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Tara Flubacher

University of Maine - Main, tara.flub@gmail.com

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DEVELOPING DURABLE HEALTH PROMOTION: THE CONNECTIONS
BETWEEN EXERCISE SETTING AND ADHERENCE TO EXERCISE IN COLLEGE-
AGED WOMEN

by

Tara Flubacher

A Thesis Submitted in Partial Fulfillment
of the Requirements for a Degree with Honors
(Kinesiology and Physical Education)

The Honors College

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Advisory Committee:

Lauren Jacobs, Lecturer in Outdoor Leadership, Advisor
Jennifer McNulty, Senior Lecturer in Health and Lifespan
Shannan Fotter, Lecturer of Kinesiology, Physical Education, and Athletic
Training

ABSTRACT

Physical inactivity is a serious issue for many women in the United States, even in the college-population, in addition to both higher rates of physical disease and a greater prevalence of depression and anxiety in women when compared to their male counterparts.¹⁻⁵ Regular exercise has been shown to address these physical and mental health conditions, making it an imperative matter to find ways to increase physical activity in this population. One solution to increase adherence to physical activity is to cultivate intrinsic motivation surrounding exercise by changing the typical exercise setting.^{6,7} The purpose of this study was to determine if college-aged women who primarily exercise outdoors demonstrate more intention to commit to an active lifestyle than women who primarily exercise indoors.

Utilizing a validated, revised EMI-2,⁸ I measured motivational reasons for exercise in an indoor (n=16) and outdoor (n=17) group of female exercisers. No significant difference was found in motivation levels between the indoor and outdoor group for the psychological, interpersonal, and fitness submodels. However, a significant difference was found for the health-related and body-related submodels indicating higher motivations for these regulation types for the indoor group, suggesting that college women who typically exercise indoors may be more extrinsically motivated. Though we could not show that intrinsic motivation is higher in the outdoor group, previous research indicates that intrinsic motivation, and therefore adherence, may be increased by moving exercise to the outdoors.

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INTRODUCTION

While most regions in the United States require that children in school receive some physical and health education,⁹ continued adherence to regular exercise is not carried into adulthood for many Americans. Approximately 1 in 2 adults do not get enough physical activity.¹ Furthermore, this discrepancy is even greater for women with more than 60% of American women not meeting the physical activity recommendation requirements, and a quarter of women not engaging in physical activity at all.² This same pattern of inactivity is seen for the college population, with college females being significantly less active than their male counterparts.⁴ Moreover, research shows that women are actually more at-risk for both physical and mental health conditions that regular physical activity is shown to address, such as cardiovascular disease, metabolic syndrome, and depression and anxiety.^{1,3,5}

According to Self-Determination Theory, intrinsic motivations produce the most effective, long-lasting behavior change.⁶ The same has been observed with adherence to regular exercise. Several studies have shown that high intrinsic motivations for exercise are linked to greater adherence to regular exercise.¹⁰⁻¹² Recent exercise motivation research has highlighted that males are typically demonstrating higher levels of intrinsic motivation surrounding exercise, while oppositely, females are primarily motivated by extrinsic factors.¹³⁻¹⁵ Therefore, to address the higher rates of inactivity in women, it is important to identify pathways that increase intrinsic motivations surrounding exercise for females.

One proposed method of increasing intrinsic motivation is changing the exercise setting. While exercise can take place in a range of different settings, the popular

approach to green exercise has recently been brought to the forefront of exercise psychology.¹⁶ Green exercise, or exercise that occurs outdoors in natural settings, has been shown to sustain physical health, reduce stress and anxiety, and promote mental focus more so than exercise in other setting.¹⁷ In addition to the increased health benefits, green exercisers have demonstrated higher levels of intrinsic motivation with concern to adherence.⁷

A promising approach to decreasing inactivity rates in women is through addressing the way in which we educate and promote exercise. Focusing our health education on green exercise could work to decrease the deficits in intrinsic motivations surrounding exercise for many women. Since female college students are typically newly learning to live on their own and independently manage time and are at a higher risk for inactivity, college females are a suitable group to further investigate on the topic. In this study, exercise motivations were analyzed among an indoor and an outdoor group of female-identifying individuals. Exercise motivations were measured by a validated, revised Exercise Motivations Inventory - 2 (EMI-2).⁸ The purpose of this study was to determine if college-aged women who primarily exercise outdoors demonstrate more intention to commit to an active lifestyle than women who primarily exercise indoors.

LITERATURE REVIEW

Introduction

The benefits of physical activity (PA) are widely known, but adherence to regular exercise into adulthood persists to be a topic of concern. According to the Center for Disease Control and Prevention (CDC), the benefits of participating in PA range from mental and brain health, through improving cognition and reducing the risk of depression and anxiety, to a plethora of physical enhancements.¹⁸ Physical activity helps manage a healthy body weight and reduces the risk of chronic diseases like cardiovascular disease, diabetes 2, metabolic syndrome, and certain cancers. Furthermore, PA strengthens both the bones and muscles, improving quality of life and longevity as we age.¹⁸ The *Physical Activity Guidelines for Americans* states that adults should get 150 minutes of moderate-intensity aerobic physical activity, in addition to at least 2 days of muscle-strengthening activity.¹⁹

Though children are educated about the benefits of physical activity and participate in exercise at school, adherence to autonomous lifelong physical activity into adulthood is insufficient in the United States. Approximately 1 in 2 adults do not get enough physical activity, costing \$117 billion in annual healthcare resources related to low PA.¹ Furthermore, inactivity is seen to increase with increasing age.²⁰ In college students, who often have just recently left the structured PA from physical education or organized sport, it is estimated that over 20% are insufficiently active.⁴ This number has improved from an older meta-analysis from the early 2000s with estimate of 40 to 50% of the college population,²¹ but concern about inactivity in college students, and as they continue to age, is still valid.

In addition to the normal inactivity shown in aging young adults, the long-term impact of the COVID-19 pandemic on PA participation is still unknown. Within the COVID-19 pandemic, young adults were seen to live more sedentary lifestyles and engaged in less exercise, while the prevalence of depression and anxiety increased in this group as well.^{22,23} American children spend years learning about the benefits of PA, yet for a large group of the population, adherence to this behavior pattern and motivation to participate is not carrying into adulthood.

