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Effectiveness of Cardiac Rehabilitation: Secondary Prevention Increases Functional Capacity in Myocardial Infarction Patients

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EFFECTIVENESS OF CARDIAC REHABILITATION:

SECONDARY PREVENTION INCREASES FUNCTIONAL CAPACITY IN

MYOCARDIAL INFARCTION PATIENTS

by

KRISTIN M. BADILLO

A thesis submitted in partial fulfillment of the requirements

for the Honors in the Major Program in Sports and Exercise Science

in the College of Education and Human Performance

and in the Burnett Honors College

at the University of Central Florida

Orlando, Florida

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Thesis Chair: Thomas Fisher, Ph.D.

Abstract

The purpose of this study was to discern the effectiveness of Cardiac Rehabilitation/ Secondary Prevention Programs (CR/ SPP's) by evaluating increased functional capacity in the form of MET (metabolic equivalent) scores post-myocardial infarction (MI) or heart attack. The Duke Activity Status Index (DASI) survey is administered as part of the Standard Operating Procedure (SOP) for participation in the Secondary Prevention Program. Criterion for the research included patients 65 and older, with a history of one myocardial infarction, and had completed all 36 sessions of CR. The scores from 11 SPP surveys were analyzed and compared in three time increments from sessions 1-18 (initial, or "pre"), sessions 19-36 ("pan"), and sessions 1-36 ("post"). A total of 11 (n=11) surveys were collected and analyzed at The Computing and Statistical Technology Laboratory in Education (CASTLE) in the Teaching Academy on UCF Main Campus. Results from the data showed mean MET scores of 6.21 at session 1, 7.59 at session 18, and 8.15 at session 36. The mean changes over time represented in METs were 1.38 (1), .56 (18), and 1.93 (36). Percent changes over time were 27% (1), 8% (18), and 36% (36). This study showed increased functional capacity over time and will improve program design in terms of frequency and duration.

Dedication

To my husband, my true supporter in all I aim for in life; the one who pushes me to be the best version of myself, I am truly thankful. Your unwavering love has given me the time and patience I needed throughout this journey.

To my children, you are proof that love is unconditional.

To my mother, "Love Always and Forever."

To my father, who always encouraged my inquiring mind.

Acknowledgements

First, I would like to thank my thesis chair, Dr. Thomas Fisher, Jr. Words cannot describe the pleasure to have been his student as well as, his mentee. His devotion, time, and patience is sincere; his wisdom invaluable; his character unforgettable.

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Thank you Dr. Clark in The Computing and Statistical Technology Laboratory in Education for going above and beyond in helping me with my data and graphs for this study.

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I would also like to thank Joseph Khayat and Steven Koski at Central Florida Regional Cardiac Rehabilitation Center. Your help was much appreciated in collecting the data for my research.

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Chapter 1: Introduction

The leading cause of mortality and morbidity in the United States is cardiovascular disease (CVD), (Arena, 2012). Roughly 785,000 individuals per year will suffer a first-time heart attack (Balady, 2011) and according to *Hamm et. al (2013),* more than half of all people with cardiovascular disease are older than 60 years of age. The incidence of experiencing a myocardial infarction (MI), or heart attack, becomes increasingly higher when individuals have CVD or other diseases such as, coronary artery disease, hypertension, hyperlipidemia, diabetes mellitus, and metabolic syndrome (Roger, 2012).

Cardiac rehabilitation is an invaluable, yet underused resource to those who have had a cardiac event. This secondary prevention program can be a preventative tool; even lifesaving (Mampuya, 2012). Once an individual has experienced an MI, the chance of reoccurrence is greater. According to Balady (2011), 22% of both men and women over 65 years of age will be inflicted by a repeated MI event or diagnosed with coronary heart disease (CHD). Of these patients who attend secondary preventative programs, risk of mortality is greatly decreased using a dose-response model (frequency, intensity, time, type) (Balady, 2011). This type of model is effective and used frequently by exercise physiologists when prescribing an exercise regimen. "Frequency" refers to how often the individual should perform the exercises. "Intensity" is the exertion needed to raise the individual's heart rate to the ideal point to benefit them. Also, "time" is the duration of the workouts or how long they should typically last. Exercise "type" refers to

specifically the resistance training or cardiovascular exercises to be included in the patient's program.

