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Exercise Adherence: Motivational Factors Influencing Exercise Adherence and Fitness Level

Justin Recklau
Lynchburg College

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Justin Recklau

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Dr. Debbie Bradney **Committee Chair**

Dr. Nancy Cowden

Dr. Jim McLaughlin

ABSTRACT

There are many factors that influence adherence to an exercise program. This research study aimed to determine which factors most effectively ensured adherence, with the hypothesis that no single factor was indicative of exercise adherence as adherence is a dynamic item. The results target exercise professionals to assist them in retaining clientele and encouraging clientele to adhere to exercise programs. A survey was implemented that had clients self-report their stage in the transtheoretical model as well as how strongly they felt about five positive factors to exercise as well as five barriers to exercise. In addition to surveys, body composition, maximal muscular strength and cardiorespiratory fitness tests were implemented. Subjects in the preparation stage of the transtheoretical model reported a more optimistic outlook on exercise. Those in the contemplation stage reported having a lack of knowledge about exercise as being a barrier to a much greater extent than any other group. Increased body fat levels correlated with decreased levels of comfort with appearance. Exercise professionals may derive benefit from attempting to maximize the retention of an optimistic outlook through positive reinforcement techniques. Concise, accurate information on how to properly adapt a healthy lifestyle may be most readily received by those who are in the contemplation stage. The body fat level of the client needs to be considered when prescribing exercise so that they do not drop out of a program due to fear of embarrassment. The hypothesis was supported, as reported in the wide variety of adherence factors and barriers to exercise adherence.

CHAPTER 1: Introduction

It is generally accepted that adequate research and knowledge currently exists in the field of exercise physiology as to which protocols are most effective to improve some aspect of physical fitness in an individual. Unfortunately, all of that knowledge and research is for naught if the health care professional is unable to convince the client, or potential client, to perform the activities necessary to obtain a physical improvement. This study assumes that the lack of information on what to do is not the problem that is contributing to the obesity epidemic in the United States; rather that the problem lies in the inability to persuade individuals to adopt a more active lifestyle and stay that way as well as eat a moderate and balanced diet. The hypothesis of this research study is that no single factor is indicative of exercise adherence as adherence is a dynamic item.

Definitions:

1RM: the maximum amount of weight that can be lifted one time with proper form for a given resistance training exercise.

Action: the stage in the transtheoretical model in which people are exercising at recommended levels for health and fitness, usually 30 or more minutes per day, five or more days per week for up to six months.

BMI: body mass index, calculated by dividing the subject's body weight, in kilograms, by their height, in meters squared.

Contemplation: the stage in the transtheoretical model in which people have intentions to start exercising in the next six months.

Exercise adherence: the act of remaining in an exercise program or following an exercise intervention.

Grade: the amount of incline or decline that an individual encounters on a motor-driven treadmill during a physical fitness assessment.

Maintenance: the stage in the transtheoretical model in which people have been exercising at recommended levels for six months or longer.

Negative predictors: predictors regarding exercise adherence that represent a negative correlation between the factor and exercise adherence, meaning that the presence of negative factors decreases the likelihood of exercise adherence.

PAR-Q: physical activity readiness questionnaire, a tool to protect subjects and avoid liabilities in exercise assessment and prescription by asking the subject if they have any contraindications to exercise prior to the beginning of a program.

Positive predictors: predictors regarding exercise adherence that represent a positive correlation between the motivation factor and exercise adherence, such as high self-esteem resulting in a higher rate of exercise adherence.

Precontemplation: the stage in the transtheoretical model in which people have no intention to start exercising within the next six months.

Preparation: the stage in the transtheoretical model in which people intend to start exercising within the next month.

Relative VO_2 max: the maximum amount of oxygen that an individual can utilize in a given amount of time relative to their body weight, expressed as milliliters of oxygen per kilogram body weight per minute.

Steady state: the point at which a metric, such as oxygen consumption or heart rate, levels off in an exercise test at a fixed work rate.

Transtheoretical model: also known as the stages of change model, this theoretical construct attempts to classify individuals as to which stage of behavior change they are in. The stages are precontemplation, contemplation, preparation, action and maintenance.

Significance of the Study:

Improved national, and possibly global, quality of life would be realized if health care professionals could effectively determine the best motivational tools for improving exercise program initiation and adherence. To effectively train any client, knowledge of what is most successful to improve whatever fitness component is currently being addressed is critical. In a similar manner, in order to convince an individual to undergo an exercise program, knowledge as to what factors are most likely to motivate the client and keep them motivated are also vital.

Purpose:

The purpose of this study was to determine which psychological factors most strongly correlated to an active lifestyle. Active lifestyle was determined using both a survey tool based on the stages of change, or transtheoretical, model as well as on physical fitness testing. The physical fitness testing battery assessed: body composition, maximal muscular strength for both the upper and lower body, and cardiorespiratory fitness.

Assumptions/Biases:

Subjects were assumed to be honest in their responses to the questionnaires reporting self-reported data. For the physical fitness tests being proctored by the administrator, it is assumed that individuals give a maximal effort on all tests and followed the requests of the administrator to abstain from caffeine, large meals and vigorous exercise three hours prior to testing. Only individuals of low risk were admitted into the test, and the sample size was limited to those on the email distribution list at Lynchburg College as well as individuals that the test administrator had direct contact within the city of Lynchburg, Virginia.

CHAPTER 2: Review of the Related Literature

Why do some people work out alone while others must have a partner? Why do certain people flock to the gym and socialize over a long workout while others prefer efficiency and/or home fitness equipment? These questions and their accompanying answers bear considerable importance to the field of exercise physiology. All of the scientific research demonstrating the efficacy of various training protocols is for naught if fitness professionals cannot persuade clientele, most notably extremely sedentary clientele, to implement training principles and physical fitness enhancing practices in their lives. The literature review found multiple positive and negative predictors of exercise adherence.

Positive Predictors:

Glaros and Janelle (2001) looked at the client having a choice in exercise modalities as a motivator. In this study, three different modes of exercise were examined: variable, static, and preferred. Participants in the variable condition performed the same exercise for 2 weeks, at which time they changed exercises. Those participants in the static condition chose an exercise and remained with that single exercise for the eight week duration of the study. Participants in the preferred mode condition were not given a protocol as to when to change their exercise and were free to determine their mode of exercise. In addition to two measures of adherence, variables such as cardiovascular fitness, enjoyment, boredom, and physical self-efficacy were examined. Glaros and Janelle (2001) concluded that the variable aerobic exercise regimen increased adherence to the workout program compared to the preferred mode, but they did not indicate the quantitative change in adherence in their results.

Furthermore, the participants in the variable program rated their workouts as more enjoyable.