The inactivity rates of American adults are staggering, but the impact is only further concerning for women. More than 60% of American women do not meet the physical activity recommendation requirements, while a quarter of women do not engage in physical activity at all.² Additionally, college females are more likely to live inactive lifestyles than their male counterparts.⁴ In addition to being generally more inactive, women also tend to have higher rates of mental illnesses, such as depression and anxiety, and greater prevalence of multiple chronic conditions.^{3,5} With an abundance of health knowledge, our health promotion education surrounding the importance of exercise for mental and physical health and our compliance to actually participate in exercise as adults is not sufficient, as evidenced by our population's lack of participation in regular exercise and the intertwined impact of inactivity and poor mental well-being. For women, this disparity is even greater.

Therefore, the gap of instilling a durable, self-determined commitment to exercise may be more valuable to the adult women population since they are at a higher risk of inactivity and the health consequences it carries. One possible component of PA promotion that could be targeted for change is exercise setting. Green exercise, exercise

that occurs outdoors in exposure to nature, has shown to sustain physical health, reduce stress and anxiety, and promote mental focus more so than exercise in other settings.¹⁷ Identifying how to make exercise more enjoyable and more intrinsically motivated, especially to women, may increase an individual's intention to commit to lifelong regular exercise. The objective of this literature review is to synthesize current research on the differences in exercise motivations by sex, motivations for exercise adherence, and the impact of exercise setting on exercise benefits, to determine gaps in research on how exercise setting could be used to increase PA adherence in college women.

Exercise Motivation Differences Among Gender

In identifying that women are more at risk for inactivity and both the mental and physical health consequences a sedentary lifestyle brings, understanding whether gender influences motivation to exercise is key. Revealing impactful motivations that drive long-term adherence to exercise that women typically demonstrate, or perhaps typically lack, could help us reform how we encourage and educate about physical activity.

Sáez and colleagues¹³ conducted a study to analyze the motivations of college students for engaging in physical activity and their relationship with gender, amount of sports activity, and satisfaction with sport activity. The study examined 1,099 (45.3% male, 54.7% female) college students at a Mexican university between the ages of 18 and 29 years old. Participants were asked to respond to the Spanish adaptation of the Behavioral Regulation in Exercise Questionnaire-2 (BREQ-2), a questionnaire to examine five subscales of exercise motivation: intrinsic regulation, identified regulation, introjected regulation, external regulation, and demotivation. Participants were also asked

to record how many hours they spent each week on sport, in addition to how satisfied they were with these activities. Sáez and colleagues found significant differences in intrinsic motivations in favor of men. Furthermore, their results indicated that intrinsic regulation could play a significant mediating role such that the weak relationship found between gender and satisfaction was highly mediated by intrinsic motivation.¹³

The finding that men may be more influenced by intrinsic motivation and women by extrinsic factors were repeated in another investigation. Choi and colleagues¹⁴ examined sex differences in physical activity and social cognitive theory factors in Korean college students. Participants were college students who were older than 18 years old, excluding students on sports teams or studying physical education. The final sample consisted of 688 participants, 285 men and 403 women. A self-reported questionnaire was given to participants to report exercise behavior, exercise feelings, and other general characteristics. Male participants were more likely to participate in physical activity and be driven by intrinsic motivators. Significant predictors of physical activity for male participants were physical activity goals, physical activity self-efficacy, and sitting time. For females significant predictors were perceived weight, physical activity goal, physical activity outcome expectations, and sitting time.¹⁴

Similar intrinsic factors for men were once again found in a study performed by Lauderdale and colleagues,¹⁵ but these researchers were able to find an additional connection between motivation and PA adherence. This study aimed to examine gender differences in motivational regulations and PA participation in college aged individuals. The 96 participants consisted of 33 males and 63 females between the ages of 18 and 24 years old at a large university in Tennessee. Participants were given the BREQ-2.

Participants were also asked to self-report the number of days a week they typically exercise. Male students were found to have significantly higher levels of intrinsic motivation than females, suggesting that males are more engaged in PA due to internal factors, such as benefits received from exercise, stimulation, and enjoyment. Furthermore, variance analysis showed that self-determined motivation is strongly linked to higher PA participation.¹⁵

These three exercise motivation studies¹³⁻¹⁵ all found that males demonstrated higher intrinsic motivation for exercise, while Choi and colleagues¹⁴ found that extrinsic factors were predictors of exercise for females, such as perceived weight, physical activity goal, physical activity outcome expectations, and sitting time. Another study by Portela-Pino and colleagues²⁴ suggests that this decreased motivation for and greater abandonment of exercise in adolescent females may be due to a higher incidence of barriers to exercise, including fatigue, laziness, obligation, and lack of time.²⁴ The extrinsic motivators more typically seen in women are not entirely harmful, however. According to previous motivation research, extrinsic motivation, especially bodily factors, may inform the early stages of exercise adoption, but intrinsic motivation regarding enjoyment is more important for progression and maintenance of the activity.²⁵ Women face a society obsessed with the external appearance of her body, fueling ambition and physical and emotional health consequences.²⁶ It is therefore important that exercise education and promotion targeted towards females works to these diminish barriers, while focusing on intrinsic drives, rather than typical fitness advertising of extrinsic factors towards females, such as weight loss and body size.²⁷

Motivations for Long-Term Exercise Adherence

Between the late 1980s and early 2000s psychologists Deci and Ryan⁶ worked to develop the Self-Determination Theory (SDT) of motivation. SDT is the ideology of human motivation and personality concerning the motivations towards growth tendencies and psychological needs in the absence of external influences. Deci and Ryan expanded the theory to define three innate, universal influences: autonomy, competence, and relatedness, regulated by both intrinsic and extrinsic motivation. Fulfilling one's self-efficacy and self-actualization is more innately done through intrinsic motivation, creating more meaningful outcomes and driving long-term change/adherence.⁶ Therefore, if we can identify that intrinsic motivation may bring about longer lasting exercise motivation, we may be able to cater physical activity promotion with intrinsic guidance, especially for a population that is typically more extrinsically motivated.