The purpose of this study was to examine the outcomes of functional capacity and those participating in cardiac rehabilitation (CR)/secondary prevention programs (SPP's) after an MI. Functional capacity is a term used to describe a person's ability to perform activities of daily living (ADL) and can be measured in metabolic equivalents (MET's) (Silbernagel, 2013). This measurement determines the amount of aerobic work required to perform an activity. It is widely used among exercise physiologists and researchers (Sandercock, 2013).

Additional questions in this study were:

1. If increases in functional capacity occurred, by how much?

2. Which point in the program resulted in the largest increases?

3. Is the current program design effective?

4. Was 36 sessions the appropriate length and what was the correlation?

In this study the criterion included were patients 65 years and older, had experienced their first MI, and had completed all 36 sessions of CR. Many individuals, who are referred to cardiac rehabilitation, choose not to attend due to different factors. By exploring these patients' outcomes with secondary prevention programs, this study sought to demonstrate how attendance in a SPP is a safe method to increasing a patient's functional capacity. This information will improve program design.

Many barriers affect attendance in CR/SPP's. Unfortunately, women, the elderly, low socio-economic status, and ethnic minorities all are factors related to lack of participation. These

populations are either, less likely to receive a referral from a physician or underutilize the service (Balady, 2011). Strategies such as home-based Cardiac Rehabilitation and internet-based programs are being implemented to remove these barriers so that all patients have equal opportunity in getting the best care possible (Mampuya, 2012).

Even those who have benefits of Medicaid and Medicare often lack the opportunity to participate in cardiac rehabilitation. More emphasis has been placed on prescribing medications to restore health instead of exercise, to address many of today's ailments (Mampuya, 2012). As a recipient of Medicare and Medicaid program benefits, individuals are eligible to receive up to 36 sessions in total at no extra cost (Hammill, 2010).

Moreover, cardiac rehabilitation is more than just about improving rates of survival after a heart attack. It addresses other life-skills to improve an individual's recovery after a life altering cardiac event. Nutrition counseling and education, psychosocial wellness, and the implementation of a smoking cessation plan are all keys to improving a cardiac patient's health and are targeted in cardiac rehabilitation (Mampuya, 2012).

These studies all target common interests: To improve patient attendance and program design so that it provides the best possible resource for post-MI patients. With these results, this thesis seeks to evaluate program effectiveness by analyzing patient outcomes through measures of functional capacity.

In the next chapter, background information and research evidence of cardiac rehabilitation and its many facets will be discussed in detail.

Chapter 2: Literature Review

This chapter provides a review of the related research literature of studies addressing cardiac rehabilitation, functional capacity, and assessments used to measure functional capacity. The contents within this section will provide the reader with background information on the subject matter.

Cardiac Rehabilitation

Cardiac Rehabilitation is also known as a Secondary Prevention Program. The term "secondary" is used because it is referred to the second of three phases of rehabilitation. After a major heart event such as, a myocardial infarction or, MI, the first phase is implemented while the patient is still in the hospital following surgery or other initial intervention.

Phase 1 consists of nutritional counseling and education addressing steps to recovery while trying to get the patient physically stable to return to their home in a self-sufficient status (Mampuya, 2012). The optimal time to plan Phase 2 of cardiac rehabilitation is before the patient leaves the hospital. Phase 2 consists of outpatient visits to the cardiac rehabilitation facility where individuals go through a planned and monitored exercise program. The program's length is typically up to 36 weeks, with 3 sessions per week. Older patients covered under Medicare and Medicaid healthcare benefits are able to take advantage of this program at no additional cost, making it affordable and enticing. Besides the benefits of increasing functional capacity, a secondary prevention program's (SPP's) goal is to implement a plan to stop smoking, improve the individual's psychosocial wellness, and to learn strategies for reducing associated risks of cardiovascular disease by implementing healthy behavior modifications.