Higher exercise self-efficacy, which is the belief that one has the capabilities to execute the courses of actions required to manage prospective situations, was found by Buckworth et al (2002) to lead to higher exercise adherence. Results of this study indicated that, as subjects progress through the stages of the transtheoretical model of exercise (Lox et al, 2006), subjects had exercise self-efficacy. Although this finding does not establish a cause and effect relationship, it suggests that exercise self-efficacy and exercise adherence could be related. Buckworth et al (2002) inferred that individuals who are more successful in their exercise programs have more confidence. Adherents to exercise programs are more likely to be successful in the face of impediments because they have likely already faced barriers and overcome them. Additionally, subjects with more exercise self-confidence work to overcome barriers because their higher self-efficacy results in a greater capacity to overcome obstacles.

Specifically, clients at the contemplation stage may need extensive thought and behavior modification interventions to overcome barriers to exercise before they have the confidence to move to the action stage (Lox et al, 2006). In the action stage, clients are at risk for relapse because most exercise relapse occurs within the first 6 months of initiation (Lox et al, 2006). These clients may benefit from tracking barriers that keep them from exercising more so than the actual exercise itself so that they can learn how to ensure their own exercise adherence. By knowing the barriers of the client and assisting the client by giving methods of overcoming those barriers, the health fitness professional can increase exercise adherence. Fitness professionals must also be

cognizant that barriers are different for different people. Additionally, making note of occasions when an individual overcame exercise adversity and adhered to their program or at least got to their exercise location may increase their exercise self-confidence (Buckworth et al, 2002).

Forge (2000) undertook a study where females were divided randomly into three groups. The exercise groups were either long-bout (LB), multiple short bout (SB) or multiple short bouts, but on home fitness equipment (SBEQ). The exercise prescribed to all was comparable, an intensity similar to brisk walking. The LB group was told to exercise once per day, five days per week, progressing from 20 to 40 minutes per day by the end of the program. The SB group was also told to exercise five days per week, progressing from 20 to 40 minutes per day, but subjects in this group were asked to perform their daily workouts in ten-minute bouts at convenient times throughout the day. Subjects in the SBEQ group were asked to exercise identically to the SB group but were provided with motorized home treadmills. They reported that if subjects had exercise equipment at home and performed the exercises in short bouts, they would exhibit the best exercise adherence out of all of the modalities used.

The components of fitness assessed in the study by Forge (2000) were body weight, body composition, cardiorespiratory fitness and exercise adherence. Of 148 subjects, 78% completed the 18-month program. At 18 months, mean weight loss was significantly greater in the SBEQ group than in the SB group (7.4 kg vs. 3.7 kg; $p < 0.05$). Mean weight loss in the LB group was 5.8 kg, not a statistically significant difference from the SB or SBEQ groups. After being 13 and 18 months into the program, exercise adherence was greater in the SBEQ group than in the SB and LB

groups ($p < 0.05$). For the SBEQ group, access to home exercise equipment was the factor that improved exercise adherence and may thus explain this group's improvement in long-term weight loss (Forge, 2000).

Hughes (2004) found that exercise adherence was greatest in groups over the weekend on home-based equipment when they were being supervised during their "work-week" exercise modalities. Perhaps being held accountable during the week or wanting to impress the exercise facilitator drove the subjects to work harder on the weekends. Unfortunately, such questions were not posed in that particular study so conclusions or rationales for the improvement cannot be drawn.

DeVahl et al (2005) reported that academic incentives for college students that amounted to bonus points on their final grades were strong motivators for exercise adherence. There were two groups, both challenged to decrease their body fat. One group was given a final exam bonus if they decreased their body fat. Another group was given a final grade bonus (overall grade in course) for doing the same, and this was determined to be the more desirable motivational factor. Groups were randomly assigned and had a similar demographic composition overall and both groups totaled 200 students. The group with the overall course grade academic incentive, which had a greater positive impact on overall course grade, lost, on average, a greater percentage of body fat than the group given only a final exam bonus. That both groups lost body fat, however, indicated that academic incentives are good tools to ensure exercise adherence in students.

Conroy (2002) found that the fear of failure was a positive adherence tool when used appropriately. Avoiding situations that have a low success rate, such as skill

based performances (basketball) or group activities with those of substantially higher fitness levels is helpful. A fear of failing to adhere and to actively progress as well as incorporate fitness into the lives of patients is a positive motivator. The article stressed the importance of the fitness instructor accentuating the positive and viewing not trying as failure as opposed to focusing on a lack of performance outcomes or physical attribute improvements as failure.

Another predictor of exercise adherence was whether or not the subject adheres to the exercise assignments that don't involve direct supervision. Those that did the unsupervised assignments early on in the study by Hughes (2004) were more likely to remain adherent, which was measured using self-reporting questionnaires. Hughes (2004) also found that adherents were more likely to be less depressed, but did not indicate which depression score was used and which statistical norms were referenced for "normal" depression. Additionally, the research by Hughes (2004) found that subjects with a lower body mass index were more likely to be adherents.

Hughes (2004) also found that good adherents were more likely to have better physiological functioning at the beginning of the exercise intervention and fewer chronic diseases and also reported that males were more likely to be adherent than females overall. The chronic diseases were not defined, and this was a study targeted mainly at improving functional capacity in the elderly that also noted the rate of attrition or non-adherence.

Douthitt (1994) studied older adults in both the nursing home and supervised standard residence settings and found that males adhered to exercise for reasons of perceived romantic appeal. She also found that females adhered to exercise for

reasons of perceived athletic competency, perceived global self-worth and perceived physical appearance.

A number of various predictors of exercise adherence were found in studies that were looking into other things but noted reasons for exercise adherence. Gill and Overdorf (2006) gave questionnaires to 272 females between the ages of 18 and 60. Participants were asked to rank the importance of 11 exercise incentives. The results of that study indicated that younger individuals ranked gaining recognition as the most important incentive factor while maintaining mental health and affiliation with a group increased in importance with advancing age. Physical health, fitness, stress management, task mastery and appearance were reported to be valued by the participants in all age groups.

Muse (2005) reported a variety of factors for motivation and exercise adherence in older adults in her research article. A decreased physical ability coupled with the desire to regain physical function was found to be a strong positive indicator of exercise adherence in that particular study. Additionally, positive results such as having their individual and unique needs satisfied and the realization of improvements in physical appearance increased adherence. Improved feelings of general well-being were also motivating factors to continue participating.

Muse (2005) also noted in that study that some older adults may approach activity more proactively and use their participation in exercise to work against preexisting physical problems or to prevent new problems from occurring. They may start or maintain an exercise program or modify a program to meet their needs and tolerance, not always considering what the trainer feels is best but what they feel that

they can "handle." Current exercisers may be motivated to exercise more strenuously when they notice the natural age-related and physical inactivity-related declines in function. They also reported that subjects may also improve stress management techniques, nutrition and be more likely to regularly and properly use medications in addition to their physical regimens.