Self-Determination Theory has been applied to exercise participation since it was first proposed by Deci and Ryan. Biddle and colleagues¹⁰ used the SDT to investigate the social-psychological variables predicting intentions to be physically active. The researchers study group consisted of 723 Hungarian school children between 12 and 16 years of age. Participants were given a pack of several self-report questionnaires assessing goal orientations, perceived competence, behavioral regulations, and intention. The researchers concluded that the main predictors of intention to exercise were rooted in self-determined forms of behavioral regulation.¹⁰

A later study used similar theories to assess how intrinsic drives may influence adherence to exercise. Wilson and Brookfield¹¹ conducted a study to examine the influence of process vs. outcome goals on motivation and adherence to an exercise class

in a six-week program. Participants were sixty (33 males and 27 females) recreational adult exercisers who volunteered to join a six-week exercise program. Motivations were measured by a 30-item questionnaire, The Intrinsic Motivation Inventory. Adherence was measured by assessing attendance during the six-week exercise program. Participants were assigned to one of three groups, those with no formal goals, process goals (relating to the program they were working on), or outcomes goals. The researchers found that participants in the process goals group showed significantly higher interest/enjoyment and perceived choice, significantly lower pressure/tension, and demonstrated greater adherence than the outcome goal and control groups.¹¹

Changing how exercise is presented to encourage intrinsic motivation in order to achieve greater participation was successfully demonstrated through a recent diabetes intervention trial by Höchsmann and colleagues.¹² This group of researchers conducted a randomized controlled trial to investigate if an interdisciplinary team's smartphone-based behavior change game would be able to motivate inactive individuals with type 2 diabetes for regular use and to increase intrinsic PA motivation. The study occurred over a 24-week period and the study participants included 36 inactive, overweight individuals with type 2 diabetes. The intervention group downloaded the game for regular use, while the control group received a one-time lifestyle counseling session. Intrinsic PA motivation was measured with an abridged version of the Intrinsic Motivation Inventory at the start and end of the 24-week study. Adherence was assessed using the smartphone and game's usage data. Both adherence and intrinsic motivation significantly increased for the intervention group, but intrinsic motivation decreased for the control group. Subscales of interest/enjoyment and perceived competence increased for the intervention

group, in addition to a positive association between time spent on the game and intrinsic motivation scores.¹²

The studies by Höchsmann and colleagues¹² and Wilson and Brookfield¹¹ both demonstrated that increased intrinsic motivation is connected with increased exercise adherence. The game app used by Höchsmann and colleagues shows us that adherence to exercise may be able to be increased by finding ways to encourage intrinsic drives.¹² This relationship was further supported by Biddle and colleagues¹⁰ work that found that self-determined regulations were the main predictors of intention to exercise. While SDT distinguishes intrinsic motivation especially important to maintenance of a behavior, studies have shown that regular exercisers actually have higher intrinsic *and* extrinsic motives than inactive individuals, suggesting that both types of regulations play an important role in regular, lifelong PA participation.^{28,29} This study by Gellar and colleagues²⁸ found that those in the “maintaining” phase of PA participation had the highest reporting for social motives, corroborating SDT founders’ theory that some extrinsic motives, like social motives, actually facilitate intrinsic motivation.^{25,28} Extrinsic motivation is not necessarily harmful to exercise adherence, but physical activity encouragement should attempt to draw on intrinsic motivation in order to make a self-determined change in lifestyle that is more permanent.

Exercise Indoors Versus Outdoors

In addition to motivation direction, exercise setting could also be a component to target change that could encourage greater PA adherence. Green exercise, or any exercise that occurs outdoors in the exposure of nature, has increased in popularity.¹⁶ The

promotion of outdoor exercise suggests that with greater enjoyment comes greater participation. The following studies investigated how mental and physical benefits, in addition to exercise adherence, differ when PA is performed indoors vs. outdoors.

Shin and colleagues³⁰ aimed to identify how the effects of the same exercise activity may differ when performed in a forest as opposed to indoors, in addition to how the effects of meditative and athletic activities differ in the same environment.

Participants, 152 college females between 18 and 25 years old, were randomly assigned a group: athletic walking in the gym (AG), athletic walking in the forest (AF), meditative walking in the gym (MG), and meditative walking in the forest (MF). Subjects in each group walked for 35 minutes, rested for 10 minutes, and repeated this sequence. The researchers assessed demographic characteristics about the participants, anxiety, happiness, and self-esteem with validated questionnaires before and after walking. Psychological aspects were shown to improve more effectively in meditative walking than athletic walking in the same environment. Walking in the forest was seen to increase happiness to a greater degree than walking in the gym at the same pace, with meditative walking in the forest having the greatest effect on happiness.³⁰

Along with happiness, natural environments may improve exercise enjoyment through increased social interaction. Rogerson and colleagues³¹ compared previously reported psychological and social outcomes of indoor versus outdoor exercise, whilst rigorously controlling for exercise mode and intensity. Twenty-four subjects ranging from 18 to 73 years of age participated in the study. Participants completed a baseline assessment, and then paired participants completed 15 minutes of cycling on an ergometer in two conditions, in a natural environment and in a laboratory setting. At

baseline and after exercising in each condition, participants were given a digit span backwards task to measure attention, in addition to self-report questionnaires assessing mood, perceived exertion, and enjoyment and intention of future exercise. Time spent socializing within paired groups was recorded. Rogerson and colleagues found that perceived exertion, intention, and mood showed no statistically significant time by condition interaction. However, participants spent significantly more time socializing in the outdoor condition than the indoor condition. Attention scores were seen to decline in the indoor condition but improve in the outdoor condition. The researchers concluded that improved attention and social interaction during exercise in the outdoor setting may positively influence future exercise intentions.³¹

Bélanger and colleagues³² sought to better define the connection between these perceived benefits during outdoor exercise. The researchers implemented a study to examine if moderate-to-vigorous physical activity (MVPA) mediates or moderates the relationship between outdoor time and positive mental health. This study was conducted on 937 children with a mean age of 10.3 years old. Over approximately six months, participants were asked three times to self-report the amount of time spent outdoors and MVPA. Due to the nature of this study, self-reporting may have been a potential weakness. Mental health was assessed with the Mental Health Continuum-Short Form (MHC-SF) questionnaire. Both MVPA and outdoor time were found to be positive predictors of flourishing mental health. Mediation analysis suggests that MVPA mediates the effect of outdoor time on positive mental health.³²