Phase 2 of cardiac rehabilitation (the focus of this paper) is a voluntary, outpatient program that consists of up to 36 sessions of a medically observed, individually tailored exercise program. The main goal is to help the patient return to their normal activities of daily living (ADL) by increasing their functional capacity in a clinically safe and risk-reduced environment (Sandercock, 2013). After a heart event such as an MI, secondary prevention programs are started 2-4 weeks after being released from the hospital depending upon the patients' condition. Upon arrival, the patient will be assessed and prescribed an exercise regimen according to the FITT (frequency, intensity, time, type) guidelines (Contractor, 2011). The FITT guidelines make CR exercise programs simple and easy to follow. They also allow alteration of different aspects in the program design for effectiveness (Sandercock, 2011). Major health risks associated with heart disease that could be contributing to their health status are addressed during this phase, such as psychosocial evaluations and smoking cessation education (Mampuya, 2012).

After completion of phase 2, the voluntary third phase is implemented. From this point, all the knowledge and experience learned and acquired from the cardiac rehabilitation department is used to maintain health and avoid a recurrent MI. Phase 3 is the management of risk factors and improving health for the rest of their lives. The patient has the option to become a member of the gymnasium at the cardiac rehabilitation facility or to continue practicing skills they have learned at home (Mampuya, 2012).

Services, such as cardiac rehabilitation, are used to enhance patient outcomes in functional capacity and quality care. By following the measures determined by the American Heart Association (AHA) and the American Association of Cardiovascular and Pulmonary

Rehabilitation (AACVPR) (Arena, 2012) the facility takes appropriate measures to ensure that the director and workers provide the best care possible by adhering to certain guidelines.

Myocardial Infarction (MI)

A myocardial infarction is another term for a heart attack. This occurs when a portion of heart tissue lacks sufficient oxygen due to partial or complete blockage in one or more arteries. Physiological effects include cell death in the portion of the heart lacking oxygen and the buildup of scar tissue upon natural healing or repair. As a result, the heart becomes less contractile and results in decreased functional capacity in the individual. Unfortunately, certain cases result in death if too severe or if acted upon too late (Thygesen, 2007).

Functional Capacity

Functional capacity is associated with a person's ability to perform tasks of everyday daily living. It may also refer to aerobic fitness, or the body's ability to use oxygen efficiently under a workload. The importance of attending secondary prevention programs has been evaluated through many studies and has been shown to improve patients' functional capacity (Silbernagel, 2013).

measuring functional capacity.

Two methods are used to test submaximal aerobic capacity in a Secondary Prevention Program. The first is the 6 Minute Walk Test. This test is performed on the treadmill. The patient walks for 6 minutes and the total distance is measured. Two different equations are used to calculate the predicted 6 minute walking distance (6MWD). For men, 6MWD = (7.57 $\times$

height$_{cm}$) − (5.02 × age) − (1.76 × weight$_{kg}$) − 309 m is used and for women, 6MWD = (2.11 ×

height$_{cm}$) − (2.29 × weight$_{kg}$) − (5.78 × age) + 667 m (Enright, 1998).

The second method is the Duke Activity Status Index survey. This study was focused on

the use of this survey in SPP's and how it may be used to improve program design. By

evaluating mean scores of functional capacity from these surveys, the results will reveal program

strengths and weaknesses, and which points of the program need improvement. These surveys

are easy to use and are self-reported at sessions 1, 18, and 36.

Research on Functional Capacity

The Six-Minute Walk Test (6MWT) is a safe method of testing aerobic capacity for

cardiac patients (Silbernagel, 2013). In the study by *Silbernagel et al, (2013)* the authors wanted

to determine if a cardiac rehabilitation program consisting of both aerobic and resistance training

could possibly improve the patients' functional capacity using the 6MWT. Out of 116

participants, males (n=86) and females (n=30), only 9 were MI patients with no heart surgery

required. The length of evaluation was the standard 36 sessions over an average of 19.4+-7.7

weeks. Exercises used for aerobic conditioning were walking, stationary cycling, arm ergometry

and recumbent cycling. The program for resistance training included one set of 10 exercises to be

done as a circuit, 10-15 repetitions performed per exercise. The 6MWT was performed at the

beginning, middle, and end of the rehabilitation program. Results indicated improvement in

functional capacity of 6.27% in the patients that had suffered an MI. The results were not

significant compared to the other variables that had undergone heart surgery and could be seen as

a limitation to the study (Silbernagel, 2013).

