BEST NURSING PRACTICES IN CARDIAC REHABILITATION

by

BRIANNA KRISTINE D'ANGELO

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Dr. Melissa Goldsmith

Abstract

Purpose: This thesis aims to develop a set of best practice recommendations for nursing in the cardiac rehabilitation (CR) setting. The objective is to increase access and adherence to CR programs while improving outcomes in patients who have experienced acute myocardial infarction (AMI).

Background: AMI is one of the leading causes of death and physical disability in developed nations (Zhang, Cao, Jiang, & Tang, 2018). Unfortunately, only about 20 percent of eligible patients will participate in a CR program after experiencing a qualifying cardiac event (Agency for Healthcare Research and Quality, 2019). It is estimated that increasing CR participation from 20 percent to 70 percent could save nearly 25,000 lives and prevent about 180,000 hospitalizations a year (Agency for Healthcare Research and Quality, 2019).

Approach to practice: A review of literature was conducted in the CINHAL Plus database. The search parameters included peer reviewed articles that were published within the last 10 years. Key words used in the search of literature search included “cardiac rehab or cardiac rehabilitation” in addition to “exercises,” “resistance training,” “home-based,” “telehealth,” and “COVID-19.”

Outcomes: The proposed best practices can be used to identify components that should be included in a quality CR program as well as evidence-based suggestions to increase CR access and adherence.

Conclusions: Home-based CR programs may offer a way to increase access and adherence to CR programs while improving patient outcomes. More research is needed to determine specific practices that may improve patient outcomes in CR.

CHAPTER 1

Introduction

Statement of Purpose

This thesis aims to develop a set of best practice recommendations for nursing in the cardiac rehabilitation (CR) setting. The objective of defining these recommendations is to increase access and adherence to CR programs while improving outcomes in patients who have experienced acute myocardial infarction (AMI). This thesis will further explore types of exercises undertaken by participants in CR programs, health education provided to patients in CR programs, and the most effective CR program delivery routes. Components of CR will be examined to determine a standard of practice that results in the best clinical outcomes for patients who attend the program.

The background of cardiovascular disease (CVD) and AMI will be discussed including their prevalence and effect on patient populations. Current practice guidelines and inclusion requirements as determined by the American Heart Association will also be considered. The target outcomes of cardiac rehabilitation will be defined and a plan for implementation of best practice into nursing care will be established. The question that this thesis aims to answer is: What are the best evidence-based nursing practices in cardiac rehabilitation for improving access, adherence, and outcomes in patients who have experienced AMI, given a review of research from the last ten years?

Background of Issue Importance

Acute myocardial infarction is one of the leading causes of death and physical disability in developed nations (Zhang, Cao, Jiang, & Tang, 2018). It affects three million people worldwide, causing more than one million deaths annually in the United States alone (Mechanic

& Grossman, 2019). AMI is considered an acute coronary syndrome (ACS) along with unstable angina (Saleh & Ambrose, 2018). AMI occurs due to a reduction or lack of perfusion to coronary arteries. The resulting lack of oxygen delivery to the cardiac myocytes causes irreversible damage (Mechanic & Grossman, 2019). Myocardial infarction often occurs secondary to coronary artery disease, which causes the hardening and narrowing of the heart's blood vessels (McCance & Huether, 2010). Coronary artery disease affects more than 16 million people in the United States, and risk factors include dyslipidemia, hypertension, cigarette smoking, diabetes, obesity, sedentary lifestyle, and an atherogenic diet (McCance & Huether, 2010). These conditions promote plaque-formation. Red blood cells can aggregate on large plaques, causing the plaque to come free from the vessel wall and create a thrombus that can occlude the coronary vessels. It should be noted that a thrombus is not necessary for AMI to occur. Other possible etiologies include systemic hypotension and increased myocardial oxygen demand (Saleh & Ambrose, 2018).

Acute myocardial infarction includes cardiac events such as ST-segment elevated myocardial infarction (STEMI) and non-ST-segment elevated myocardial infarction (NSTEMI). These terms are used to categorize the severity and subsequent cardiac damage that occurs to the cardiac muscle (McCance & Huether, 2010). When a STEMI occurs, ischemia and damage to the heart tissue occurs from the outermost epicardium through to the innermost endocardium. Following a STEMI, an electrocardiogram (EKG) will show an elevation in the ST segment (McCance & Huether, 2010). When a NSTEMI occurs, the area of necrosis in extends into the endocardium, but does not transverse the myocardium and epicardium (McCance & Huether, 2010). If a thrombus is the cause of the NSTEMI, it breaks up before complete necrosis of the cardiac muscle can occur.