Kilpatrick et al (2005) found that the personality and type of exercise were also an important matter to consider in college students of both genders. That study indicated that subjects had an increased likelihood to state intrinsic motives, such as enjoyment and challenge, for engaging in sport. However for planned exercise interventions the motivations were more extrinsic and focused on appearance, body weight maintenance and keeping stress at a reasonable level. The researchers suggested that motives for sport participation were more desirable than those for exercise and that using sports instead of traditional exercise intervention strategies such as the utilization of fitness equipment (treadmills, cycle ergometers, elliptical trainers, resistance machines, etc.) may facilitate improved adherence to physical activity recommendations.

Roach et al (1999) conducted an interesting study regarding fire rescue workers using a survey and convenience sampling. The study found that the fear of injury or the belief that fitness prevents injury had little bearing on current fitness or exercise status. Rather, physical activity was found to correlate most strongly with the idea that one is never too old to begin exercise, competition in the exercise program makes individuals want to continue, exercise is a habit worth repeating and integrating into a balanced life, and if time is available to exercise while on duty.

Negative Predictors:

In a study of older adults that were all recipients of a heart, lung or heart-lung transplant De Geest et al (2005) found that younger age correlated with lowered exercise adherence. They also found that lower education level, family dysfunction and a lack of effective social support networks were predictive of reduced exercise adherence. Unfortunately, none of the metrics used to discern education level or level of dysfunction were reported. The rest of the reports in that study were also vague, but they stated that unstable living circumstances, long distances from treatment settings, laziness, time conflicts, extremely poor health status and high cost of medication reduced the likelihood of exercise adherence.

Muse (2005) found that previous lifestyle habits, such as alcohol and/or tobacco use and poor nutrition, may also influence whether an older adult desires or is able to participate in an exercise program. Additionally, that study found that, compared with younger adults, some older adults have a decreased tolerance to physical activity due to age-related and physical inactivity-related changes. Muse (2005) also found that psychological factors, such as not caring about losing the ability to live independently may cause some individuals to continue poor lifestyle habits and stay extremely sedentary despite information that it is harmful to their health. Another psychological problem proposed is that older adults who have long been exercising but become sick or succumb to disease may feel that physical activity failed them.

Summary:

The positive predictors were found to be: variety in training; higher self-efficacy; exercising at home; having to report exercise done outside of scheduled exercise bouts

to the exercise specialist; academic incentives; better baseline physiological function; desire for recognition, physical health and stress management; sense of belonging to something special; intrinsic motivation; and, finally, belief that it is never too late to begin exercising. The positive reasons for exercising vary with age, health status and other demographic differences. The negative predictors were: lower education level; family dysfunction; lack of social support; alcohol use; tobacco use; and poor nutrition.

This study planned to investigate which specific psychological factors, as illustrated by self-reported questionnaire results, contributed significantly to exercise adherence or nonadherence. In addition to self-reported questionnaires that depicted both the stage in the transtheoretical model as well as the positive factors and barriers to exercise adherence, physiological fitness testing was performed. This physiological fitness testing aimed to determine correlations between physiological test results and the stage in the transtheoretical model as well as self-reported factors in exercise adherence.

CHAPTER 3: Methodology

Subject Selection/Setting:

The subjects in this study were all Caucasian Americans. There were six men and seven women with a mean age of 31.4 years (SD 11.6 years) and a mean BMI of 23.5 kg/m^2 (SD 3.6 kg/m^2). All of the subjects were selected from a Division III, private institution in Central Virginia community of approximately 3500 faculty, staff, students and student-alumni over the past two years, who graduated in May of 2004 or later. Subjects were admitted to the study if they were low-risk according to ACSM risk stratification criteria and could meet with the test administrator at a time that was acceptable for both the administrator and subject. Low risk was defined as men <45 years of age and women <55 years of age who are asymptomatic and meet no more than one coronary artery disease risk factor threshold (ACSM, 2006). The setting for data collection was the Lynchburg College Fitness Center as well as the Lynchburg College Exercise Physiology Lab.

Apparatus:

Precor C956 Treadmill

Lange Skin Fold Calipers

Detecto Balance Scale with Height Gauge

25 lb Olympic Curl Bar

45 lb Olympic Straight Bar

Nautilus Lat Pull down (23.5 – 266.5 lb in 13.5lb increments)

Standard Olympic Weight Plates (2.5 lb, 5lb, 10 lb, 25 lb and 45 lb)

Williams Strength Leg Press: Sled Type (45 degree angle)

Atlantis Olympic Flat Bench

Omron Heart Rate Monitor (Chest Strap with Wireless Transmitter and Receiver Watch)

Sources of the Physical Testing Battery:

The physical testing battery used for this test, shown in appendix A, was designed by the test administrator. The body composition portion is based on the ACSM text (2006). The strength battery is based on the Heyward text (2002). The cardiorespiratory fitness test is based on the Heyward text (2002).

Sources of the Psychological Testing Battery:

The psychological assessments were derived from two sources. To create a framework for where in the process of incorporating fitness into an individual's life a test subject was categorized a cognitive-based model was needed. The transtheoretical model, also known as the stages of change model, was used for this purpose (Lox et al, 2006). It depicts the five stages that an individual goes through in attempting and maintaining an exercise program. It begins with precontemplation, progresses to contemplation, preparation, action and, finally, maintenance. The definitions of these terms can be found in the introduction.

The second source lists five promoters and five barriers for exercising. Both sources are based on the work be Nigg, Rossi, Norman and Benisovich (1998). The sources appear under appendix B. The positive factors addressed desiring the mood improvements exercise offers, desiring to be more attractive as a result of exercising, using exercise as a way of relieving stress and using exercise as a way of increasing energy. The negative factors addressed exercise as a negative use of time, not being

comfortable enough with their appearance to exercise and a lack of knowledge about exercise.

Procedures:

Subjects were identified using a campus-wide e-mail along with the test administrator's own word-of-mouth recruiting. After the potential subjects replied to the first e-mail, a second e-mail was distributed to those who responded only. The second e-mail also included four attachments: PAR-Q, informed consent and two questionnaires (Appendices A, B, C and D). Both emails are included in appendix E. Each participant was given 45 minutes to one hour of testing. They were asked to fill out the items included in the respondent-only e-mail. There are five components of physical fitness: muscular strength, muscular endurance, cardiorespiratory fitness, flexibility and body composition. Physical fitness testing order was as follows: body composition, muscular strength and cardiorespiratory fitness testing.

The three site skin fold test to measure body composition was done using procedures outlined in the ACSM handbook (ACSM, 2006). Scoring the skin fold thickness measures versus norms was conducted using a chart from the Heyward text (2002). The physical strength testing battery was then administered using the steps for 1RM testing explained in Heyward (2002). The best of three attempts was used and only a properly executed repetition counted.

