after the first meeting, the researcher met with the participants for a second time.

During the second meeting, the baseline step count of each participant was calculated as a mean of the daily step counts for a minimum of five days. In order to control for reactivity, step counts within the first three days after the first meeting were not included in the baseline calculation as suggested by Matevey et al. (2006). Participants were then randomly assigned into selected goal groups with 10, 20, and 40 % increases in their step counts over baseline. After the participants understood their assigned goal, their level of goal commitment was assessed by paper and pencil survey. A minimum of six days after the second visit, the researcher met with the participants for a third time and recorded the number of steps taken during the last six days. To be included in the goal-setting week data, participants had to have at least six days and one weekend day of pedometer wear time.

Statistical analyses

Descriptive statistics were determined for participant characteristics including age, sex, height, weight, BMI, and average step counts at baseline and at the goal-setting week for all groups. Body mass index (BMI) was calculated with the formula

(weight/height^2). To calculate the average daily steps at baseline and post goal setting, participants had to have had at least five days of pedometer data with at least one weekend, but no more than three weekend days to be included in the analyses.

To examine the moderating effects of the associated change in PA level, a multiple regression analysis was used. The dependent variable was change in step count from baseline to the goal-setting week. Independent variables (IVs) included in this analysis were goal, goal commitment, and the interaction between goal and goal commitment. All independent variables were assessed for multicollinearity using correlation coefficients of each pair of variables and the variance inflation factor (VIF). Multicollinearity occurs when the VIF is greater than 10 (Cohen et al., 2003). When one or more of the IVs is highly correlated with the other IVs, it can be problematic because multicollinearity increases the standard errors of the coefficients (Cohen et al., 2003). Through diagnosis of multicollinearity, a very high level of multicollinearity was present (*VIF* = 39.02 for goal, 46.59 for interaction between goal and goal commitment). In order to control for multicollinearity, each predictor (i.e., goal, goal commitment, and interaction) was centered by subtracting it from its mean. After the goal was centered, the multicollinearity issue was resolved (*VIF* = 1. 07 for goal, 1.07 for goal commitment, 1.14 for interaction between centered goal and goal commitment). All analyses were performed using the SPSS statistical program version 16.0 for Windows (SPSS, Inc., Chicago, IL, USA).

Results

The participants had on average 8,107 steps during the baseline period and had on average 10,536 steps during the goal-setting week. Across all groups, the average step goal was 9,948 steps. It is interesting to note that participants exceeded their assigned goal by about 589 steps. The average goal commitment score was 4.20 ± 0.63. Means in step counts are presented in Table 3.3.

Table 3. 3. Average steps across all groups

	Steps
Baseline	8107.30 ± 3055.61
Goal groups	9947.94 ± 3717.03
Post test	10536.14 ± 4331.91
Change in steps	2397.63 ± 2184.11

Multiple regression analysis showed that the three predictor model was significant, (R^2= 0.23, F (3 , 65) = 6.617, $p < .01$) and explained about 23 % of the variance in the improvement of daily steps ($R^2 = 0.23$, Adj $R^2 = 0.20$). In addition, goal ($\beta = 0.40$, $p < 0.01$) and goal commitment ($\beta = 0.23$, $p < 0.01$) significantly predicted change in steps. In this study, the interaction term between goal and goal commitment was not a significant contributor to performance. This indicates that there was no moderating effect of goal commitment on the relationship between goal and performance. Coefficients for IVs are presented in Table 3.4.

Table 3. 4. Coefficients for IVs

IVs	b	beta	t
Goal	0.24	0.40	3.58*
Goal commitment	793.11	0.23	2.04*
Interaction	-0.10	-0.12	-1.03

Note. *p<.05

Discussion

The purposes of the current study were to examine the effects of goal and goal commitment on PA. In addition, this study examined whether goal commitment was a moderator of the relationship between goal and performance. To achieve these purposes, it was expected that (a) goals and goal commitment influence performance, and (b) goal commitment would moderate the relationship between goals and performance. Study results partially supported these hypotheses.

The main findings in this study showed that goals and goal commitment had direct independent effects on increasing daily step counts. These findings can be interpreted in two ways. First, setting a goal is important factor for increasing performance. The literature also suggests that goals influence performance through directive, energizing, persistence, and development functions (Locke & Latham, 2002). Second, goal commitment can be considered as equally important a predictor as are goals for increasing performance. This finding is consistent with previous studies that showed that goal commitment plays a critical role in goal-setting effects (Hollenbeck & Klein, 1987). These two main findings in current study support previous studies in

that goals and goal commitment can be important mediators in contributing to increased performance (Dodd & Anderson, 1996; Theodorakis, 1996).

In contrast to some goal-setting literature (Erez & Zidon, 1984; Hollenbeck & Klein, 1987; Seijts & Latham, 2011), this study did not find the role of goal commitment to be a moderator of performance. A number of explanations could account for the lack of interactive effects of goal commitment. First, the role of goal commitment as a moderator might be less important. For example, a review by Donovan and Radosevich (1998) found that only 3 % of the variance in performance was explained by the moderating effect of goal commitment on goal and performance. Second, findings in the current study may align with previous literature that states that goal commitment should be treated as a mediator instead of a moderator of performance. For instance, Theodorakis (1996) and Dodd and Anderson (1996) found that goal commitment had direct effects on tennis performance. Third, the contradictory finding in this study may have resulted from its small sample size. Larger sample sizes would increase the significance level sufficiently to fully evaluate the moderating effect of goal commitment.

To my knowledge, this study is the first attempt to identify the specific mechanisms of the theoretical framework of goal-setting in a pedometer-based PA intervention by measuring goal commitment. This is of significance because many previous pedometer-based interventions have used goal setting as a strategy, and do not adopt a theoretical framework of goal setting by not measuring additional variables and do not examine the effects of those potential moderators.

A limitation of the current study is that all the participants were informed of the aim of the current study during their first meeting with the researcher. Thus, it is likely that knowing the purpose of the study may have influenced the responses of goal commitment and performance.

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Chapter 4. General Conclusions

The following summary includes: 1) research findings for hypotheses from each manuscript; 2) overall research conclusions from findings of two studies, and future research directions

Hypotheses and Research Findings for Manuscript 1

1. There are significant differences between different degrees of goals on daily step count.

A 2 x 5 (time x group) repeated measures ANOVA yielded that there was significant time by group interaction, $F(4, 91) = 5.11$, $p < 0.01$, partial $\eta^2=0.18$. The main effect of time was also significant, $F(1, 91) = 97.96$, $p < 0.01$, partial $\eta^2=0.51$. Post hoc analysis revealed that change in steps in both difficult goal (3,052 steps, *SD* = 2,496 steps) and improbable goal groups (3,446 steps, *SD* = 1,722 steps) were statistically significantly different from do-the-best and control. No other significant differences were found between, easy (1,751 steps, *SD* = 1,951 steps), do-your-best (1,166 steps, *SD* = 2,351 steps) and control group (2,099 steps, *SD* = 2,262 steps). These results indicate that difficult goals and improbable goals were significantly different from the other goal groups.