In addition to affective benefit, other studies included physiological measures. Wang and colleagues¹⁷ investigated the physiological and psychological effects of

walking with different exercise settings and intensities for obese college students. Participants were 77 obese college students between the ages of 18 and 21 years old at a Chinese university. Participants were assigned to one of four groups: fast walking in the park, slow walking in the park, fast walking in the gym, or slow walking in the gym. Physiological indices of stress were measured before and after walking by taking participants' blood pressure and heart rate. To assess psychological measures, the researchers measured attention level with the Symbol Digit Modalities Test, the moods state scale for emotion, and environmental perception was assessed using the semantic differential (SD) scale before and after walking. Wang and colleagues found that exercising in the park setting was more effective at relieving stress and improving attention than in the gym setting.¹⁷

Other research shows that, though the affective benefits prevail outdoors, physical responses to exercise remain relatively similar in either setting. Krinski and colleagues³³ conducted a study to analyze whether environmental settings of exercise impact psychological and physiological responses. Thirty-eight women with obesity participated in the study. Participants were asked to walk for 30 minutes at their own pace in two exercise settings, on a treadmill inside or outdoors. Oxygen uptake, heart rate, ratings of perceived exertion, affect, attentional focus, enjoyment, and future intentions to walk were assessed in both conditions. While physiological responses remained similar in both conditions, the researchers found higher attention, positive affect, lower ratings of perceived exertion in the outdoor condition, with greater enjoyment and higher levels of predicted future intentions to outdoor walking.³³

Though the physical health benefits gained from exercising outdoors rather than indoors conditions appear to be relatively similar,³³ an array of studies support that exercising outdoors may be more impactful for the mental health benefits of exercise, including lowered stress and increased positive emotion.^{17,30,32,33} In addition to an improved mood state, both the studies by Rogerson et al.³¹ and Wang et al.¹⁷ found that attention level improved more so when exercising outdoors versus indoors.^{17,31} Exercising in any environment will bring about the physical enhancements that support health, however, for a population that suffers more frequently from poor mental health, introducing and promoting outdoor physical activity may be especially favorable.

An interesting element of these studies looking at exercising indoors versus outdoors is the differences in the two conditions across each study. The indoor conditions across these studies were relatively similar; an indoor recreational gym on a machine such as a treadmill or ergometer.^{17,31,33} Differently, Shin and colleagues³⁰ utilized an indoor track. Nevertheless, there remained great variability within the outdoor conditions. Only the study by Shin and colleagues³⁰ included a truly green environment minimally impacted by man-made architecture and influences. The outdoor condition in the Rogerson and colleagues³¹ study included a relatively green scene, but the consisted of a grassy artificial field. Wang and colleagues¹⁷ utilized an outdoor space with a cemented pathway in an urban park, while Krinski and colleagues³³ utilized an outdoor track. The type of exercise performed ranged from walking to biking, while the study by Bélanger and colleagues³² did not specify the self-reports of exercise type or the characteristics of the outdoor environment. The exercises performed across these studies also varied

greatly, from placing a stationary bike outside to regular walking on either a treadmill, track, or path.

Green Exercise Setting and Nature Benefits

Regular exercise is good for health in any setting, but being exposed to nature holds unique benefits that may make it a more inviting experience, thus promoting greater participation. Furthermore, exercising outdoors may promote the intrinsic drive research has determined to be more effective at promoting adherence to PA.

Fraser and colleagues⁷ implemented a study to expand knowledge on green exercise by comparing motivational drivers between the different types of outdoor exercise: recreational PA, competitive sport, and outdoor adventure sport. A total of 184 participants were recruited to complete two motivation questionnaires assessing motivation and exercise modality. Six male and female participants were additionally interviewed to achieve a more in-depth view of motivations, attitudes, and perceptions towards green exercise. Extrinsic motivators, like environment, family, and friends, were found to be key factors in beginning and continuing activities. However, intrinsic motivators were shown to be more important in adherence to green exercise. Additionally, enjoyment was seen to be the greatest motivator across all types of green exercise.⁷

Exercise outdoors has also been recorded to be particularly beneficial for females from adolescence to middle life. Hohashi and Kobayashi³⁴ conducted a study to evaluate the effectiveness of forest therapy on stress and relaxation for adolescent girls. Twenty-seven females between 12 to 14 years old participated in the study. Participants were assigned to do activities (walking and viewing landscapes) either in a city or forest

setting. Physiological measurements via salivary amylase samples were taken before, after walking, and after the completion of all activities. Subjective feelings were measured after walking utilizing The Mood Inventory. Hohashi and Kobayashi found that participants experienced a more relaxed mood after walking in the forest, in addition to significantly lower presence of negative moods and higher levels of subjective relaxation levels than in the city.³⁴

Chen and colleagues³⁵ found similar conclusions in a study design with older women. Chen and colleagues aimed to investigate the effects of forest bathing on stress recovery in middle-aged females, a group defined as vulnerable to stress due to the transitional stage of life. Sixteen middle aged women were recruited for a two-day forest therapy field experiment in Taiwan's Aowanda National Forest Recreation Area. Psychological and physiological indicators of stress were measured before and after the experiment. Psychological indices were assessed with two questionnaires: the Profile of Mood States (POMS) and the State-Trait Anxiety Inventory (STAI). Pulse rate, systolic or diastolic blood pressure, and salivary α -amylase were measured for physiological assessments. After the forest visit, negative mood states and anxiety levels were significantly reduced, in addition to improved positive mood states. A significant decrease in systolic blood pressure was found after the intervention.³⁵

Being outdoors with the sunshine and fresh air appears to have significant health benefits, possibly making it one of the most ideal settings for exercise. Studies by Chen and colleagues³⁵ and Hohashi and Kobayashi³⁴ found similar results that outdoor time improved mood and worked to help increase relaxation. While we know from SDT that exercise commitment driven by intrinsic motivation may be more long-lasting, Fraser and

colleagues'⁷ findings that this internal drive is the most prominent regulation for green exercisers is important to helping us find more ways for women to become more encouraged to sustain self-determined, lifelong PA.