Following the physical strength battery was the cardiorespiratory fitness battery. A predicted relative VO_2 max test that involved the utilization of a heart rate monitor and a walking protocol on a treadmill was used. The subject put the heart rate monitor as per manufacturer instructions and then went onto a treadmill. A speed between 3 mph

and 4.5 mph was used. The initial walk, which was on a flat, 0% grade, was expected to get a heart rate response of 50% to 70% of the age predicted heart rate maximum (220-[age in years] formula used to predict maximum heart rate).

Once a steady state was reached, which was within four minutes of the beginning of the test, the test administrator increased the grade to 5%. A steady state had to be reached again, always within four minutes. At the new grade, the heart rate was recorded and the speed (miles per hour), heart rate (beats per minute), age (years) and gender (female=0, male=1) were entered into the formula that accompanies that testing protocol. Based on that formula an estimated relative VO_2 max was found. During the testing any fitness-related questions were answered and the administrator asked each subject their particular goals for fitness. This information was used to complete a training program for each participant as a mode of repayment for study participation.

CHAPTER 4: Results

Figure 1 has a body fat score that is based on a 1-6 scale. The measured body fat was 2.90 +/- 1.60. The number-relationships are as follows: (1) low, (2) low-mid, (3) mid, (4) mid-upper, (5) upper, and (6) obese. These numbers represent different percentages of body fat for men and women, but this is corrected by scoring and reported thusly. The percentage of body fat that qualified an individual for each category may be found in Heyward (2002).

Strength was scored using a 0-4 scale. The measured strength battery results were 2.50 +/- 1.00. The number-relationships are as follows: (0) poor, (1) fair, (2) average, (3) good and (4) excellent. The strength norms, table and scoring may be found in Heyward (2002).

The relative VO_2 max testing scoring is based on relative VO_2 max, which is expressed as ml O_2/kg/min. The relative VO_2 max testing results were 2.30 +/- 0.90. The scores are based on a 1-3 scale with the following metrics: (1) good, (2) excellent and (3) superior. Superior is the highest value. The scores of poor and fair were omitted as nobody had test results of poor or fair. The scoring for this test is based on the Heyward text (2002).

The transtheoretical model scoring is based on a 1-4 point scale, with the number-relationships as follows: (1) maintenance, (2) action, (3) preparation, and (4) contemplation. Although precontemplation is also a stage in the transtheoretical model, no subjects reported being in the precontemplation phase. The mean score for the transtheoretical model stage survey was 1.70 +/- 1.00. Please note that a lower score indicated being more active which was the desired outcome.

Negative use of time, being uncomfortable in exercise clothes, and lack of knowledge about exercise were all barriers to exercise adherence. Negative use of time and being uncomfortable in exercise clothes were on the survey twice and the average of the two answers for each reported. Their reporting was on a 1-5 scale, with the following relationship: (1) not important, (2) a little bit important, (3) somewhat important, (4) quite important, and (5) extremely important. Please note that the scale was derived from Marcus et al. (1992), but the numbers were switched. Originally the scale was: (1) extremely important, (2) quite important, (3) somewhat important, (4) a little bit important and, (5) not important. The numbers were switched solely for graphical purposes so that the greater the important, the higher the value on the graph. The mean score for negative use of time was 1.50 +/- 0.70. The mean for being uncomfortable in exercise clothes was 1.60 +/- 0.90. The mean for lack of knowledge about exercise was 1.20 +/- .60.

Exercise improves mood, improves appearance, relieves stress and increases energy were all promoters of exercise adherence. Improves mood was on the survey twice and the two scores averaged. Their reporting is on the same scale as the exercise barriers, with the same number switching performed. The mean score for exercise improves mood was 4.50 +/- 1.80. The mean score for exercise improves appearance was 3.50 +/- 1.70. The mean score for exercise relieves stress was 4.80 +/- 0.40. The mean score for exercise increases enérgy was 4.30 +/- 0.60.

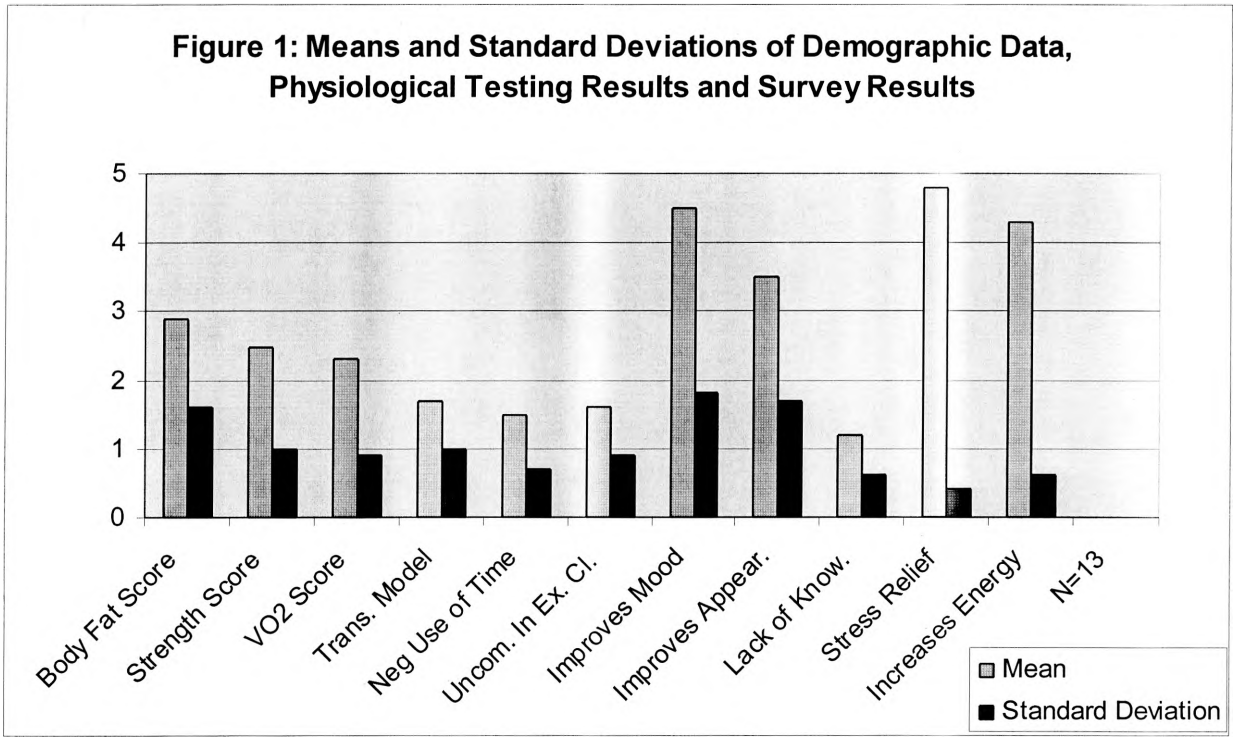

Figure 1: Means and standard deviations of the body composition, strength, cardiorespiratory fitness tests as well as answers to the psychological survey data.