2. There are significant differences on the rates of goal achievement between different degrees of goals.

Results from a one-way ANOVA showed that no significant difference on the rate of goal achievement between easy, difficult, and improbable goal group was found $F(2, 56) = 0.16$, $p > 0.05$. Total participants reached their goal an average rate of 4.8 days out of 7 days; participants in easy goal reached their goal an average of 4.8 days (*SD* = 1.7); participants in difficult goal reached their goal an average of 5 days (*SD* = 2.0); and participants in improbable goal reached their goal an average of 4.6 days (*SD* = 2.2). These results indicate that there was no significant difference on the rates of goal achievement between different degrees of goals.

Hypotheses and Research Findings for Manuscript 2

1. Goal commitment is a moderator of the relationship between goal and daily step count.

Results from multiple regression yielded that there was no significant goal and goal commitment interaction ($\beta = -0.12$, $p > 0.05$). Results indicate that there was no moderation effect of goal commitment on the relationship between goal and commitment.

2. Goal and goal commitment independently influence the increase in daily step count.

Multiple regression analysis showed that goal ($\beta = 0.40$, $p < 0.01$) and goal commitment ($\beta = 0.23$, $p < 0.01$) were found as significant predictors for goal-setting effects on increasing step count. These results indicate that goal and goal commitment are important factors of change in daily step count.

Overall Conclusions

The primary findings suggest that higher levels of specificity and difficulty in goals can be effective when setting goals for increasing step counts in middle-aged adults. The results also suggest that goal and goal commitment are important factors of change in physical activity level.

Future Research Directions

Future research is needed to examine whether the effects of different degrees of specific and difficult goals on increasing step counts are different for individuals with disabilities. Another area for future research is to examine the role of additional variables for goal-setting effects on physical activity promotion, such as self-efficacy.

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Appendices

Appendix A: Review of Literature

While the importance of physical activity has been emphasized in numerous health campaigns, most individuals remain sedentary and do not meet recommended levels of daily physical activity. Walking has been reported as the most common type of physical activity, and increasing the number of daily steps has been suggested as a way to meet daily physical activity recommendations (Sidman, Corbin, & Rhea, 2003; Wilde, Sidman, & Corman, 2001). In particular, the "10,000 Steps A Day" slogan has been widely used for physical activity promotion. However, some literature has suggested that the 10,000 step goal may not appropriate for certain individuals. For example, Tudor-Locke and Bassett (2004) proposed that a 10,000 daily step goal is not typical of many regular daily activities and may not be appropriate for some populations, such as older adults and individuals with chronic diseases. Although their suggestion is plausible, it directly contradicts with Goal-Setting Theory. The main premise of the Goal-Setting Theory is that specific and difficult goals lead to higher performance than easy, do-your-best goals, or no goals at all (Lock & Latham, 1985). Currently, there is limited empirical evidence on the effectiveness of goal setting in the physical activity realm. In order to improve the effectiveness of any physical activity promotion program, it is very important to apply sound theory (Rhodes & Nigg, 2011). The purpose of the current review of literature is to provide the background information for how to develop effective physical activity promotion programs using Goal-Setting Theory. For the purposes of organizing, the current review of literature, the following topics will be discussed: (1) physical activity; (2)

walking activity; (3) pedometer; (4) step count goals; (5) goal setting; (6) factors affecting goal setting; and (7) goal setting in exercise/sports.

Physical activity

Physical activity (PA) is defined as "any bodily movement produced by skeletal muscles that result in energy expenditure" (Caspersen, Powell, & Christenson, 1985, p.126). The term exercise which is often used interchangeably with PA (Caspersen et al., 1985; Sigal, Kenny, Wasserman, & Castandeda-Sceppa, 2004). Exerise is defined as "physical activity that is planned, structured, repetitive, and purposive in the sense that improvement or maintenance of one or more components of physical fitness is an objective" (Caspersen et al., 1985, p.128). In addition, Motl, McAuley, and Snook (2007) have reported that leisure-time activities, sport, exercise, occupational work, and household chores can be considered as PA. Thus, the meaning of PA in this review of literature will be used as a broad term that encompasses all of these domains.

In 1995, the Centers for Disease Control and Prevention (CDC) recommended that "every US adult should accumulate 30 minutes or more of moderate-intensity physical activity on most, preferably all, days of the week" (CDC, 1995). This recommendation suggests that moderate-intensity PA can have beneficial health effects. However, a later study conducted by Blair, LaMonte, and Nichaman (2004) argued that 30 minutes of daily activities were not sufficient for those who want to

prevent weight gain. In order to prevent weight gain based on the Blair et al (2004) findings, additional activities should be performed.

In 2007, Haskell et al.(2007) released the updated PA recommendation for adults. These recommendations stated that every adult should have a combination of moderate-intensity PA including muscle-strengthening activities. According to these recommendations, even brief 10-minute bouts of PA can be counted toward the 30-minute goal. Later recommendations made by the Healthy People 2010 (HP 2010) included the accumulation of at least 30 minutes of moderate-intensity activities per day for five or more days per week (Carlson et al., 2010). More recently, the United States Department of Health and Human Services (USDHHS) released the 2008 Physical Activity Guidelines for Americans. These guidelines do not emphasize a minimum frequency requirement as long as PA occurs for at least 10 minutes per bout (USDHHS, 2008). The 2008 guidelines recommend that adults should have moderate-intensity aerobic activity for at least 150 minutes per week, vigorous-intensity activity for at least 75 minutes per week, or any combination of moderate to vigorous PA (USDHHS, 2008). In addition to aerobic activity recommendations, the 2008 guidelines suggest performing muscle-strengthening activities on two or more days per week.

The beneficial physical and psychological effects of regular PA are well documented For example, regular and moderate PA has been shown to decrease the risk of cardiovascular disease, coronary artery disease, hypertension, obesity, colon cancer, breast cancer, and type II diabetes mellitus (Nelson et al., 2007; Penedo &

Dahn, 2005). Schoenborn and Stommel (2011) compared the mortality risk rates of U.S. adults who met the 2008 guidelines to adults who did not. Their results suggest that meeting the recommended amount of PA contributed to decreasing the risk of all-cause mortality risks.

Research has shown the beneficial effects of PA for people with disabilities. For example, White and colleagues (2004) found that an eight week of strength training improved power in the lower extremities in adults with multiple sclerosis (MS). In addition, further evidence suggests that MS symptoms could be positively managed with regular PA. McCullagh et al. (2008) found that the fatigue level in individuals with MS significantly decreased after aerobic exercise. In addition to the potential physical health benefits, PA has also been shown to be beneficial for mental health (Penedo & Dahn, 2005). For instance, Tyson et al. (2010) found that university students who engaged in high levels of PA had significantly lower anxiety and depression than students who were less physically active. Regular PA has also been proposed to be positively associated with quality of life (McCullagh et al., 2008; Petajan et al., 1996).

Despite the well-known beneficial effects of PA, many individuals in the US do not meet the PA recommendations. For example, USDHHS (1996) reported that only 15 % of American adult women met the recommended levels of PA. Both Crespo et al. (1996) and Ham et al. (2005) have examined the prevalence of US adults reporting no Leisure-Time PA (LTPA). Crespo et al. (1996) interviewed 9488 adults who were 20 years or older and found that 22 % of them reported not engaging in any

LTPA. Women had higher rate (27 %) of no LTPA than in men (17 %). More recently, Ham et al. (2005) found that 23.7 % of their study participants had no LTPA.