The study by Rankin, (2002) used DASI as one of the methods for measuring outcomes comparing African American and Caucasian women post-acute myocardial infarction. The validity of the DASI and VO_{2max} has been verified by the Spearman correlation coefficient, a statistical analysis formula. The purpose was to examine physical and psychosocial recovery rates over the course of 1 year. Out of the 76 women, the average age of the participants in the study was 67.8 years old with 81% being Caucasian and 19% African American. Results showed that Caucasian women have an estimated 50% better recovery rate than African American women in terms of physical health. Psychosocially, both groups had similar results (Rankin, 2002).

Due to the need for reliable yet simple assessments in SPP's, measuring patient outcomes using the 6MWT and the DASI are the preferred methods.

Duke Activity Status Index Survey

The Duke Activity Status Index (DASI) survey is part of a standard procedure in SPP's. This survey was developed in 1989 by Hlatky *et al* and has a high validity rate. 50 individuals underwent exercise testing for peak oxygen uptake and completed the DASI to compare results. They found that the questions from the DASI had a correlation of ($p < 0.0001$) with the exercise test results (Hlatky, 1989).

This survey is used to measure a patient's functional capacity at three points during the duration of the program. This survey consists of 12 standard questions relating to activities of daily living (ADL). Each activity has a correlating score that has been predetermined to represent the amount of effort it takes to complete the activity. Metabolic equivalents (METs) are the

numerical scores used to represent the amount of oxygen uptake required to complete the activities. If the patient is unable to complete the activity that is asked, the score is 0. All scores to the "yes" answers get totaled and put through an equation to get a final MET in functional capacity score. A sample of this survey is in Appendix A.

Metabolic Equivalents

Metabolic equivalents or METs are numerical representations of the amount of oxygen consumption used by an individual to complete a task. For example, 1 MET represents a person at rest and 1 MET equals 3.5 ml $O_2 \cdot kg^{-1} \cdot min^{-1}$. Even at rest, the body is still using energy to keep alive.

Patient Attendance and Adherence

When examining patient's adherence to the recommended 36 sessions of cardiac rehabilitation, not all people complete the program. In the study by *Hammill et. al, (2010),* choosing to complete all 36 could be possibly in favor of recovery and a significant reduction in the risk of a new myocardial infarction, compared to those who only chose to attend 12 or less sessions. Methods used to collect this data were taken from a national 5% sample of Medicare beneficiaries and the average age of subjects was 74 years old, with the study population being 65 and older. A Cox proportional hazards model was used to estimate the time to either re-infarction at 4 years (Hammill, 2010). This statistical analysis technique assessed the patients' risk of a recurrent event. Less variables in the analysis results in more exact results. The results from this study show a strong relationship between program adherence and the improvement in

functional capacity. Those who attended all 36 sessions had a 14% lower risk of death (Hammill, 2010).

Peak oxygen uptake remains standard in most secondary prevention programs as a method of testing a patient's functional capacity using the formula VO_{2peak} in $(mL \cdot kg^{-1} \cdot min^{-1})$ (Sandercock, 2013). For years, the main focus in secondary prevention programs was aerobic exercise as a way to increase a patient's functional capacity and help them to return to their activities of daily living (Berent, 2011). However, research showed the relationship of a program combining resistance training with aerobic training resulted in a greater increase in functional capacity compared to aerobic training alone (Berent, 2011). Non-advantageous results occurred from increasing the volume to 3 sets of 15 repetitions from 2 sets of 12. Additionally, patients' end results exhibited the correlation of increased functional capacity due to the incorporation of resistance exercises versus aerobic exercise alone. This information is important to healthcare professionals and especially, those working with cardiac patients.