On top of the health benefits these studies have agreed upon, spending time outdoors improves health by improving sleep quality, improving vision and slowing the progression of myopia, and helping in vitamin D synthesis.³⁶⁻³⁸ Research from the 1980s suggests that the mood enhancing and stress relieving properties of natural environments may be due to an evolutionary preference for this setting that feels more comforting than urbanized environments.^{39,40} While the forest therapy study by Chen and colleagues³⁵ took place in a reserve deep in the forests of Taiwan, the “forest” in the study by Hohashi and Kobayashi³⁴ was only a small woodland area on the city border. With this degree of variability in forest setting, it is hard to determine whether one’s inherent preference for natural environments is disturbed by distant city noises or sights, and if and how health benefits may be impacted.

Conclusions

This literature review aimed to explore and evaluate research on the differences in exercise motivations by sex, motivations for exercise adherence, and the impact of exercise setting on exercise benefits to better understand how exercise promotion could be improved through changing settings to encourage long-term adherence in women. Women are more at risk for inactivity,² so determining how to increase exercise motivation for this population is paramount. Research has shown that women are typically more extrinsically motivated to exercise when compared to their male

counterparts.¹³⁻¹⁵ From Deci and Ryan's work with Self-Determination Theory, we know that, while extrinsic motivation is also an important component in affective regulation, intrinsic motivation results in greater commitment to an action or change, and the same has been demonstrated with long-term exercise adherence.^{6,25,41} Therefore, it is important to explore how guiding exercise promotion in settings that encourage intrinsic motivation changes adherence to exercise in women. In addition to an abundance of other benefits, spending time outdoors may bring about significant mental health advantages, while exercising in the outdoor setting may increase these benefits more so than the indoor settings.^{7,34,35} Green exercisers have also reported higher levels of intrinsic motivation with concern to adherence.⁷

Among the research investigating the differences between exercise outdoors versus indoors, there seems to be great variability in the actual conditions of the setting, especially so for the outdoor setting. The outdoor condition appears in the studies ranging from a track to a field, all the way to more natural wilderness. The research that supports an innate preference for natural environments is based on evolutionary standards of pre-industrialized settings.^{39,40} Many of the studies examined in this review were performed in urban parks, which offer greenery, but man-made structure and sounds most likely persisted. A study conducted in a more rural environment may better help apply these theories. Additionally, the type of exercise performed in each study varies greatly from walking to the abnormal placement of an ergometer outdoors. Conducting a study that compares motivations gained from performing a self-determined exercise type in each setting may take out any influence that assigning a particular type of exercise might cause.

While these studies compared the benefits of indoor versus outdoor exercise, there were few that compared the types of motivational regulations at play in each condition without encouraging a particular type, intrinsic or extrinsic. Though uncontrollable variables may be more influential, it would be beneficial to research motivations of women exercisers without impeding on either motivation or PA setting, or prescribing exercise at all. This way, the most prominent type of motivation in each indoor and outdoor setting may be revealed in a group of women that already choose to participate in PA. This would not only help health professionals and educators confirm again that intrinsic motivation may be brought about more naturally in the outdoor environment during PA, but the specific type of intrinsic regulation that the women typically experience during self-determined PA. In doing so, this research could improve PA opportunities and education for an at-risk population, ultimately improving health and quality of life outcomes for women.

METHODS

Objective and Hypothesis

The purpose of this study was to determine if college-aged women who primarily exercise outdoors demonstrate more intention to commit to an active lifestyle than women who primarily exercise indoors.

Participants

Participants were 33 female-identifying individuals at the University of Maine in Orono, Maine. Participants were college students between the ages of 18 and 25 years old. Participants in the indoor group were 16 women attending free exercise classes at the University of Maine's recreation center. Participants in the outdoor group were 17 student members attending a weekly meeting of the University of Maine's chapter of the Backcountry Squatters. Backcountry Squatters is a national club for female-identifying individuals that plan and participate in outdoor recreation activities as a group, such as biking, hiking, backpacking, skiing, climbing, and paddling. Participants in each group were given an anonymous paper/pencil survey at the beginning of each survey with an informed consent statement attached. The study and survey materials were approved by the University of Maine's Institutional Review Board in November of 2022.

Experimental Design

This study took place at the University of Maine campus in Orono, Maine during the spring semester of 2023. Female-identifying participants were chosen due to the higher rates of inactivity in women, in addition to higher prevalence of mental and

physical health complications.^{2,3,5} Participants were from one of two groups, the indoor or outdoor group. Participants were given a printed copy of the 33-item revised EMI-2 and supplied with a writing utensil. Informed consent was attached on the first page of the survey. Participants were assured that the survey was anonymous and were asked to not record their names. Participants in both groups completed the survey in 3 to 5 minutes, at which point they were returned to the surveyor.

Participants in the outdoor group were greeted at a weekly meeting of a Backcountry Squatters club. After a brief introduction to the study, the outdoor group was given the survey within their meeting and completed in within 3 to 5 minutes.

Participants in the indoor group were greeted at the end of their exercise class, and any male-identifying individuals or older community members were asked not to participate. Due to small class sizes of the indoor group, surveys were collected from five separate indoor classes on different dates. A minimum of 15 completed surveys was the desired goal from each group. This number of participants was chosen to be a reasonable goal (approximately 60% response rate for a group of 25) and because it would provide enough data for an initial statistical analysis.

This study is a quasi-experimental, static-group comparison.⁴² This pre-experimental design was selected because randomization was not feasible for the practical reason of minimizing intervention in the study group and utilizing a smaller sample size. Since surveys were only completed at one point during the interaction, instrumental bias concerning familiarization with survey items was minimized. One benefit of this design was the ability to observe the influence of motivations without assigning the participant a particular exercise setting or type of exercise. This way, we

could observe innate motivations and differences in women who choose to exercise in a self-determined setting and mode.

Limitations of this study design include a chance of selection bias. Lack of randomization allows for differences at baseline to go undetected, risking an alternative explanation for outcomes in each group. Examples of extraneous variables that could be due to lack of randomization include participants choosing an exercise class when most of their other typical exercise occurs outdoors, or vice versa. Other uncontrollable variables that could have influenced the outcomes of the study was the time of year. Maine winters are cold and wet, and some outdoor physical activities are less accessible during this time of year, possibly influencing some individuals to choose the gym for PA over the harsher outdoor environment.