Recently, Carlson and colleagues (2010) examined the prevalence of US adults that meet the 2008 PA Guidelines. Their results revealed that only 18.2 % of U.S. adults met both the aerobic and muscles strengthening recommendations However, 43.5 % of U.S. adults were found as active to meet the aerobic guidelines only. The higher PA levels found in the Carlson et al. (2010) study could be explained the use of different PA guidelines. The PA recommendations from CDC/ACSM and HP 2010 cite a specific duration of daily activities and a minimum frequency per week. However, the 2008 Guidelines do not include a minimum requirement of duration or frequency. PA levels reported in a Carlson et al. (2010) study is likely due to difference in recommendations and their interpretations and not to an actual increase of PA level (Schoenborn & Stommel, 2011).

Individuals with disabilities are generally known to be sedentary (Motl et al., 2005; Stanish & Draheim, 2005). The empirical evidence for low PA rates for individuals with disabilities have demonstrated in several previous studies. For example, Rimmer et al. (1999) surveyed the PA patterns of African American women with physical disabilities (n = 50). Their results showed that only 8.2 % involved in any LTPA. Using accelerometry to measure PA, NG and Kent-Braun (1997) compared the PA levels between individuals with MS (n = 17) and a control group (n = 15). The results showed that the MS group had lower activity level than the control group. Marie et al. (2009) also found that 75 % or higher percentages of the

participants with MS reported being inactive or doing light intensity PA during their leisure time, occupational, and household activities. Also, less than 25 % of the participants with MS reported that they engaged in moderate or heavy intensity leisure time, occupational, and household PA (n = 8983).

Walking activity

Walking is often reported as the most common and the preferred type of PA in many different populations (Clemes, O'Connell, Rogan, & Griffiths, 2010; Stanish & Draheim, 2005; Siegel, Brackbill, and Heath al., 1995; Weikert et al., 2011). For example, Siegel et al. (1995) examined the prevalence of walking as a form of PA from the results of the Behavioral Risk Factor Surveillance System (n = 81,557). About one third of the total adult participants reported that they walked for exercise during the past month. Walking was also found as common activity for people with disabilities (Motl, Snook, & McAuley, 2005; Stanish & Draheim, 2005). For instance, Weikert et al. (2011) surveyed the most common types of PA among people with MS (n = 272). Results indicated that 79 % of the participants reported walking as a frequent type of PA in the previous year.

Empirical evidence has supported that walking is associated with many health benefits (Chan, Ryan, & Tudor-Locke, 2004; Iwane et al., 2000; Shneider et al., 2006). For example, Iwane et al. (2000) examined the effects of walking in patients with mild hypertension. After 12 week of intervention, the results showed that walking contributed to lower blood pressure, sympathetic nerve activity, and maximal oxygen intake. In a different 12-week walking promotion conducted by Chan, et al. (2004), the

results showed increased resting heart rate and decreased waist girth. Schneider and his colleagues (2006) found positive effects of walking intervention in thirty-six overweight/obese adults: reduction in body weight, percentage body fat, and hip/waist circumference.

Pedometer

Since walking is quantified in step counts, pedometers have often been used to measure walking activity. Pedometers are relatively simple, inexpensive, and objective tools to measure ambulatory activities (Bassett, Wyatt, Thompson, Peters, & Hill, 2010; Croteau, 2004; Tudor-Locke et al., 2011). Due to these advantageous features, pedometers are considered as a more practical instrument than other monitors (Tudor-Locke et al., 2011). Two types of pedometers have often been used: spring-levered and piezoelectric. The spring-levered type pedometers are considered as the traditional ones; the spring lever arm moves up and down with each step (Silcott et al, 2011; Tudor-Locke et al., 2011). The piezoelectric pedometer has a horizontal beam and piezoelectric crystal to record acceleration at the hip, and this mechanism is the same as an accelerometer (Silcott et al., 2011). In terms of the accuracy of pedometers, piezoelectric pedometers will only be discussed in this review of literature.

Different versions of the Omron pedometers (model HJ-112, HJ-151, & HJ-720 ITC) are piezoelectric types, and these types of pedometers are found to be more accurate than spring-levered pedometers in obese individuals and individuals with a slower gait (Pitchford & Yun, 2010; Tudor-Locke et al., 2011). Slow walking speed

and pedometer tilt could be the major sources of pedometer measurement error (Pitchford & Yun, 2010). Pitchford and Yun (2010) examined the accuracy of piezoelectric pedometers in adults with Down Syndrome (DS). The results of Pitchford and Yun (2010) indicated that piezoelectric pedometers are more accurate than spring-levered pedometers even with different gait patterns and pedometer tilt. The accuracy of piezoelectric pedometers has been examined in both controlled and free-living conditions (Hasson et al. 2009; Holbrook et al., 2009; Silcott et al., 2011). While the two studies (Hasson et al. 2009; Holbrook et al., 2009) found that the pedometers were accurate in controlled settings, step counts in free-living conditions seemed underestimated in the study that was done by Silcott et al. (2011). The above three studies (Hasson et al., 2009; Holbrook et al., 2009; Silcott et al., 2011) have also examined the validity and reliability of the piezoelectric pedometers in different placements, including shirt pockets, pants pockets, around the neck, midback, and backpacks. While most pedometers are suggested to be worn on a belt or waistband (Tudor-Locke et al., 2011), multiple different locations have been found to be just as reliable for the piezoelectric pedometers: hip, midback, shirt pockets, and neck (Hasson et al. 2009; Holbrook et al., 2009; Silcott et al. 2011). However, pants pockets and backpacks were not suggested locations in two studies (Hasson et al., 2009; Holbrook et al., 2009), but a study done by Silcott (2011) found that pants pockets are reliable locations for individuals with obesity (BMI > 30 $kg.m^{-2}$).

According to Baranowski and de Moor (2000), PA behavior changes day to day. Due to this variability of PA, a number of studies have sought to determine

appropriate days of pedometer monitoring for the estimation of habitual PA. For weekly PA levels in free-living, Tudor-Locke et al (2005) found that three days (including Wednesday, Thursday, and Friday) of pedometer data were enough to have a reliability of 0.80. Sunday, in this study had the lowest steps when compared to all of the other days; as a result, the authors suggested that Sunday was the last predictor to be placed in regression analysis (Tuor-Locke et al., 2005). Similar results regard to a number of pedometer monitoring days was found in a study done by Felton and his colleagues (2006). Felton et al. (201) found that three days (including Sunday) of monitoring were highly (> 90 %) associated with variance of weekly average steps in college adults. Estimating the number of days of pedometer monitoring for one month was also examined. Clemes and Griffiths (2008) found that seven days should be reliable for monthly habitual activity in healthy adults with free-living settings.

The literature proposed that if individuals are aware of observing or examining their level of PA, their usual activity level and pattern might be different. This is called "reactivity." According to Matevey et al (2006), reactivity is "a change in behavior due to being monitored" (p. 2). In addition to the measurement role of pedometers, they have often been used as a self-monitoring tool. Thus, a person's activity level might be changed when wearing a pedometer (Clemes et al., 2008; Matevey et al., 2006). This reactivity issue has been examined with using sealed and unsealed pedometers in adult populations (Clemes, Matchett, & Wane, 2008; Clemes & Parker, 2009; Matevey et al., 2006). While Matevey et al (2006) found no significant differences in average daily step counts between the group with sealed pedometers and

the group with unsealed pedometers, two studies done by Clemes and colleagues (2008; 2009) found that step counts increased in the group wearing the unsealed pedometers. Both studies from Clemes (2008; 2009), however, did not find that wearing the pedometer itself influenced increasing daily step counts. Instead of revealing the specific mechanism for pedometer reactivity, both studies from Clemes and his colleagues (2008 and 2009) suggested that having participants required to keep daily step logs would be of the greatest help in increasing their daily activity levels.