Services, such as cardiac rehabilitation, are used to enhance patient outcomes in functional capacity and quality care. By following the measures determined by the American Heart Association (AHA) and the American Association of Cardiovascular and Pulmonary Rehabilitation (AACVPR) (Arena, 2012) the facility takes appropriate measures to ensure that the director and workers provide the best care possible by adhering to established guidelines.

Cardiac Rehabilitation/Secondary Prevention is a resource that is significantly underused by patients suffering from heart disease and other cardiac related conditions (Mampuya, 2012). *Arena et al* (2012) suggested that participation rates are lowered due to poor referral rates by

physicians. Populations that are most commonly affected include the elderly, females, those with lower education, and individuals with low socio-economic status (Arena, 2012). Consequently, new methods are being studied that could improve participation rates and remove the barriers people may be facing (Mampuya, 2012).

Chapter 3: Methodology

The immediate purpose of this study was to investigate the effectiveness of Cardiac Rehabilitation Programs in terms of frequency and duration. In order to address the hypothesis of this study, Duke Activity Status Index Surveys were collected and statistically analyzed to formulate a conclusion. The data was used to compare mean and percentage differences between each of the three time segments.

Measures Used

The Duke Activity Status Index is a questionnaire used in CFRH's Cardiac Rehabilitation Center to calculate a patient's functional capacity. The questions on the survey are related to activities of daily living (ADL's). This survey is a Standard Operation Procedure (SOP) across Secondary Prevention Programs to assess the patients' progress at sessions 1 ("pre"), 18 ("midpoint"), and 36 ("post"). This study used a correlative and quantitative approach in determining increases in functional capacity. It addresses patient metabolic equivalent scores. This numerical data was used to evaluate which of the three time-segments demonstrated the greatest increases in functional capacity, and the program as a whole.

Per requested by email, a total of eleven (n=11) surveys were collected from the exercise physiologist at CFRH's Cardiac Rehabilitation Center. This facility was chosen, as it was the closest and had the most convenient access to collect the data. Surveys were then assigned specific numbers from 1 through 11 for identification purposes due to the anonymous nature of this study. Personal information other than data scores was not revealed.

Strict criterion of this study limited participation to patients 65 and older, had experienced their first myocardial infarction (MI), and subjects must have completed all 36 sessions of Cardiac Rehabilitation. This specific population was chosen to narrow the focus of this study. The limitation to patients 65 and older was due to the relevance of Medicaid/ Medicare and program benefits. Including only patients who have had one MI resulted in less possibility for other confounding variables. Additionally, the completion of all 36 sessions provided the necessary panoramic information for this study and to explore the benefits of adherence to the program for maximal gains in functional capacity.

After collection of the surveys, they were taken to The Computing and Statistical Technology Laboratory (CASTLE) in the Teaching Academy on the University of Central Florida's Main Campus to be quantitatively analyzed. To discern effectiveness of program design, sessions 1-18, 18-36, and 1-36 were each statistically analyzed for the greatest increases in functional capacity. The descriptive statistics were represented in the form of a graph and table (refer to Appendices) for visual representation of patient outcomes.

The Duke Activity Status Index survey was used as the primary method of research for this study in measurement of patient outcomes. It provided an easy and inexpensive strategy that was also deemed a valid self-report tool (Rankin, 2002).

The results and limitations discussed in the following chapter will provide insight into Cardiac Rehabilitation and enable the formation of conclusions to the questions proposed in this study.

Chapter 4: Results and Limitations

The purpose of this study was to discern the effectiveness of cardiac rehabilitation/

secondary prevention programs (CR/ SPP's) by evaluating increased functional capacity in the

form of MET (metabolic equivalent) scores post-myocardial infarction (MI) or heart attack. This

chapter includes an explanation of the findings, along with the limitations that may have effected

the results.

Survey Results

The data were expressed in three different ways to analyze functional capacity outcomes

for the 11 participants. The first analysis showed mean MET scores of 6.21 at "pre", 7.59 at

"midpoint", and 8.15 at "post". These results are represented in Graph 1 in Appendix C for

visual effect. This graph is valuable to see the end change in functional capacity as it predicts a

possible plateau occurring after session 36.