Assessment

Participants were given a revised version of the Exercise Motivations Inventory - 2 (EMI-2). Markland and Hardy developed the original EMI based on Deci and Ryan's Self-Determination Theory.⁴³ The EMI-2 was developed to assess fitness and health-related subscales, and to include individuals who are not typically active already. The EMI-2 consists of 51 items utilizing a 6-point Likert scale from 0 (with 0 being not true for me and 6 being very true for me). Higher scores indicate higher exercise motivation. Each item is categorized under a theme: affiliation, appearance, challenge, competition, enjoyment, health pressures, ill-health avoidance, nimbleness, positive health, revitalization, social recognition, strength and endurance, stress management, and weight management. Submodels are calculated by calculating the average of 3-4 items based on

a scoring key. Submodels were developed to complete the model by grouping conceptually related components: psychological motives (stress management, revitalization, enjoyment and challenge); interpersonal motives (social recognition, affiliation); health motives (health pressures, ill-health avoidance and positive health); body-related motives (appearance); and fitness motives (strength and endurance, and nimbleness).⁴⁴

A revised version of the EMI-2 (Appendix 1) was validated for use among college students. Kim and Cho⁸ conducted a study to determine if the EMI-2 was suitable for measuring exercise motivations in college students. Participants included 325 college students in a Southern U.S. university. The researchers used the EMI-2 response data to analyze Rating Scale Fit, Differential Item Functioning (DIF), and Item fit. Kim and Cho determined that a five-point Likert scale was more appropriate for college students, allowing for a neutral selection. Additionally, a total of 18 items on the questionnaire were eliminated, validating a revised 33-item inventory for college aged individuals.⁸

Statistical Analysis

Conceptually related questionnaire items were grouped according to the tool's five submodels: psychological, interpersonal, health motives, body-related, and fitness.⁴⁴ Each submodel consists of the average scores of one or more themes (revitalization, enjoyment, etc.) (Appendix B)⁴⁴ Each participants' submodel scores were found for each group by finding the mean of the items that compose each theme of the submodel. The normality of the distribution of each submodel in each group was checked with a Shapiro-Wilk test due to the smaller sample sizes. Since the data was found to be

normally distributed, the response data was then combined to compare motivational scores between the two groups utilizing an independent T-Test for significance. Analysis was done using SPSS.⁴⁵

RESULTS

Figure 1. Descriptive Statistics and Mean Motivational Scores

		Mean				
		Psychological	Interpersonal	Health-Related	Body-Related	Fitness
Indoor	n					
	16	3.62	2.81	4.10	3.45	4.22
Outdoor	17	3.61	3.01	3.58	2.63	3.87

Figure 2. Shapiro-Wilk Test for Normality ($p > 0.05$)

p values		
	Indoor	Outdoor
Psychological	0.114	0.306
Interpersonal	0.710	0.361
Health-Related	0.386	0.348
Body-Related	0.111	0.199
Fitness	0.075	0.180

The response data was checked for the normality of distribution with a Shapiro-Wilk Test due to the small sample sizes of each group. For all submodels of each group, the distribution was found to be normal ($p > 0.05$).

Figure 3. Independent T-Test Results for Significance

	p
Psychological	0.967
Interpersonal	0.470
Health-Related	0.027*
Body-Related	0.028*
Fitness	0.172

Note. * Indicates a significant difference in motivational scores between the groups ($p > 0.05$).

Since the distribution of the data was normal, an independent T test was run for each submodel, psychological, interpersonal, health-related, body-related, and fitness. There were no significant differences in the average motivational scores between the indoor and outdoor groups for the psychological, interpersonal, and fitness submodels. A significant difference ($p = 0.027$) in the health-related submodel was observed in the indoor group, where higher scores indicate higher motivations.⁸ A significant difference ($p = 0.028$) was also found for the body-related submodel, again with higher means observed in indoor group.

DISCUSSION

The purpose of this research was to identify if female college students who typically exercise outdoors demonstrate more intention to commit to regular physical activity than female college students who typically exercise indoors. Previous research demonstrates that exercise habits that are driven more from intrinsic regulations may result in longer, more committed adherence to regular physical activity than extrinsic motivations.^{10,11} This is also supported by the core concepts of Self-Determination Theory.⁶ Finding ways to increase intrinsic motivations surrounding exercise has been successful in increasing adherence.¹² One promising solution to increase intrinsic motivation for exercise in women is moving the exercise setting to the outdoors. Regular green exercisers have shown to have high intrinsic motivation for exercise,⁷ in addition showing significant increased mental health benefits from exercise outdoors when compared to the same exercise indoors.^{17,30,32,33} This is especially a benefit for women, who are reported to have higher prevalence of depression and anxiety.³

Our indoor and outdoor groups were given the freedom to choose both their group and exercise mode. While this choice was done primarily to decrease intervention in a small sample size, this also gave participants the opportunity to demonstrate a more self-determined exercise experience. The indoor group were 16 university college students who chose to attend an indoor exercise class, while the outdoor group consisted of 17 university members of an outdoor recreation club.

Utilizing a revised EMI-2 validated for the college population,⁸ we investigated motivations of each group to identify any differences in intrinsic and extrinsic regulations surrounding exercise. The tool categorizes the components of the psychological and fitness

submodels including themes such as enjoyment, challenge, and skill as intrinsic motives. The creators defined intrinsic motivations as being concerned with competence and interest, with participation being free from pressure and involved with the experience of choice. Extrinsic motivations, that being concerned with the achievement of outcomes extrinsic to participation and driven by tension, pressure, and compulsion to participate were measured by scales of fitness, body-related, health-related, and interpersonal motives. In validating the second version of the EMI, however, the creators did find that some health-related pressures were positive and closely related to intrinsic motivation aspirations such as self-acceptance.^{25,44}

When comparing the motivation scores for the indoor and outdoor group, no significant difference was found for the psychological, interpersonal, and fitness submodels. For the stress management component of the psychological submodel, these results differ from results of the studies by Shin and colleagues³⁰ and Wang and colleagues¹⁷ that found that outdoor exercise is more effective at relieving stress than indoor exercise. It is important to note that these factors may not directly compare, as the psychological submodel was composed of the stress management theme along with other themes of revitalization, enjoyment, and challenge. It was hypothesized that the psychological submodel would show a significant difference with higher motivations in the outdoor group due to flourishing mental health benefits of being and exercising outdoors, but no such difference was found with this study. A study by Weng and Chiang⁴⁶ exploring the psychological benefits on indoor and outdoor leisure activity found similar results that the environment had no significant influence on the reduction of anxiety. Weng and Chiang attributed these results that do not agree with an abundance of previous findings

to the small sample size ($n = 40$) and limited activity options.⁴⁶ This may also be the case for the results of our study due to even smaller sample sizes.