Previous literature consistently supported that pedometers are motivational tools for increasing PA (Baker & Mutrie, 2005; Morgan, Pangrazi, & Beighle, 2003; Pal et al., 2009; Rooney et al.,, 2003; Sidman et al., 2004; Stovitz, VanWormer, Center, & Bremer, 2005). Pedometers provide feedback to show the accuracy and progress of performance (Neubert, 1998) and these can motivate people to increase their PA level. This hypothesis has been tested in many pedometer-based interventions. For example, Stovitz et al (2005) examined the effects of nine-week pedometer intervention. Participants were randomly assigned into either pedometer (n = 50) or control groups (n = 44). The participants in the both groups were asked to increase their daily average step counts by 400 each week. Pedometers were given to the pedometer group, but pedometers were not given to the control group. After nine weeks, participants who completed the intervention in the pedometer group showed a 41 % improvement from baseline (average daily steps from 6,779 ± 4,079 to 8, 855 ± 4, 690). Another study done by Pal and his colleague (2009) examined the effects of the use of pedometers in overweight and obese women (n = 26). After 12 weeks, the

participants in the pedometer group had significant increment of step counts while the control group did not change their PA levels. Based upon these findings, the use of pedometers could be effective for increasing PA levels.

A number of studies examined level of PA by using pedometers in different populations (please see table1). In 2007, Bohannon's meta-analysis (including 43 studies, published between 1983 and 2004, n = 6,199), reported that the average daily step counts for all participants from all studies were 9,448 steps, excluding Amish participants. A reason for an exclusion of Amish participants was that step counts for Amish who were 65 years of age or higher had more than 10,000 daily steps and this many step counts was not representative of a common population. In this study, older adults with a mean age of 65 years or older (n = 1,202) had an average of 6,565 daily steps. In a review done by Tudor-Loke, Washington, and Hart (2009), expected values of daily steps for many different special populations were discussed: heart and vascular diseases (4,684 steps), chronic obstructive lung disease (2,237 steps), diabetes and dialysis (6,342 steps), breast cancer (7,409 steps), neuromuscular disease (5,887 steps), younger people with intellectual disabilities (7,787 steps), and older adults with disabilities (1,214 steps).

Table 1. Average number of steps measured by pedometers in previous studies

Authors	Subjects	Measurement	Steps
Bassett et al (2010)	1,136 adults	Yamax SW	5, 117
Bohannon (2007)	6,199 adults	Yamax, Omron, and etc	9,448
Gosney et al (2007)	196 adults with MS (46.1 ± 9.8)	Yamax SW-200	5,887 ± 3,218
Motl et al (2006)	30 adults with MS (28 females, 2 males, & 42.3 years ±9.5)	Yamax SW-200	7,097 ± 3,931
Peterson et al (2008)	131 adults with mild and moderate intellectual disabilities (ID)	Omron (HJ-700IT)	6,508 ± 3,296
Stanish & Draheim (2005)	103 adults (38 females (39.7 years ± 9.5) and 65 males (35.9 years ± 11.2)), with mild or moderate ID	Yamax SW-500 & SW-700	Highest on Wednesday (9,548 ± 9,865) Lowest on Sunday (5,828 ± 4,598)

Step count goals

Step-count goals have often been used for PA promotion. Particularly, the "10,000 steps a day" slogan was developed in Japan (Hatano, 1993; Tudor-Locke & Bassett, 2004). According to Hatano (1993), 10,000 walking steps can be equivalent to between 300 and 400 kcal/day energy expenditures. It is required to perform 30

minutes of PA to consume these amounts of energy. As noted, 30 minutes of activities was generally treated as the recommended amount of PA. In addition, literature suggested that walking 10,000 daily steps can be considered as one of the alternative ways to meet the daily PA recommendation (Sidman, et al., 2003; Wilde et al., 2001).

Evidence suggested that 10,000 daily steps are not typically achieved in typical activities. For example, all of the study participants in Hatano's study (1993) (n = 401) who were office clerks, school teachers, and housewives, did not walk 10,000 daily average steps. In a study done by Schneider et al (2006), among the 56 participants, only one third of them could complete the 10,000 steps per day during the 36-week study. Another study done by Choi and his colleagues (2007a) examined the feasibility of 10,000 daily steps in a Canadian family which consisted of a father who worked in an office, a mother who worked at home, a 11th-grade son, and an eighth-grade daughter in their real-life setting. The results showed that the average steps were 6,685 steps.

In addition, some researchers suggested that 10,000 steps may be a challenge for certain individuals, such as older, sedentary, and obese adults (Choi et al., 2007b; Schneider et al., 2006; Wilde et al., 2001). Results from Schneider et al (2006) showed that only one third of overweight adults (n = 56) could complete the 10,000 steps per day during the intervention. Wilde et al. (2001) also tested 10,000 steps per day as target for women who were classified as sedentary (n = 32). During four consecutive days, participants were asked to walk 30 minutes for two of four days which were called "walking days," and the other days were called "non-walking days." The results

suggested that a 30-minute walk did not contribute to achieving 10,000 daily steps. Wilde et al. (2001) reported that the participants' low baselines might be a factor as to why many of the participants did not reach their goals. In addition, Burton et al (2008) examined mid-aged (average 52 years) male's (n = 39) reactions to the 10,000-steps message. The results indicated overall reactions were negative because the participants perceived 10,000 steps as being too much for them.

Goal setting

Goal-setting theory is a framework that explains that goals are closely related to performance and behaviors (Lock & Latham, 2002). A goal is defined as an "object, aim or endpoint of an action, or what an individual describes as an accomplishment being sought" (Bar-Eli, Tenenbaum, Pie, Btesh, & Almog, 1997, p. 125). One literature reported that goals are regulators of human action (Locke & Latham, 1990). The assumption of goal setting theory is "cognitions serve to regulate purposeful human behavior" (Miller & McAuley, 1987, p. 103). Thus, goal setting has been used to increase motivation for performance (Weinberg, Bruya, Jackson, & Garland, 1987). The goal-setting theory was developed by Lock and Latham (1985) and was originally inspired by several researchers' ideas that performance is influenced by goals individuals want to achieve. There has been much goal-setting research on organization/laboratory task performance, such as typing, assembling, and loading (Locke & Latham, 1985). The main premise of the goal setting is that specific and difficult goals lead to higher

performance than easy goals, "do-your-best" types of goals, and no goals at all (Lock & Lathm, 1985; 1990; 2006).