The second analysis was the average change over time in MET scores. These were

1.38, .56, and 1.93. This analysis reveals the amount of increases in functional capacity the 11

participants achieved.

In the third analysis, the data is represented in percent change over time. Session 1

through 18 showed the largest average increase of 27%. Session 18 through 36 revealed a lower

average increase of 8%. As a whole the total average increase in functional capacity was 36% for

the 11 participants. This data is also represented in Appendix D as Table 1. The table shows

individual results listed along with their specific calculations. Only three participants showed no

increases in functional capacity however, this does not mean their scores were 0. It signifies

there were no changes in MET scores for increased or decreased functional capacity. Specific results such as this would require further investigation of other factors involved with these participants to explain their outcomes.

Limitations

The anonymous surveys allowed for a basic knowledge of how effective participation in Cardiac Rehabilitation is for post-myocardial infarction patients. There are limitations to this study due to specific unknown information such as age, gender, self-reported, comorbidities, psychological status, functional capacity status prior to heart attack, and sample size.

Age plays a role in recovery and responses to exercise prescription. The results from this study could be better understood if ages were known to compare outcomes between age brackets (Fleg, 2000).

Gender is an important factor regarding any exercise program. Women and men respond differently to exercise and improvements are attained at different rates (Beckie, 2013).

Although self-reported surveys are used across all CR programs, they may be seen as a limitation if patients underestimate or overestimate their abilities. Baseline data reports may be most affected by this. Patients recently released from the hospital may not yet have a clear idea of their capabilities.

Comorbidities play a major role in patients' functional capacity outcomes. Other chronic illnesses that require patients to take medications, such as hyperlipidemia and diabetes mellitus, may inhibit exercise responses and performance. The metabolic effects of having multiple chronic diseases may slow down an individual's progress (Marzolini, 2012).

Psychological status may alter a person's drive and motivation towards recovery. The event of a heart attack can have a significant impact on mental wellness. The fear of exercise may prevent them from gaining the most benefits (Shepherd, 2012).

Knowing the prior functional capacity status of the patient would benefit all hospital personnel. This information allows for a better prediction of functional capacity outcomes when attending SPP's.

Finally, the sample size of this study was relatively small. A larger sample size could allow for more comparisons across variables, and would allow for the ability to generalize to a larger population.

Chapter 5: Conclusions

Preliminary investigation of this research was initiated due to the chronic illness that is taking the greatest number of lives: Cardiovascular Disease. This topic addresses a large portion of the population afflicted by CVD. This thesis sought to educate and inform those who are currently suffering, along with those who are caretakers of loved ones affected by this debilitating disease. With highest intentions, this study sought to bring forth valuable preliminary information that may improve all phases of Cardiac Rehabilitation.

Results in this study demonstrated effectiveness in Cardiac Rehabilitation/ SPP's when post-myocardial infarction patients complete all 36 sessions. The Duke Activity Status Index survey revealed stronger increases in functional capacity in the first half of the program. The second half of the program showed lower average increases than the first half. This evidence is significant when evaluating program design and effectiveness. Overall, Cardiac Rehabilitation/SPP's remain a safe and effective program for post-myocardial infarction patients.

The Duke Activity Status Index (DASI) is a self-report tool that which may be questioned as a valid estimation of functional capacity. Through research and the use of the survey in this study, the implementation of the DASI as part of a standard protocol is a valid estimation of maximal oxygen uptake. The survey is low cost and is safer for high-risk patients.

Perhaps, the relationship of the current program design is directly related to the amount of sessions in the CR program and allowances from insurance companies. Patients receiving Medicaid/ Medicare are not burdened from a financial standpoint however, results from this

study show program design in terms of frequency and duration may not be optimal. Further research is needed to determine the best method of improving patient outcomes.

Chapter 6: Implications

This study seeks to benefit numerous disciplines in the healthcare fields such as exercise physiologists, doctors, and nurses. They work closely together in all three phases of Cardiac Rehabilitation.

Practical implications for exercise physiologists include initiating necessary process changes. Programs will continue unchanged unless research is considered. This study hopes to inspire those already working in the field, or healthcare professionals beginning to seek insight into how the exercise program design could be enhanced. This could promote patient attendance rates. A successful program with high attendance rates may persuade others to do the same.