Figure 2 is listed next. BMI was reported simply as kg/m^2 rather than as a category. The mean BMI was 23.50 +/-3.60. The mean reported age was 31.40 +/- 11.60 years. Additionally, the overall positive view of exercise score, with a possible score ranging between 5 and 25, had a mean of 20.80 +/- 3.10. The overall negative view of exercise score, with a possible score ranging between 5 and 25, was 7.50 +/- 2.10.

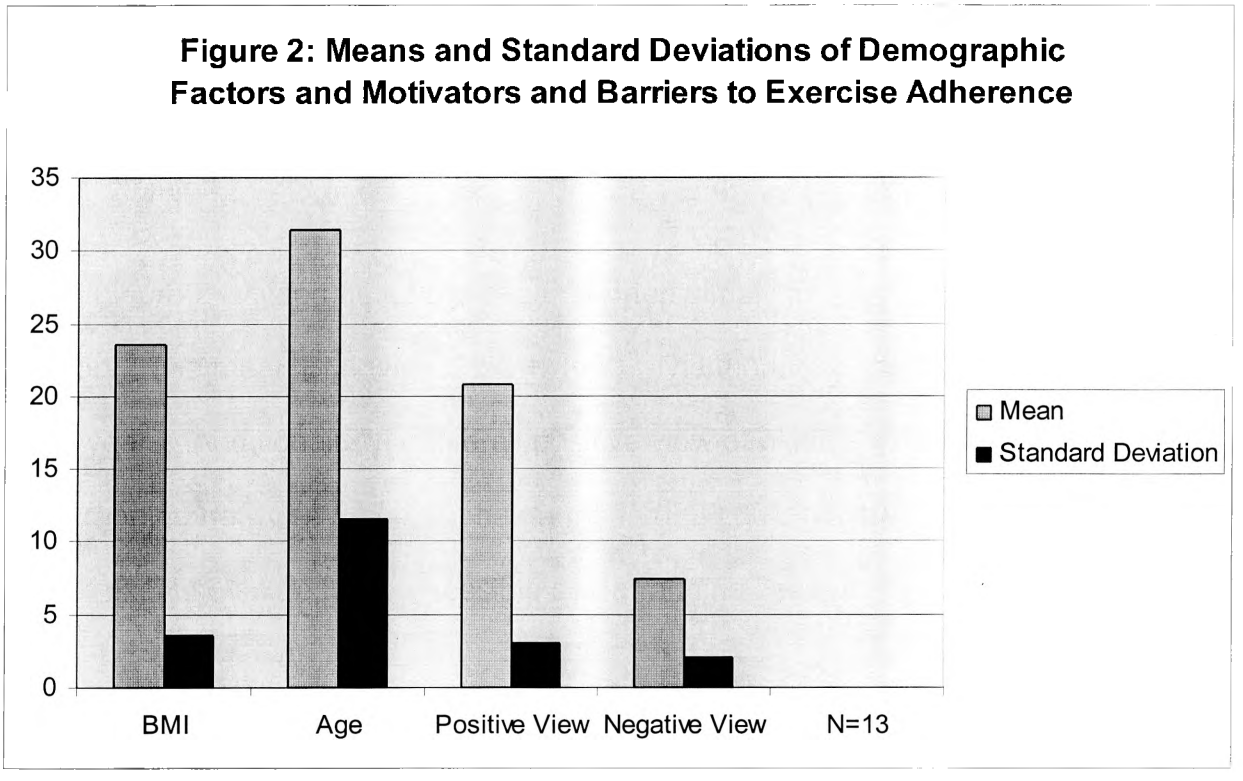

Figure 2: Means and standard deviations for BMI, age and motivators as well as barriers to exercise adherence.

The ANOVA results may be seen in Table 1. The values in the ANOVA are the significance values, otherwise reported as p-values. The two correlations with a p-value < 0.05 are shaded grey and are the only values considered statistically significant. No other relationships were found to be statistically significant from the ANOVA analysis.

Table 1: Analysis of Variance (ANOVA)
Significance of Selected Study Variables

	Body Fat	Strength	Trans Model
Factor	**Significance**	**Significance**	**Significance**
Neg Use of Time	0.897	0.1	0.757
Uncom. In Ex. Cl.	0.438	0.332	0.721
Improves Mood	0.002	0.708	0.989
Improves Appear.	0.195	0.134	0.858
Lack of Know.	0.272	0.801	0.002
Stress Relief	0.684	0.767	0.579
Increases Energy	0.636	0.114	0.403
Positive View	0.192	0.152	0.685
Negative View	0.606	0.123	0.728

Table 1: Analysis Of Variance: The grey items were the only two relationships found to be statistically significant, as reported by having a p-value < 0.05.

The result of subtracting the negative views of exercise from the positive views of exercise sums the overall attitude towards exercise, which is the middle line in Figure 3. Those in the maintenance and contemplation stages of exercise regard exercise similarly, having the most negative view of exercise. Those in the preparation stage had the most positive overall outlook of exercise. Those in the action phase of the transtheoretical model were somewhere in between.

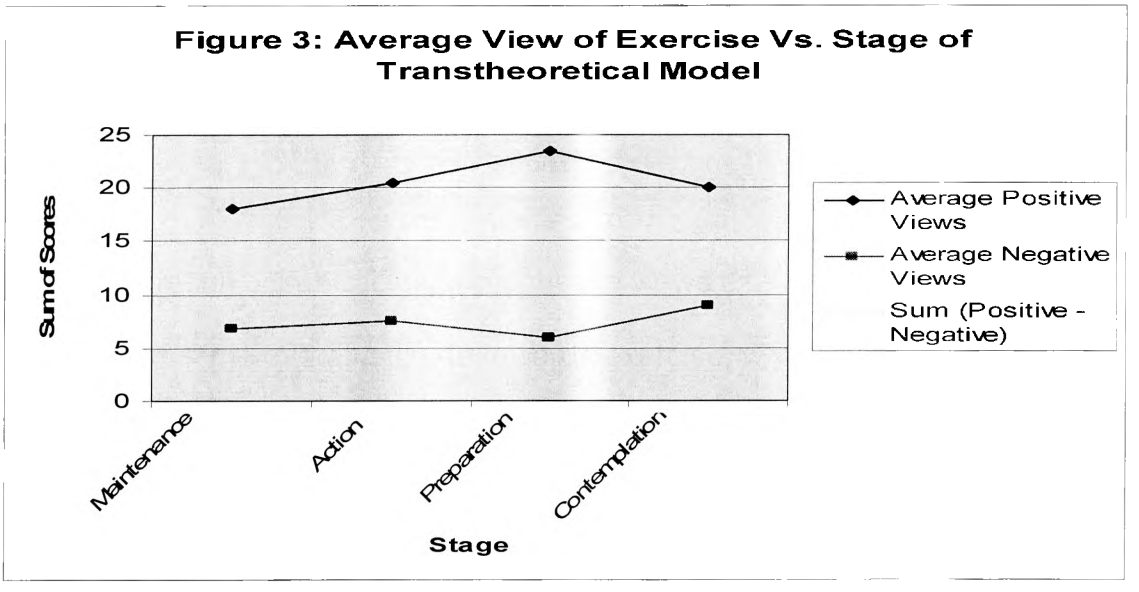

Figure 3: Illustration of the average of the positive and negative views of exercise, which is the middle line with the triangle indicators, versus the stage in the transtheoretical model, labeled from the phase of highest adherence (maintenance) to the stage of lowest reported adherence (contemplation) on the x-axis.