The concepts of specific and difficult goals have been discussed in previous studies. Specific goals usually mean quantified instead of vague (Frost & Mahoney, 1976). For example, while losing weight is considered as a general goal, "losing 1 pound per week and 8 pounds over the next two months can be considered as a specific goal (Poag & McAuley, 1992). Specific goals are a necessary element of goal setting effects (Locke & Latham, 1990). Goals should not only be specific but also should be difficult. Many specific goals in previous studies, however, were not considered as difficult and were rather easy (Locke, 1991). If specific goals are considered as too easy to be achieved, the goals may not be effective (Locke, 1991; Shunk, 1991). Locke (1991) also reported that difficult goals should not be too easy and should be set so that no more than 10 % of participants can achieve them. Nevertheless, if goals are extremely difficult, those goals may not be effective either. Weinberg (1994) reported that continuous failures toward goals due to very difficult goals will lead to lower motivation and hinder better performance. Even though operational definitions of degree of difficult goals were not clearly stated, examples of difficult goals could be found in previous studies. In a study done by Bar-Eli et al. (1997), they used the following goal difficulties on muscular endurance performance such as sit-ups: a 10 % of improvement from baseline as "easy goals", a 20 % improvement as "difficult but realistic goals", and a 40 % improvement as "improbable/unattainable goals" (p. 127). Both Morgan et al. (2003) and Stovitz et al.

(2005) suggested that a 10 % step count increase from baseline would be a realistic goal for increasing PA with the use of pedometers.

According to Locke and Latham (2002), there are four mechanisms through which performance is influenced by goals: direction, effort, persistence, and development. First, goals provide direction of attention and action toward performance (Locke & Latham, 1990). Thus, goals help individuals to focus on goal-related tasks and to remove goal-irrelevant tasks (Locke & Latham, 2002). The second mechanism of goals is energizing performance through motivation (Locke & Latham, 2002). Generally, difficult goals lead to higher effort, and more effort results in higher performance (Locke & Latham, 1990). Persistence is the third mechanism and is defined as "effort maintained over time" (Locke & Latham, 1990, p. 90). When individuals have difficult goals, they may have had to maintain their effort for a long period of time until those goals were achieved (Locke & Latham, 1985). The last goal mechanism is strategies development. In order to achieve goals, individuals try to use their knowledge and apply different strategies. In contrast to direction, effort, and persistence, development is considered as a more indirect mechanism (Locke & Latham, 1990).

Factors affecting goal setting

Through review of goal-setting literatures, it can be inferred that goals alone might not be enough for improvement of performance (Locke, 1991; Locke & Latham, 2002; Locke & Latham, 2007). Hollenbeck and Klein (1987) also suggested that goal-setting effects will not be guaranteed if additional variables are not present because

these additional factors moderate the relationship between goal and performance. Locke and Latham (2002) suggested potential moderating variables are goal commitment, self-efficacy, task complexity, and feedback. Goal commitment and self-efficacy will be focused on and described in this review of literature.

Goal commitment: Goal commitment is suggested as one of the important moderators for the effectiveness of goal setting (Hollenbeck & Klein, 1987; Lock, Latham, & Erez, 1988; Theodorakis, 1996). According to Hollenbeck and Klein (1987), goal commitment is defined as "the determination to try for a goal and implies the extension of effort, over time, toward the accomplishment of an original goal and emphasizes an unwillingness to abandon or to lower the original goal" (p. 212). Goal commitment is also interpreted as a strong will to pursue a goal (Locke et al., 1988). In addition, Locke et al. (1988) reported the importance of goal commitment by stating that "it is virtually axiomatic that if there is no commitment to goals, then goal setting does not work" (p. 23). Locke and Latham (2002) reported that goal commitment is especially important when goals are difficult because the effectiveness of difficult goals might depend on the level of commitment. It is hypothesized that individuals with high commitment to difficult goals are likely to put forth more effort and are persistent towards that goal (Hollenbeck & Klein, 1987).

Due to the confusion between the terms of goal commitment and goal acceptance (Locke et al., 1988), it was determined that they needed to be clearly distinguished. For example, goal commitment was interchangeably used with goal

acceptance in an earlier research (Yukl & Latham, 1978) even though both terms have distinct definitions (Hollenbeck & Klein, 1987; Locke et al., 1988). Goal acceptance is a type of commitment and is defined as an "initial agreement with a goal" (Hollenbeck & Klein, 1987, p. 212). Goal acceptance is used as a commitment for assigned goals only. In contrast, goal commitment is used for all cases of goals, such as "assigned", "self-set or participatively set" goals (Locke et al., 1988, p. 24). Accepting goals does not always lead individuals to have a commitment toward their goals (Hollenbeck & Klein, 1987). Thus, commitment to difficult goals has to be differentiated from acceptance of difficult goals (Hollenbeck & Klein, 1987; Theodorakis, 1996).

In terms of measures of commitment, three different ways could be used: direct, indirect, and use of inference (Locke et al., 1988). The first measurement of commitment is a direct way, and it can be asked in a question form. Examples of the questions are: "How committed are you to attaining the goal set?" and "To what degree do you accept the goal set?" (Locke et al., 1988, p. 24). The second measure of commitment is the indirect way. With indirect measure, commitment is assessed by the discrepancy between an assigned goal level and a personal goal level (Locke et al., 1988). Thus, this indirect measure of commitment is used when goals are only assigned. The third measure of commitment is inferring from performance (Locke et al., 1988). It is assumed that individuals with a high commitment level will likely have a higher performance level since there is a close relationship between action and commitment. However, measuring commitment inferred from performance can be reasonable when the goal level and ability have been controlled (Locke et al., 1988;

Locke & Latham, 1990). Some researchers reported that the timing of commitment measures may have different results (Hollenbeck & Klein, 1987). However, one literature suggested that there was no commitment difference found both before and after performance (Locke et al., 1988).

Only a few studies examined the role of commitment to goals until the 1980's and their results were not considered as supportive to goal-setting effects. For example, two studies (Frost & Mahoney, 1976; Yukl & Latham, 1978) have used single-item measures of commitment. However, one research reported that using a single-item instrument of commitment could be one of the methodological errors for those studies which used a single-item measure of commitment (Hollenbeck & Klein, 1987). Erez and Zidon (1984) also found goal acceptance as a moderating effect between the relationships of goal difficulty to performance. As noted, goal acceptance should not be treated the same as goal commitment, the result regarding the relationship in that study was questioned. Results from these earlier studies might not be useful to support the importance of goal commitment.

After that, there were a few more investigations examined as to whether commitment worked as a moderator of goal-setting effects, but they also had inconsistent results. For example, Dodd and Anderson (1996) did not find any moderating effect of commitment on self-set goals on exams given to university students. The results in that study indicated that the goal difficulty level contributed more to performance than the effect of commitment. A review of Donovan and

Radosevich (1998) also found that goal commitment accounted for only three percent of the variance in the relationship between goal and performance. In this review, the different definition of commitment and different measurements of commitment might have contributed to the limited evidence as to the moderating effect of goal commitment.

Self-efficacy: Self-efficacy is also suggested as a moderating variable of the goals-to-performance relationship (Kyllo & Landers, 1995; Locke & Latham, 2002). Self-efficacy is defined as "one's beliefs about how well one can perform a task" (Locke & Latham, 1990, p. 115). Since self-efficacy is not personality or general beliefs, the degree of self-efficacy can be different depending on specific tasks or situations (Strecher et al., 1995). Self-efficacy is one of the factors influencing an individual's choice of activities, effort, and persistence (Strecher et al., 1995). It is hypothesized that individuals with higher self-efficacy put more effort into goal performance (Bandura & Cervone, 1983; Schunk, 1991).