Additionally, our results demonstrate no significant difference in the interpersonal submodel between the indoor and outdoor group, which is different from results by Rogerson and colleagues that demonstrated social time significantly increased in the outdoor exercise setting.³¹ Based on the assumption that participants in each group were regular exercisers in their respective setting, the finding that there were no significant differences in the psychological, interpersonal, and fitness submodels, representing a range of both intrinsic and extrinsic factors, makes sense when compared to previous research that shows active individuals have both higher intrinsic and extrinsic motivations compared to inactive individuals.²⁸

A significant difference in favor of the indoor group was found for the health-related submodel, which is composed of health pressures, positive health, and ill-health avoidance. The health-related submodel is categorized as extrinsic motivation that is important to exercise adoption, but is noted to be somewhat influenced by intrinsic drives towards self-acceptance.⁴⁴ A significant difference with higher motivations in the indoor group was also found for the body-related submodel, composed of the extrinsically regulated appearance theme. Additionally, it is important to note that Self-Determination Theory expands extrinsic motivation on a scale ranging from amotivation to intrinsic motivation, where extrinsic motivation is made up of four subscales in between. Themes of health pressures, positive health, and ill-health would fall on the most intrinsically-motivated extrinsic category, integrated regulation, or self-determined extrinsic motivation.⁴⁷ These findings support previous research that indoor exercisers are more

motivated by extrinsic motivations.⁷ The body-related submodel would be introjected regulation, or nonself-determined extrinsic regulation.⁴⁷

A study by Calogiuri and Elliott⁴⁸ found similar findings when investigating reasons for green exercise when compared to sport and gym-based exercise. While they found that green exercisers participated mostly to experience nature, the sport and gym-based exercisers were motivated more so for physical health and social motives, including body weight and appearance motives. Calogiuri and Elliott also found that another distinguishing motive for green exercisers from sport and gym-goers was convenience, suggesting that easily accessible and well-maintained green leisure areas may increase green exercise that is free and open for use at convenient times.⁴⁸

The finding that the indoor group was more significantly motivated by both body- and health-related regulations than the outdoor group may indicate that college women who typically exercise indoors are more extrinsically motivated. While the study could not demonstrate the college women who typically exercise outdoors are more intrinsically motivated, this could be due to the very small sample size and lack of randomization. Based on previous findings, we know that while both intrinsic and extrinsic motivations play a role in a behavior, intrinsic motivation drives long-term adherence, and we see that outdoor exercisers demonstrate higher intrinsic motivations for exercising.^{6,7,48}

Implications of this study indicate that exercise promotion targeted towards women should include more options for outdoor exercise that may help to increase intrinsic motivation for exercise, and therefore increase participation in regular exercise for the female college population. The CDC reports that people that have access to green environments are generally more active, but less than half of Americans live within a half

mile to a park.⁴⁹ Therefore, it is important for communities to invest in well-maintained outdoor recreation area for community members. Additionally, it may be beneficial for universities to encourage more student-led outdoor recreation groups and advertise outings in the same place/manner as indoor fitness classes, especially for schools within more urban environments. For universities with outdoor trails and paths, it is important for campus to be well-patrolled and offer safety-call points to create a safe and comfortable environment for outdoor female exercisers.

Several limitations may have impacted the results of this study. Due to lack of time and to decrease intervention in the group, lack of randomization and the small size of the sample groups may have influenced the results. Since we did not assign participants to their group, we assumed that participants in each group were regular exercisers and that their typical or preferred method of exercise was in their group setting. This assumption may not have been the case for all participants of each group, especially since during Maine winter many outdoor recreation activities are limited. Additionally, another limitation was lack of available data for the indoor group. Five different exercise classes of different modes at different dates had to be surveyed due to low class attendance. This resulted in the indoor data being collected from a range of exercise type and intensity, from yoga to high intensity interval training. Lastly, with self-reported questionnaires, it is assumed that participants are honest with their responses, but there is a chance that reports over- or under-reported true motivation levels.

CONCLUSION

No significant difference was found in motivation levels between the indoor and outdoor group for the psychological, interpersonal, and fitness submodels. However, a significant difference was found for the health-related and body-related submodels with higher mean motivational scores in the indoor group. Health-related and body-related motivations are categorized as extrinsic regulations, suggesting that college women that typically exercise indoors may have higher extrinsic motivation, and possibly less intention to commit to regular exercise than those who typically exercise outdoors. Self-Determination Theory and previous research applying the theory to exercise adherence suggests that intrinsic motivation drives more committed, long-lasting participation in a behavior, and that outdoor exercise may better cultivate these intrinsic regulations.^{6,7,10-12}

Future research on the topic should continue to investigate participants that choose their own setting and exercise type but identify ways to validate a strong exercise adherence history in their setting. Investigations including larger groups may help to decrease bias in the sample size and data. Additionally, the impact of exercise setting on exercise adherence in other age groups of women should be investigated as exercise adherence tends to decrease with age.²⁰ If solutions such as moving exercise outdoors are identified to help increase regular exercise adherence early into adulthood for women, it is hoped that better mental and physical health outcomes for women will follow.

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APPENDICES

APPENDIX 1: REVISED EMI-2 SURVEY

Revised Exercise Motivations Inventory - 2

On the following pages are a number of statements concerning the reasons people often give when asked why they exercise. Whether you currently exercise regularly or not, please read each statement carefully and indicate, by circling the appropriate number, whether or not each statement is true for you personally, or would be true for you personally if you did exercise. If you do not consider a statement to be true for you at all, circle the '1'. If you think that a statement is very true for you indeed, circle the '5'. If you think that a statement is partly true for you, then circle the '2', '3' or '4', according to how strongly you feel that it reflects why you exercise or might exercise.

Remember, we want to know why you personally choose to exercise or might choose to exercise, not whether you think the statements are good reasons for anybody to exercise.