Figure 4 is the average lack of knowledge versus the stage in the transtheoretical model, one of the statistically significant data sets resultant from the ANOVA. Those in the maintenance, action and preparation stages all had low lack of knowledge scores, indicating that knowing how to properly exercise was not a self-reported barrier to exercise for them. However, those in the contemplation phase, who are considering exercise but have not actively begun exercising, reported a lack of knowledge being a barrier to exercising.

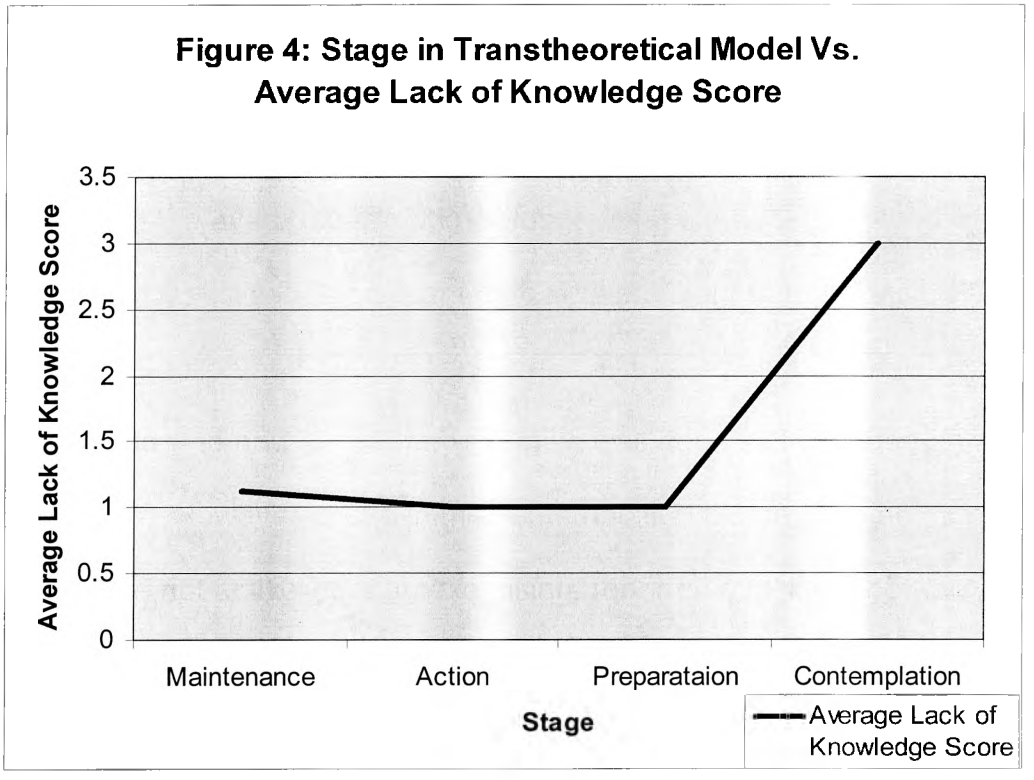

Figure 4: Figure displaying the correlation between stage in the transtheoretical model and self-reported lack of knowledge scores, on a 1-5 scale. Notice that at the contemplation stage, which is the second stage of the transtheoretical model, lack of knowledge was a significant barrier to exercise adherence.

Figure 5 is the correlation between body composition and the average of the two "exercise makes the subject uncomfortable with appearance" scores from the survey. There is a direct correlation where, as body fat increases, comfort level decreases.

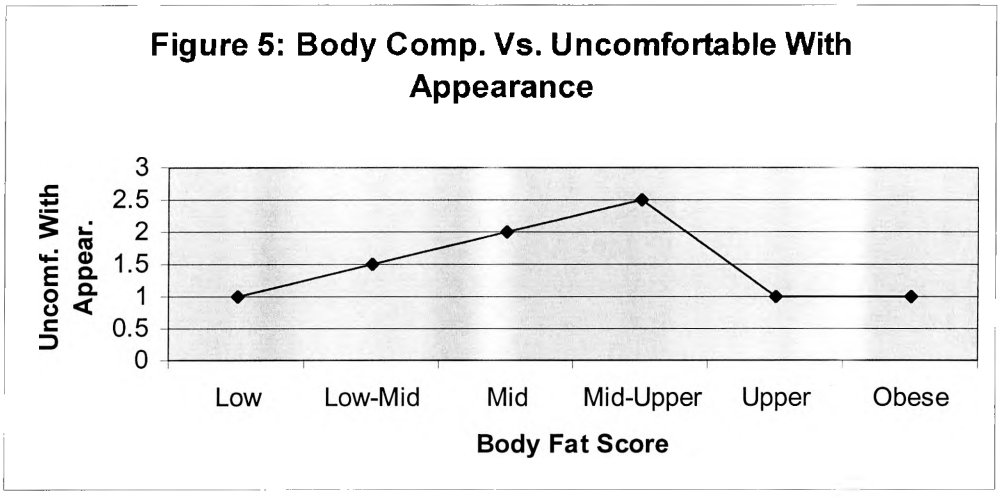

Figure 5: There was a direct relationship between body fat score, as reported using skin-fold caliper analysis against age-gender norms, and a increasing barrier to exercise adherence as self-reported as being uncomfortable with appearance while exercising.

CHAPTER 5: Discussion and Conclusion

There were several problems encountered during this study. The leg extension and leg curl were both originally tests of maximal muscular strength that had to be omitted due to the inaccuracy of the leg curl and leg extension at the fitness testing center. An individual who would only get a four on a one-ten point scale on leg press would get a ten on both the leg extension and the leg curl with perfect form. The test administrator consulted with some instructors in the exercise physiology program and came to a consensus that the resistance on the machines is not indicative of the resistance on the status-based norms that they were being correlated to. The lack of flexibility and muscular endurance testing were due to time constraints.

This study had a very small sample size of only thirteen individuals. This presented many data analysis problems and was not large enough to be representative of the community being studied. As with all studies with no significant compensation, such as money, the kind of individual who volunteered for this type of a study may not be representative of the overall community. There was a large standard error for the cardiorespiratory fitness testing, reported to be within 10-15% of actual relative VO_2 max on the first standard deviation (Heyward, 2002) versus maximal cardiorespiratory testing that employed direct spirometry. Such testing was determined to be unnecessarily difficult for the subjects in the study and, judging from the low subject response, may have resulted in even fewer numbers. Testing order was improper, according to ACSM guidelines, and the cardiorespiratory fitness testing should have been carried out prior to the muscular strength battery (ACSM, 2006).