The literature consistently reported that self-efficacy is positively associated with performance (Kyllo & Landers, 1995; Locke & Latham, 1985; Locke & Latham, 1990; Poag & McAuely, 1992; Stretcher et al., 1995; Theodorakis, 1996). A review paper of Strecher et al (1995) found a positive association between self-efficacy and health behavior changes in areas including smoking, weight loss, contraception, alcohol abuse, and exercise. For example, Poag and McAuley (1992) found that exercise efficacy was associated with intensity of exercise, but not with frequency in

female adults (n=76) in local exercise classes. One of reasons why this study done by Poag and McAuley (1992) did not find that efficacy predicted both intensity and frequency of exercise could be explained by the participants' exercise experiences. The results of the above current study gave supporting evidence that goal setting may be more effective for individuals who are not regular exercisers or who are beginners. Theodorakis (1996) examined the effect of goal setting including many variables on tennis performance. Path analysis in the current study indicated that self-efficacy influenced both the personal goal and its performance. Contrary to goal setting, self-efficacy was found as a mediating variable for overcoming barriers for PA in the social cognitive theory (Motl, Dishman, Ward, Saunders, Dowda, Felton, & Fate, 2005).

Goal setting in exercise/sports

Previous literature has attempted to use goal-setting strategies to determine effectiveness in exercise/sport settings (Smith, Hauenstein, & Buchanan, 1996). For example, Hall, Weinberg, and Jackson (1987) examined the effects of difficult, specific goals, and feedback on grip strength in male college students (n = 94). After baseline data was obtained, ninety-four of the participants were randomly assigned to three groups: 40 second improvement over their baseline, 70-second improvement over their baseline, and do-your-best. The results showed that both of the two specific goal groups had significantly greater improvements than the do-your-best group. A

study done by Wanlin et al. (1997) found goal-setting effects in female teenage speed skaters (n = 4). In addition, Annesi (2002) examined the effects of goal setting on adherence rate to a new exercise program. Adult participants were randomly assigned into a goal-setting group (n = 50) and a control group (n = 50). The results showed that the goal group had higher attendance and had fewer dropouts than the control group.

There is evidence that goal effects might differ if goals are assigned or self-set. Goal-setting effects on exercise performance between self-set and assigned goals were tested. Boyce and Wayda (1994) examined the effects of three goal groups (assigned, self-set, and do-your-best as control groups) on the weight- training performance in female university students (n = 252). More than half of the participants had no experience with weight training. The results showed that the assigned goal group demonstrated better performance than the self-set goal group. Also, the results indicated that the performances in the two goal groups (assigned and self-set) were better than the do-your-best group.

While goal setting has been known as an effective strategy, the results of some studies failed to find an association between specific and difficult goals and performance (Miller & McAuley, 1987; Weinberg et al., 1987). For example, Weinberg et al. (1987) examined the relationship between very high goals and performance by performing two experiments. In the first experiment, 30 participants performed sit-ups for a baseline level and were assigned to one of three different goal groups (easy, moderately difficult, and very difficult goal groups). The degrees of the three different goal groups were the following: easy goals: 15 sit-up increment from

baseline, moderately difficult goals: 30 sit-up increment from baseline, and very difficult goals: 45 sit-up increment from baseline. Those three difficulty levels of sit-ups were determined by previous literature. After five-week practices, there were no significant group differences. In the second experiment, the effects of goal specificity were examined. The participants were assigned to an extremely hard, highly improbable, or do-your-best group, and the rest of the procedures were the same as the first experiment. In this study, 40 sit-up increments from baseline was considered as a very hard goal and 50 sit-up increments from baseline was considered as a highly improbable goal. The results in this experiment also showed that there were no performance differences among the goal groups. Findings in that study did not support predicted difficult goal effects. Another study done by Miller and McAuley (1987) examined the effect of goal-setting training on the accuracy of basketball free-throws, perceptions of success, and self-efficacy in college students. The results after a five-week intervention showed that perception of success and self-efficacy were more improved in the goal-training group than in the control group, but the free-throw accuracy was not significantly improved in the goal group. The participants' initial abilities and pretest skill levels could partially be explained for the no-performance improvement.

As noted earlier, while it is hypothesized that difficult goals lead to higher performance, it has been argued that unrealistically difficult goals do not produce better performance (Weinberg, 1994). According to Stretcher et al (1995), goal setting will not work if goals are way beyond a person's ability. However, there was a lack of

empirical support for this argument. For example, Bar-Eli and his colleagues (1997) examined the effects of specific and difficult goals on sit-up performance in high school students. Participants were randomly assigned into several goal conditions (easy goals: a 10 % improvement on their own baseline, difficult/realistic goals: a 20 % improvement, improbable/unattainable goals: 40 % improvement, "a do-your-best", and a control). Results showed that the three specific goal groups had significantly more sit-ups than the two non-specific goal groups. However, all 10 %, 20%, and 40 % improved goal groups had similar improvements.

Inconsistent results of goal-setting effects in sports could be explained by some methodological errors (Locke, 1991; Weinberg, 1994). First, Locke (1991) reported that previous studies had difficulty in maintaining do-your- best conditions (Locke, 1991). Individuals in do-your-best goal groups in the previous studies often set their own specific goals. Second, most of the previous goal research did not measure personal goal levels (Locke, 1991). One such literature reported that personal goal levels compared to assigned goals were highly correlated with performance. Even if the same assigned goals are given, individuals may accept that goal differently: some accept what they are assigned and some reject the goal and set their own personal goals. For example, some individuals may set even higher than assigned goals, and some may set lower ones. Third, specific goals should not only be detailed, but also should be difficult; however, many previous studies failed to make their specific goals difficult (Locke, 1991). According to Locke (1991), specific goals in previous studies in sport settings were not considered as difficult but rather as moderate or easy. Next,

goal commitment has not often been measured in previous literature (Locke et al., 1991). Goal commitment has been reported as an important element for goal effect particularly when goals are difficult (Locke Latham, 2002). However, previous studies have overlooked examining the moderating effects of goal commitment in sport settings (Hollenbeck & Klein, 1987; Klein, Wesson, Alge, Wesson, & Hollenbeck, 1999).

Conclusion

The literature regarding pedometer-based interventions using goal-setting theory demonstrated that there is limited evidence on the effects of difficult goals and the effects of additional variables for goal-setting effects on performance. Therefore, the current review suggests two directions for future research. The first direction is to examine the effects of different degrees of goal setting on PA promotion. I hypothesize that more difficult step count goals would have higher performance than easy and no goals. Also, we need to examine the rate of goal achievement for different degrees of difficult goals. The second direction is to examine the effects of additional factors, such as goal commitment and self-efficacy that influence goal-setting effects on performance. I hypothesize that goal commitment would moderate the relationship between difficult goals and performance.

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Appendix B: Institutional Review Board Approval

Institutional Review Board • Office of Research Integrity
B308 Kerr Administration Building, Corvallis, Oregon 97331-2140
Tel 541-737-8008 | Fax 541-737-3093 | IRB@oregonstate.edu
http://oregonstate.edu/research/ori/humansubjects.htm

NOTIFICATION OF APPROVAL
June 15, 2012

Principal Investigator:	Joonkoo Yun, PhD	Department:	Nutrition Exercise Science
Study Team Members:			
Student Researcher:	Dalhyun Moon		
Study Number:	5239		
Study Title:	The Effects of Different Goal Settings on Physical Activity		
Funding Source:	John C. Erkkila, M.D. Endowment for Health And Human Performance		
Funding Proposal #:			
PI on Grant/Contract:	Joonkoo Yun, PhD		
Submission Type:	Initial Application received 03/08/2012		
Review Category:	Expedited	Category Number:	6, 7
Waiver(s):	None	Number of Participants: *Do not exceed without prior IRB approval*	120
Risk level for children[1]:	N/A		

The above referenced study was reviewed and approved by the OSU Institutional Review Board (IRB).