This study also seeks to promote future research. Expansion of the focus of this study will lead others to question the current practices and will give a foundation to build upon.

Most of all, hospitals and insurance companies will be the main beneficiaries of this research. Phase 1 of CR starts in the hospital before the patient is discharged. The statistics from this research will directly help the hospital and the patient.

First, CR is usually affiliated with a hospital. Patients in recovery need informational tools such as pamphlets to read and take home. Having this research on paper, along with the

data on increased functional capacity may positively influence patient attendance rate and adherence until completion of all 36 sessions. And since the physician referral rate is lacking, this study hopes to bring awareness of CR programs to individuals with heart conditions.

Next, actuaries are individuals who work for insurance companies, Medicaid, and Medicare that assess risk and the cost/benefit of programs. This study may assist them to a better understanding Cardiac Rehabilitation program design, taking these results into consideration when determining the appropriate length of future programs.

To conclude, implications of this thesis will encompass a wide spectrum of beneficiaries. The results indicated an area in Secondary Prevention Programs that needs to be addressed. Increasing functional capacity is life changing for post-myocardial infarction patients. Overall, these programs provide an invaluable service. Furthermore, the effectiveness of Cardiac Rehabilitation depends on the constant improvements of the program. This study suggested the relationship of the final metabolic equivalent scores to average increases in functional capacity that were required in answering questions to support the hypothesis.

Chapter 7: Future Research

Expansion upon this research should include a larger sample size with comparison between genders and age brackets. There is a need to separate the analyses with gender and compare results between men and women due to the difference in responses to exercise prescription. Further analyzing and comparing increased functional capacity in individuals within age brackets of 50, 60, and 70 year olds within genders who completed CR, will provide the necessary information to improve and tailor the program to individual needs.

Future analysis of those who completed less than 36 sessions would determine appropriate measures to have in place to increase adherence. This information will also help those in the healthcare fields stay informed of factors that may contribute to the dropout rate.

Also, investigating the correlation of increased functional capacity and body fat percentage or with weight lost during the program could be a logical extrapolation. Certain risk factors such as waist circumference measurements are associated with cardiovascular disease. This measurement could be established as part of a routine procedure to track patient's decreased risk of another cardiac event or increasing functional capacity.

Last, research in expanding this study may include examining individuals using the Dartmouth Quality of Life Index survey in relation to increases in functional capacity. This survey is also used at Central Florida Regional Hospital's Cardiac Rehabilitation Center. It

examines various aspects of the patient's overall well being such as feelings, pain, social support and more. These are important factors to consider after having a heart attack and could affect the patient's outcome in the program. If the individual is suffering from loneliness and discomfort, their ability to motivate themselves will be decreased and in turn their outcomes will be less than satisfactory. This follows a negative, cyclical pattern in which this research can supplement the appropriate design of interventions.

Appendix A: Duke Activity Status Index Survey Example

Duke Activity Status Index

Overview:

The Duke Activity Status Index is a self-administered questionnaire that measures a patient's functional capacity. It can be used to get a rough estimate of a patient's peak oxygen uptake.

Item	Activity	Yes	No
1	Can you take care of yourself (eating dressing bathing or using the toilet)?	2.75	0
2	Can you walk indoors such as around your house?	1.75	0
3	Can you walk a block or two on level ground?	2.75	0
4	Can you climb a flight of stairs or walk up a hill?	5.50	0
5	Can you run a short distance?	8.00	0
6	Can you do light work around the house like dusting or washing dishes?	2.70	0
7	Can you do moderate work around the house like vacuuming sweeping floors or carrying in groceries?	3.50	0
8	Can you do heavy work around the house like scrubbing floors or lifting and moving heavy furniture?	8.00	0
9	Can you do yardwork like raking leaves weeding or pushing a power mower?	4.50	0
10	Can you have sexual relations?	5.25	0
11	Can you participate in moderate recreational activities like golf bowling dancing doubles tennis or throwing a baseball or football?	6.00	0
12	Can you participate in strenuous sports like swimming singles tennis football basketball or skiing?	7.50	0