The ANOVA, as seen in Table 1, indicated that only two sets of variables were found to be statistically significant. The first statistically significant set of variables was the exercise improves mood scores analyzed against their body fat score. The second statistically significant set of variables was an individual having a lack of knowledge regarding exercise analyzed against their stage in the transtheoretical model. All analyses were done using analysis of variance (ANOVA) putting the number of variables from each item, either survey or physiological test, against some other variable. For example, body fat had six variables and exercise improves mood had five variables, so it was a 5x6 ANOVA analysis.

The data from Figure 3 gives an interesting correlation. The data indicated that those who exercise regularly or do not exercise regard exercise less optimistically than those planning to start exercising in the immediate future. This is important for the exercise professional to consider, as it is often when people are in the preparation or action stages of the transtheoretical model when they actively seek health care professionals to assist them in the behavior modification process. If the fitness professional can assist the client in maintaining the positive outlook on exercise it could, possibly, have a positive impact on exercise adherence.

Figure 4 suggested that, for subjects in the contemplation stage of the transtheoretical model, simplified pamphlets or simplified exercise books that concisely describe the proper ways to begin an exercising program may improve adherence. Additionally, knowledgeable and certified health care professionals may benefit the individuals by consulting them on ways to improve their fitness safely and effectively

and health-related classes may give them the knowledge needed to reduce the lack of knowledge barrier to exercising.

Finally, Figure 5 suggests that higher body fat would be a significant barrier to exercise as individuals are now more negatively conscious of their appearance and want to avoid being seen exercising. Both the upper and obese categories were only one individual each, possibly being another limitation of the small sample size. Overall, a clear, positive, direct relationship between comfort with appearance and body fat score was illustrated.

In summary, subjects in the preparation stage of the transtheoretical model reported a more optimistic outlook on exercise and fitness professionals may derive benefit from attempting to maximize the retention of that optimistic outlook through positive reinforcement techniques. Subjects in the contemplation stage reported having a lack of knowledge about exercise as being a barrier to a much greater extent than any other group, indicating that concise, accurate information on how to properly adapt a healthy lifestyle may be most readily received by those who are considering exercise as opposed to those who are not considering exercise or have already begun an exercise program.

Additionally, the body fat level of the client needs to be considered when prescribing exercise. Exercise professionals should be cognizant of this correlation by not prescribing exercises that place the individual in front of others who may judge their appearance as the client may come to fear that judgment to a greater extent then they desire the physical fitness improvements that exercise may offer them.

Overall, the major theme of exercise adherence is similar to exercise physiology: specificity. Depending on the desired outcome for the client, fitness professionals must not only tailor exercise programming to elicit the appropriate physiological response but also interact with the client in a manner that motivates them. This is not a one size fits all approach, as both the study results and literature show, but a comprehensive evaluation of where the client is in the transtheoretical model, the client's feelings about his/her body, any issues the client may have and other factors that will be specific to each client. Success in the field of exercise physiology depends on both the ability to properly prescribe exercise as well as match programming to client personality, goals and psychological factors. The hypothesis was supported, indicating that exercise adherence is a dynamic item that changes depending on more factors than are possible to account for. To properly prescribe programming for a client, the exercise professional must listen and ask pertinent questions, which will vary depending on the client, before prescribing advice or programming that is appropriate for the client at that time.

Recommendations for Further Research

Based on the outcome of this study, research utilizing longitudinal experiments with a large sample size across many demographic groups would give more valuable data as to proper techniques to ensure adherence. Administrators should first determine the stage in the transtheoretical model then, when the stage is determined, employ a variety of techniques to promote adherence based on the stage the subject is currently in. Due to the variety of techniques for each stage, over the course of a minimum of 9 months, administrators could then determine the adherence through both self-reported questionnaires as well as changes in physiological fitness variables based on the protocol used. The information from a study of this design and magnitude would better explain which motivational techniques and exercise protocols most effectively ensure adherence to an exercise program by determining causal relationships between administered programs and rates of both adherence and physiological fitness improvement.

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Appendix A

Subject Name	Date	Body Weight and Height	Age	Gender
				M F

Body Composition (3 Site Skinfold) (P. 63 ACSM 7e)

Male		Female		
Chest		Triceps		
Abdomen		Thigh		
Thigh		Suprailium		
Total		Total		
Body Fat %		Body Fat (Percentile Rank)		P. 66-67

Strength Battery	Weight	Strength-to-Body Mass Ratio	Points
Bench Press			
Arm Curl			
Lat Pull-Down			
Leg Press			
		Total Points:	

CRF

Testing Protocol	Single Stage Treadmill Walking Test
Speed in mph	
HR in bpm	
VO2 Max	

Appendix B

Exercise: Stages of Change - Short Form

Regular Exercise is any *planned* physical activity (e.g., brisk walking, aerobics, jogging, bicycling, swimming, rowing, etc.) performed to increase physical fitness. Such activity should be performed *3 to 5 times* per week for *20-60 minutes* per session. Exercise does not have to be painful to be effective but should be done at a level that increases your breathing rate and causes you to break a sweat.

Question:

Do you exercise regularly according to that definition?

- Yes, I have been for MORE than 6 months.
- Yes, I have been for LESS than 6 months.
- No, but I intend to in the next 30 days.
- No, but I intend to in the next 6 months.
- No, and I do NOT intend to in the next 6 months.

Source: http://www.uri.edu/research/cprc/Measures/Exercise02.htm

Exercise: Decisional Balance

This section looks at positive and negative aspects of exercise. Read the following items and indicate how important each statement is with respect to your decision to exercise or not to exercise in your leisure time. Please answer using the following 5-point scale:

5 = Not Important
4 = A little bit important
3 = Somewhat important
2 = Quite important
1 = Extremely Important

If you disagree with a statement and are unsure how to answer, the statement is probably not important to you.

How important are the following opinions in your decision to exercise or not to exercise?

1. I would have more energy for my family and friends if I exercised regularly. ❑
2. I would feel embarrassed if people saw me exercising. ❑
3. I would feel less stressed if I exercised regularly. ❑
4. Exercise prevents me from spending time with my friends. ❑
5. Exercising puts me in a better mood for the rest of the day. ❑
6. I feel uncomfortable or embarrassed in exercise clothes. ❑
7. I would feel more comfortable with my body if exercised regularly. ❑
8. There is too much I would have to learn to exercise. ❑
9. Regular exercise would help me have a more positive outlook on life. ❑
10. Exercise puts an extra burden on my significant other. ❑

*Source: http://www.uri.edu/research/cprc/Measures/Exercise05.htm *Note: I, Justin Recklau, changed the numbers (inverted the scale) to make it more graphically pleasing. Having the most important as a five rather than a one is more intuitive graphically.*

Appendix C

Lynchburg College's Center for Health and Fitness Development:

Informed Consent

Purpose and Explanation of the Test: I hereby consent to voluntarily participate in a fitness evaluation. I understand that in order to assess my current fitness levels, I will engage in one or more of the following tests: a graded exercise test, body composition tests, muscular strength and endurance tests, and flexibility assessments.