Approval Date: 06/15/2012
Expiration Date: 06/14/2013

Annual continuing review applications are due at least 30 days prior to expiration date

Documents included in this review:

- ☒ Protocol
- ☒ Consent forms
- ☐ Assent forms
- ☐ Alternative consent
- ☐ Letters of support
- ☒ Recruiting tools
- ☒ Test instruments
- ☐ Attachment A: Radiation
- ☐ Alternative assent
- ☐ Project revision(s)
- ☐ External IRB approvals
- ☐ Translated documents
- ☐ Attachment B: Human materials
- ☒ Grant/contract
- ☐ Other:

Comments:

Principal Investigator responsibilities for fulfilling the requirements of approval:

- All study team members should be kept informed of the status of the research.
- Any changes to the research must be submitted to the IRB for review and approval prior to the activation of the changes. **This includes, but is not limited to, increasing the number of subjects to be enrolled.**
- Reports of unanticipated problems involving risks to participants or others must be submitted to the IRB within three calendar days.
- Only consent forms with a valid approval stamp may be presented to participants.
- Submit a continuing review application or final report to the IRB for review at least four weeks prior to the expiration date. Failure to submit a continuing review application prior to the expiration date will result in termination of the research, discontinuation of enrolled participants, and the submission of a new application to the IRB.

If you have any questions, please contact the IRB Office at IRB@oregonstate.edu or by phone at (541) 737-8008.

[1] Where parental permission is to be obtained, the IRB may find that the permission of one parent is sufficient for research to be conducted under §46.404 or §46.405. Where research is covered by §§46.406 and 46.407 and permission is to be obtained from parents, both parents must give their permission unless one parent is deceased, unknown, incompetent, or not reasonably available, or when only one parent has legal responsibility for the care and custody of the child.

Appendix C: Informed Consent

Movement Studies in Disability
Oregon State University, 203D Women's Building, Corvallis, Oregon 97331
Tel 541-737-2643 | Fax541-737-6914 | jk.yun@oregonstate.edu

CONSENT FORM

Project Title:	The Effects of Different Goal Settings on Physical Activity Promotion
Principal Investigator:	Joonkoo Yun
Student Researcher:	Dal-Hyun Moon
Sponsor:	John C. Erkkila, M.D. Endowment for Health & Human Performance
Version Date:	06/05/2012

1. WHAT IS THE PURPOSE OF THIS FORM?

This form provides you the information you will need to help you decide whether to take part in this study. Please read the form carefully and ask the researcher(s) questions about anything that is not clear.

2. WHY IS THIS STUDY BEING DONE?

The purposes of this study are to examine the effects of different goal groups on physical activity and to examine the effects of goal commitment, goal importance, and self-efficacy on the increasing of physical activity. Often, goal setting has been used for the promotion of physical activity, but many studies on physical activity had inconsistent results. In addition, no previous study has examined how goal commitment, goal importance and self-efficacy affect the relationship between goals and physical activity.

This study will serve as the doctoral dissertation research project for Dal Moon. Up to 120 participants may be invited to take part in this study.

3. WHY ARE YOU BEING INVITED TO TAKE PART IN THIS STUDY?

You are being invited to take part in this study because you are between 18 and 65 years of age and you are able to walk without assistance.

4. WHAT WILL HAPPEN IF YOU TAKE PART IN THIS RESEARCH STUDY?

If you decide to participate in this study,

1. You will be required to meet a researcher three times.
2. Each meeting will take about 10 to 30 minutes.
3. During the first meeting, your height and weight will be measured by a researcher. A researcher will give you instructions about how to wear a pedometer. Then you will be asked to wear the pedometer for the next ten days.
4. After ten days, you will have a second meeting with a researcher to data download the step count data from the past ten days. During this meeting, you will be assigned into one of five different goal groups:

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1) The first goal - 10 % increase in additional steps from past seven days.
2) The second goal - 20 % increase in additional steps from past seven days.
3) The third goal - 40 % increase in additional steps from past seven days.
4) The fourth goal - do your best.
5) The fifth goal - no goal.

You will be asked to reach the assigned goal for the next seven days. If you are in one of the first four groups, you will be asked answer a survey that should take less than 30 minutes to complete.

5. After seven days, you will have the last meeting to return the pedometer and you will be asked to complete a survey.

Storage and Future use of data or samples:

Since the purpose of this project is to gain the knowledge of specific mechanisms of goal setting for increasing daily physical activity, we may want to use some of the data for future use. Future use of information will be limited expanding on studies about the mechanisms of goal setting and developing physical activity interventions. If you agree now to the future use of your data, but decide in the future that you would like to be removed from research database, please contact Joonkoo Yun, Associate Professor, and Movement Studies in Disability Program at (431) 737-8584 or by email at jk.yun@oregonstate.edu.

_____You may store my information for use in future studies.
Initials

_____ You may not store my information for use in future studies.
Initials

5. WHAT ARE THE RISKS AND POSSIBLE DISCOMFORTS OF THIS STUDY?

In this study, some demographic information will be recorded, but a risk of breach of confidentiality is minimal. The security and confidentiality of information sent by email cannot be guaranteed. Information sent by email can be intercepted, corrupted, lost, destroyed, arrive late or in complete, or contain viruses.

The answers you provide will be kept confidential to the extent permitted by law. To help protect your confidentiality, we will use identification numbers and data will be placed in locked filing cabinets in our lab for three years. After three years, the data will be destroyed.

6. WHAT HAPPENS IF YOU ARE INJURED?

Oregon State University has no program to pay for research-related injuries. If you think that you have been injured as a result of being in this study, please contact the study personnel.

7. WHAT ARE THE BENEFITS OF THIS STUDY?

You will not directly benefit from being in this study. However, you may become more aware of your current level of physical activity. In addition, we hope that, in the future, other people

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might benefit from this study because the results from the current study will provide a base for how to develop an effective health promotion program for improving physical activity.

8. WILL YOU BE PAID FOR BEING IN THIS STUDY?

You will be paid for being in this research study. You will receive a $ 25 gift card as compensation for participation.

9. WHO IS PAYING FOR THIS STUDY?

John C. Erkkila, M.D. Endowment for Health & Human Performance is partially paying for this research.

10. WHO WILL SEE THE INFORMATION YOU GIVE?

The information you provide during this research study will be kept confidential to the extent permitted by law. Research records will be stored securely and only researchers will have access to the records. Federal regulatory agencies and the Oregon State University Institutional Review Board (a committee that reviews and approves research studies) may inspect and copy records pertaining to this research. Some of these records could contain information that personally identifies you.

The names of participants recruited from the LIFE registry will be reported back to the Center for Healthy Aging Research, but the center will not have access to any other information collected during this study. All the other information will be stored in a secure location and is only accessible to the PI and the student researcher.