Duke activity status index =

= SUM(values for all 12 questions)

Interpretation:

• maximum value 58.2

• minimum value 0

estimated peak oxygen uptake in mL/min =

= (0.43 * (duke activity status index)) + 9.6

Appendix B: IRB Approval Letter

From : **UCF Institutional Review Board #1**
FWA00000351, IRB00001138

To : **Thomas J. Fisher and Co-PI: Kristin M. Badillo**

Date : **March 25, 2015**

Dear Researcher:

On 03/25/2015 the IRB determined that the following proposed activity is not human research as defined by DHHS regulations at 45 CFR 46 or FDA regulations at 21 CFR 50/56:

Type of Review:	Not Human Research Determination
Project Title:	Effectiveness of Participation in Cardiac Rehabilitation: Secondary Prevention Increases Functional Capacity in Post-Myocardial Infarction Patients
Investigator:	Thomas J Fisher
IRB ID:	SBE-15-11193
Funding Agency:	
Grant Title:	
Research ID:	n/a

University of Central Florida IRB review and approval is not required. This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are to be made and there are questions about whether these activities are research involving human subjects, please contact the IRB office to discuss the proposed changes.

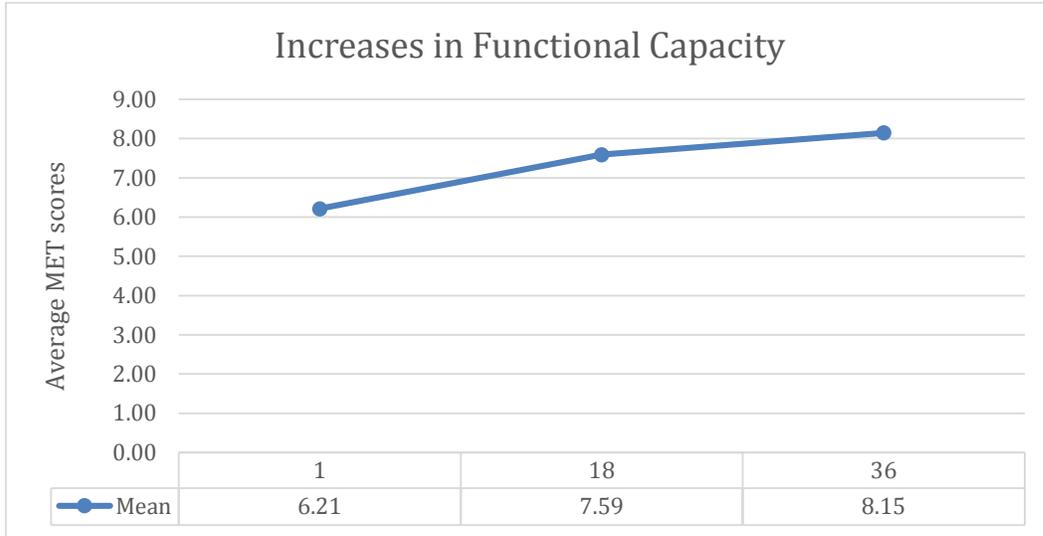On behalf of Sophia Dziegielewski, Ph.D., L.C.S.W., UCF IRB Chair, this letter is signed by:

Joanne Muratori

Signature applied by Joanne Muratori on 03/25/2015 03:09:31 PM EDT

IRB manager

Appendix C: Graph 1

Graph 1

Increases in Functional Capacity

	1	18	36
Mean	6.21	7.59	8.15

Y-axis: Average MET scores (0.00 to 9.00)

Appendix D: Table 1

Table 1

Participant	1 to 18	18 to 36	1 to 36
1	58%	0%	58%
2	0%	0%	0%
3	36%	0%	36%
4	87%	18%	121%
5	0%	47%	47%
6	0%	0%	0%
7	32%	7%	42%
8	14%	20%	38%
9	0%	0%	0%
10	12%	16%	29%
11	52%	-16%	28%
Mean	**27%**	**8%**	**36%**

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