Responsibilities of the Participant: I have been informed that during my participation in this personal fitness testing program, I will be asked to complete the physical activities unless symptoms such as fatigue, shortness of breath, chest discomfort, or similar occurrences appear. I have been advised that at any point, it is my complete right to stop exercise and that it is my obligation to inform the test administrator of my symptoms. I understand that information I possess about my health status may affect the safety of my exercise test and, as such, I am responsible for fully disclosing my medical history to the test administrator.

Risks and Discomforts: I understand and have been informed that there exists the possibility of certain changes occurring during the test including, but not limited to, abnormal blood pressure, fainting, dizziness, disorders of heart rhythm, and very rare instances of heart attack, stroke, or even death. I further understand that there exists the risk of bodily injury including, but not limited to, injuries to the muscles, ligaments, tendons, and joints of the body. Every effort will be made to minimize these occurrences by evaluation of preliminary information relating to my health and fitness and by careful observations during testing. Knowing these risks, it is my desire to participate as herein indicated.

Expected benefits from testing: I understand that these tests assess my physical fitness status and the results are used to prescribe a safe, sound exercise program for me.

Confidentiality and use of information: I understand that the information that is obtained during exercise testing will be treated as privileged and confidential and will consequently not be released or revealed to any person without my expressed written consent. I do, however, agree to the use of any information that is not personally identifiable with me for research and statistical purposes.

Inquiries and Freedom of consent: I understand that any questions I have about the procedures used in the exercise test or the results of my test are encouraged. I hereby consent to voluntarily engage in an exercise test to assess my fitness status. My permission to perform this exercise test is given voluntarily and I understand that I am free to stop the test at any point, if I so desire.

Contact Information:

Test Administrator:	Justin Recklau	[email deleted]	[phone number deleted]
Thesis Advisor:	Dr. Debbie Bradney	[email deleted]	[phone number deleted]
IRB Chair:	Dr. Don Werner	[email deleted]	[phone number deleted]

I have read this form, and I understand the test procedures that I will perform and the attendant risks and discomforts. Knowing these risks and discomforts, it is still my desire to participate in this test.

Participant's Signature: _____ **Date:**_____

Test Administrator: _____ **Date:**_____

Appendix D

PAR-Q Physical Activity Readiness Questionnaire

For most people physical activity should not pose any problem or hazard. PAR-Q has been designed to identify the small number of adults for whom physical activity might be inappropriate or those who should have medical advice concerning the type of activity most suitable for them.

Common sense is your best guide in answering these few questions. Please read them carefully and check the yes or no opposite the question if it applies to you.

1.	○	○	Has your doctor ever said you have heart trouble?
2.	○	○	Do you frequently have pains in your heart and chest?
3.	○	○	Do you often feel faint or have spells of severe dizziness?
4.	○	○	Has a doctor ever said your blood pressure was too high?
5.	○	○	Has your doctor ever told you that you have a bone or joint problem such as arthritis that has been aggravated by exercise, or might be made worse with exercise?
6.	○	○	Is there a good physical reason not mentioned here why you should not follow an activity program even if you wanted to?
7.	○	○	Are you over age 65 and not accustomed to vigorous exercise?

If you answered YES to one or more questions...
If you have not recently done so, consult with your personal physician by telephone or in person before increasing your physical activity and/or taking a fitness test.

If you answered NO to all questions...
If you answered PAR-Q accurately, you have reasonable assurance of your present suitability for exercise.

Source: http://www.d.umn.edu/kmc/student/loon/soc/phys/par-q.html

Appendix E

First Email:

I am a senior exercise physiology major conducting a study on the psychological factors in exercise adherence, essentially what makes people want to exercise. If you participate in my study, I will give you a free, basic exercise prescription as well as the data from your exercise tests. I will be conducting maximal bench and leg press tests, relative VO_2 max testing, most likely on the treadmill, as well as body fat analysis so you will know both your estimated body fat percentage and lean mass values using skin calipers. There will also be a questionnaire portion of no greater than 10 minutes to give informed consent, a PAR-Q and a brief psychological profile so I can determine what makes you want to exercise. Please email me at [email address deleted] so that we can schedule this approximately 1 hour test. Thank you and have a great day!

Second Email:

I'm sorry for the long delay but I had to wait for approval from the Institutional Review Board of Lynchburg College before I could move any further. Now that that is settled, there are a few preliminary questions and preparations to make this as effective as possible.

Also, I have attached a few forms for you to print out and bring with you. The Informed Consent, PAR-Q and Exercise Motivation Factors can all be filled out either at your leisure prior to our appointment or while we are together, whichever suits you better. The 1RM Strength, CRF and Body Comp Worksheet is something that I must fill out but if you'd like to put your name, date, height, age and gender that would also be appreciated.

I understand that this is taking some time of you and I appreciate that. For this reason I wanted to get the forms to you as soon as possible to expedite the testing portion as much as possible. If you have any questions, don't hesitate to ask!

Preliminary questions: if you answer, "No," to all of these, there is no need to reply. If you answer, "Yes," to any of these, please reply ASAP. Thanks.

Are you a male 45 years old or older?
Are you a female 55 years old or older?
Do you have cardiac, peripheral vascular or cerebrovascular disease?
Do you have chronic obstructive pulmonary disease, asthma, interstitial lung disease or cystic fibrosis?
Do you have diabetes mellitus (either insulin-dependent or non-insulin dependent), thyroid disorders, renal or liver disease?
Do you take any medications? If so, which ones?
Do you have a pacemaker?

If you answered, "No," to all of the above questions, please do not reply. If, "Yes," please reply and tell me the specific details of the condition that caused you to say yes to see if it allows us to continue on. Please do not withhold any information and participate in the testing if you answer, "Yes." It would be better for us both if you inform me of the specific details of your situation, if any condition exists.

Before testing, please do the following:

No caffeine 3 hours prior to the testing
No meals greater than 500 calories 3 hours prior to the testing (also, please don't have 2-500 calorie meals back-to-back, thanks)
No vigorous exercise 3 hours prior to testing
Maintain adequate hydration, indicated by clear or lightly colored urine, upon arrival for the test
Please do not use any body lotion prior to testing

Setting up appointments:

My availability:
Monday, Wednesday and Friday – Noon until 3 PM, 8 PM until Midnight
Tuesday and Thursday – 8 PM until Midnight
Saturday – 6 PM until Midnight
Sunday – 10 AM until Noon, 6 PM until Midnight
If none of these work, email me your availability and we will set a time up.