If the results of this project are published your identity will not be made public.

11. WHAT OTHER CHOICES DO YOU HAVE IF YOU DO NOT TAKE PART IN THIS STUDY?

Participation in this study is voluntary. If you decide to participate, you are free to withdraw at any time without penalty. You will not be treated differently if you decide to stop taking part in the study. You are free to skip any questions in the survey that you would rather not answer. If you choose to withdraw from this project before it ends, the researchers may keep information collected about you and this information may be included in study reports.

12. WHO DO YOU CONTACT IF YOU HAVE QUESTIONS?

If you have any questions about this research project, please contact: Dr. Joonkoo Yun at jk.yun@oregonstate.edu or by phone at (541) 737-8584.

If you have questions about your rights or welfare as a participant, please contact the Oregon State University Institutional Review Board (IRB) Office, at (541) 737-8008 or by email at IRB@oregonstate.edu

Movement Studies in Disability
Oregon State University, 203D Women's Building, Corvallis, Oregon 97331
Tel 541-737-2643 | Fax541-737-6914 | jk.yun@oregonstate.edu

13. WHAT DOES YOUR SIGNATURE ON THIS CONSENT FORM MEAN?

Your signature indicates that this study has been explained to you, that your questions have been answered, and that you agree to take part in this study.

Do not sign after the expiration date: 06/14/2013

Participant's Name (printed): _____

_____ _____
(Signature of Participant) (Date)

_____ _____
(Signature of Person Obtaining Consent) (Date)

Appendix D: Forms

Eligibility Screening

I am conducting a research study to measuring the effects of different goal settings on physical activity.

Are you interested in this study?

If you are interested to participate in this study, I would like to ask a few questions to determine eligibility.

1. Are you the age between 18 and 65 years?

   NO: _____

   YES: _____

   ** If no, participant is not eligible, and further screening is not necessary.

2. Are you currently using a walking device?

   NO: _____

   YES: _____

   ** If yes, participant is not eligible, and further screening is not necessary.

If the participant meets the eligibility criteria, the investigator will set up the first meeting.

Demographic Information

1. What is your date of birth? _____ (month/day/year)

   Age:

2. What is your gender?

   Male _____ Female _____

3. What is your height?

   _____inches or (_____cm)

4. What is your weight?

   _____ lbs or (_____ kg)

Did You Set a Personal Goal(s)?

Directions: Please answer the following questions relating to any personal goals you might have set during the past seven days.

Did you set your own separate goal(s) besides the goal that was assigned?	Yes □	No□

If yes, then please indicate what that was:

Do you have any other things you want to share?

Receipt

I, _____ received a $ 25 gift card for participating in this study

(Name)

_____ _____

(Signature of participant) (Date)

Appendix E: An email invitation for participants

Dear LIFE Registry member,

I am sending you this email to ask for your support in my research project. My name is Dal Moon and I am a graduate student in the Exercise Sport Sciences program at Oregon State University. I am conducting a research study to identify the specific mechanisms of goal setting for increasing physical activity. I believe results of this project will provide practitioners and researchers with information for how to develop an effective physical activity intervention.

I am looking for participants who are 40 to 65 years of age and are able to walk without assistance.

This study will require a total of three meetings with a researcher. The each meeting will be last for no more than 30 minutes. The participants will be asked to wear a pedometer for a total of 17 days. You will also be asked to answer a survey and it should take approximately 10 minutes to complete. Upon completion of study, the participants will get a small amount of a gift card.

If you are interested in participating or learning more about this project, please contact Dal Moon (541) 207 - 2683 or by email at moonda@onid.orst.edu) or Joonkoo Yun (541)737-8584 or by email jk.yun@oregonstate.edu.

Thank you for your time,

Dal Moon

Appendix F: Surveys

Oregon State OSU College of Public Health and Human Sciences

Subject ID #: _____

Goal Commitment, Self-Efficacy, and Goal Importance Survey

Thanks for participating in this study. The purpose of this survey is to examine your self-efficacy, commitment, and perceived importance of a given goal. There is no right or wrong answer in this survey. Please mark the most appropriate box. Your responses will help us to understand the contribution of factors for goal-setting effects. This survey consists of three sections. With regard to your step goal, please complete the following questions about your level of commitment, self-efficacy, and importance of goals.

Based on pedometer step counts, you took an average of _____ steps/day.

Your goal for next seven days is _____ steps/day.

Section 1: Goal Commitment:
Direction: Goal commitment is defined as a strong will to pursue a goal. For each question below, please mark the box that represents your level of commitment for the assigned goal.

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
It's hard to take this goal seriously.	☐	☐	☐	☐	☐
Quite frankly, I don't care if I achieve this goal or not.	☐	☐	☐	☐	☐
I am strongly committed to pursuing this goal.	☐	☐	☐	☐	☐
It wouldn't take much to make me abandon this goal.	☐	☐	☐	☐	☐
I think this is a good goal to shoot for.	☐	☐	☐	☐	☐

Section 2: Self-Efficacy:
Direction: Self-efficacy is person's own belief in his/her ability to achieve a goal. For each question below, please mark the box that represents your level of self-confidence for the assigned goal.

I am confident that I can achieve the goal when:	Not confident at all			Somewhat confident			Very confident
I am tired.	☐	☐	☐	☐	☐	☐	☐
I am in a bad mood.	☐	☐	☐	☐	☐	☐	☐
I feel like I don't have the time.	☐	☐	☐	☐	☐	☐	☐
I am on vacation.	☐	☐	☐	☐	☐	☐	☐
The weather is bad.	☐	☐	☐	☐	☐	☐	☐

Section 3: Goal Importance:
Direction: For each question below, please mark the box about importance of your goal.

	Not at all	A little	Moderately	Very	Extremely
How important is this goal to you?	☐	☐	☐	☐	☐
Is this goal a high priority for you?	☐	☐	☐	☐	☐

Thank you for taking the time to complete this survey!

Appendix G: Advertisement

Want to know about your level of physical activity?

The Exercise and Sport Sciences program at Oregon State University is trying to examine the specific mechanisms of goal setting for increasing physical activity.

We are looking for participants who are between 40 and 65 year s of age and who walk without assistance.

If you participate, this study involves the following:

- Meeting three times with a researcher approximately less than 30 minutes for the first two meetings and 10 minutes for the last meeting
- Wearing a pedometer for total of 17 days
- Answering a survey (it should take 10-15minutes to complete)

You will receive a gift card for completion of study.

For additional information about participating in this study, please contact:

Dal Moon
(541) 207- 2683
moonda@onid.orst.edu

Principal Investigator: Joonkoo Yun (jk.yun@oregonstate.edu)

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Dal Moon 541-207-2683 moonda@onid.orst.edu

Appendix H: Reminders




Your goal is
_____ steps

Your goal is
_____ steps

Your goal is
_____ steps

Your goal is
_____ steps

Your goal is
_____ steps

Do Your Best
Today!

Do Your Best
Today!

Do Your Best
Today!

Please
Don't forget

Please
Don't forget

Please
Don't forget

Please
Don't forget


Your goal
_____steps
Oregon State OSU College of Public Health and Human Sciences
Don't Forget
Pedometer!
Oregon State OSU College of Public Health and Human Sciences
Do Your Best
Today !
Oregon State OSU College of Public Health and Human Sciences