Personally, I exercise (or might exercise)...	Not at all true for me					Very true for me
1. To avoid ill-health	1	2	3	4	5	
2. To help me look younger	1	2	3	4	5	
3. To show my worth to others	1	2	3	4	5	
4. To give me space to think	1	2	3	4	5	
5. To have a healthy body	1	2	3	4	5	
6. To build up my strength	1	2	3	4	5	

Personally, I exercise (or might exercise)...	Not at all true for me					Very true for me
7. Because I enjoy the feeling of exerting myself	1	2	3	4	5	
8. To spend time with friends	1	2	3	4	5	
9. To give me goals to work towards	1	2	3	4	5	
10. To prevent health problems	1	2	3	4	5	
11. Because I find exercise invigorating	1	2	3	4	5	
12. To have a good body	1	2	3	4	5	
13. To compare my abilities with other peoples'	1	2	3	4	5	
14. Because it helps to reduce tension	1	2	3	4	5	
15. Because I want to maintain good health	1	2	3	4	5	
16. To increase my endurance	1	2	3	4	5	

Personally, I exercise (or might exercise)...	Not at all true for me					Very true for me
	1	2	3	4	5	
17. To give me personal challenges to face	1	2	3	4	5	
18. To recharge my batteries	1	2	3	4	5	
19. To improve my appearance	1	2	3	4	5	
20. To gain recognition for my accomplishments	1	2	3	4	5	
21. To help manage stress	1	2	3	4	5	
22. To feel more healthy	1	2	3	4	5	
23. To get stronger	1	2	3	4	5	
24. For enjoyment of the experience of exercising	1	2	3	4	5	
25. To have fun being active with other people	1	2	3	4	5	
26. To help recover from an illness/injury	1	2	3	4	5	

Personally, I exercise (or might exercise).	Not at all true for me			Very true for me	
27. To stay/become flexible	1	2	3	4	5
28. To look more attractive	1	2	3	4	5
29. To accomplish things that others are incapable of	1	2	3	4	5
30. To release tension	1	2	3	4	5
31. Because I feel at my best when exercising	1	2	3	4	5
32. To make new friends	1	2	3	4	5
33. To measure myself against personal standards	1	2	3	4	5

APPENDIX 2: REVISED EMI-2 SCORING GUIDE

ADJUSTED EMI – 2 SCORING GUIDE

Scale scores are obtained by calculating means of the appropriate items

	SCALE ITEMS
Psychological	
Stress Management	30, 21, 14, 4
Revitalization	11, 18
Enjoyment	31, 24, 7
Challenge	9, 17, 33
Interpersonal	
Social Recognition	29, 20, 13, 3
Affiliation	8, 25, 32
Health Motives	
Health Pressures	26
Ill-Health Avoidance	1, 10
Body-Related	
Appearance	28, 19, 12, 2
Fitness	
Strength & Endurance	23, 16, 6
Nimbleness	27

APPENDIX 3: IRB APPROVAL

APPLICATION COVER PAGE

- **KEEP THIS PAGE AS ONE PAGE – DO NOT CHANGE MARGINS/FONTS!!!!!!!!!!**
- **PLEASE SUBMIT THIS PAGE AS WORD DOCUMENT**

APPLICATION FOR APPROVAL OF RESEARCH WITH HUMAN SUBJECTS Protection of Human Subjects Review Board, 311 Alumni Hall

(Type inside gray areas)

PRINCIPAL INVESTIGATOR: Tara Flubacher EMAIL: tara.flubacher@maine.edu

CO-INVESTIGATOR: EMAIL:

CO-INVESTIGATOR: EMAIL:

FACULTY SPONSOR: Dr. Lauren Jacobs EMAIL: lauren.jacobs@maine.edu

(Required if PI is a student):

TITLE OF PROJECT: Developing Durable Health Promotion: The Connections Between Exercise Setting and Adherence to Exercise in College-Aged Women

START DATE: 01/01/2023 PI DEPARTMENT: Honors College, Kinesiology & Physical Education

STATUS OF PI: FACULTY/STAFF/GRADUATE/UNDERGRADUATE U (F,S,G,U)

If PI is a student, is this research to be performed:

- | | | | |
|-------------------------------------|--|--------------------------|------------------------|
| <input checked="" type="checkbox"/> | for an honors thesis/senior thesis/capstone? | <input type="checkbox"/> | for a master's thesis? |
| <input type="checkbox"/> | for a doctoral dissertation? | <input type="checkbox"/> | for a course project? |
| <input type="checkbox"/> | other (specify) | | |

Submitting the application indicates the principal investigator's agreement to abide by the responsibilities outlined in [Section I.E. of the Policies and Procedures for the Protection of Human Subjects](#).

Faculty Sponsors are responsible for oversight of research conducted by their students. The Faculty Sponsor ensures that he/she has read the application and that the conduct of such research will be in accordance with the University of Maine's Policies and Procedures for the Protection of Human Subjects of Research. **REMINDER:** if the principal investigator is an undergraduate student, the Faculty Sponsor MUST submit the application to the IRB.

Email this cover page and complete application to umric@maine.edu.

FOR IRB USE ONLY Application # 2022-11-08 Review (F/E): E Expedited Category:
ACTION TAKEN:

- | | |
|-------------------------------------|--|
| <input checked="" type="checkbox"/> | Judged Exempt; category 2 Modifications required? Yes Accepted (date) 11/30/2022 |
| <input type="checkbox"/> | Approved as submitted. Date of next review: by Degree of Risk: |
| <input type="checkbox"/> | Approved pending modifications. Date of next review: by Degree of Risk: |
| <input type="checkbox"/> | Modifications accepted (date): |
| <input type="checkbox"/> | Not approved (see attached statement) |
| <input type="checkbox"/> | Judged not research with human subjects |

FINAL APPROVAL TO BEGIN 11/30/2022
Date

10/2018

AUTHOR'S BIOGRAPHY

Tara C. Flubacher was a student from Winter Harbor, Maine and graduated high school from Sumner Memorial High School in 2019. She majored in kinesiology and physical education with a concentration in exercise science and a minor in human nutrition at the University of Maine. Tara tutored students in anatomy and physiology and spent a year as a rehabilitation technician at a local, out-patient physical therapy clinic. Upon graduation, Tara will be attending the Doctor of Physical Therapy program at Husson University in Bangor, Maine.