The first line of treatment for AMI is administration of anti-thrombotic drugs, used to break up blood clots blocking the artery (Cleveland Clinic, 2019b). Drugs such as aspirin, heparin, anti-platelet drugs, or thrombolytic therapy ("clot busters" such as tissue plasminogen activator/ tPA) should be given as soon as possible when an AMI is suspected (Cleveland Clinic, 2019b). The next line of treatment is percutaneous coronary intervention (PCI), which involves inserting a catheter into the coronary arteries. A balloon may be used to open the artery at the site of the blockage and a stent may be placed. The third line of treatment, and the most invasive, is coronary artery bypass surgery. If less invasive treatment methods are ineffective at restoring normal blood flow, then the patient may require this surgery to create new pathways for blood flow in the heart. Grafts are created from the patient's own vasculature and then attached below the site of the blockage to reroute blood flow (Cleveland Clinic, 2019a). American College of Cardiology and the American Heart Association guidelines detail that patients experiencing AMI should be receiving PCI 90-minutes after arrival to the Emergency Department, to minimize damage to the heart and promote positive outcomes (Cleveland Clinic, 2019b).

After patients have undergone treatment and had a period of recovery after their cardiac episode, they may be referred to a CR program. The recovery time required before CR will vary between patients based on which treatment they require, and their physical ability afterwards, as determined by their physician. CR programs offer a non-invasive approach to wholistic patient recovery. These programs often include cardio and strength training exercise components and patient education under the supervision of health care professionals (Zheng et al., 2018). According to the American Heart Association, research indicates that participation in a cardiac rehabilitation program can lower patients' risk for a future cardiac event, promote weight loss, promote heart-healthy eating, and give patients the physical ability to return to work (American

Heart Association, 2016). Additionally, research suggests that cardiac rehabilitation reduces risk of hospital admissions by 31 percent and risk of cardiovascular deaths by nearly 30 percent (Agency for Healthcare Research and Quality, 2019). One study found that healthcare costs associated with heart attack hospital admissions were reduced by at least $8.5 million a year due to implementation of CR programs (American Heart Association, 2015). Another study found that CR participation reduced costs associated with follow-up cardiac admissions by $900 per patient (American Heart Association, 2015).

A 2007 update by the American Heart Association outlined core components of CR programs. According to the update, all CR programs should include baseline patient assessment, nutritional counseling, risk factor management (including lipid, blood pressure, weight, diabetes, and smoking management), psychosocial interventions, physical activity advisement, and exercise training (Balady et al., 2007). Exercise training should be composed of both aerobic and resistance training. Each individualized exercise plan is developed by nurses or other healthcare professionals and then reviewed by a physician (Balady et al., 2007). This thesis will review the latest evidence-based research and combine it with current recommendations to develop a comprehensive protocol for CR programs.

Significance to Nursing

Nurses often supervise CR programs; they are responsible for creating individualized exercise plans, monitoring patients' conditions during exercise, and providing health education during the program (American Heart Association, 2016). It is essential that nurses providing CR are informed on the best evidence-based practices, so that CR can be accessed by more patients and programs can yield the best results. Knowledge of CR is also important for nurses not directly involved in delivering CR services. More than half of men and over one third of women

over the age of 40 will acquire coronary artery disease, placing a large portion of the population that nurses care for at risk for experiencing cardiac events (McCance & Huether, 2010). It is important that nurses are aware of evidence-based interventions that will promote optimal recovery after a cardiac event occurs so that they can encourage attendance after hospital discharge. Unfortunately, only about 20 percent of eligible patients will participate in a CR program after experiencing a qualifying cardiac event (Agency for Healthcare Research and Quality, 2019). It is estimated that increasing CR participation from 20 percent to 70 percent could save nearly 25,000 lives and prevent about 180,000 hospitalizations a year (Agency for Healthcare Research and Quality, 2019). Nurses are in an ideal position to encourage participation in CR participation due to their role in direct patient care and patient education.

Summary

Cardiac rehabilitation is a proven method for reducing hospital readmissions and reducing length of stay after patients have experienced a cardiac event (Thomas et. Al, 2019). There is a urgent need to increase CR participation after experiencing a cardiac event. The purpose of this thesis is to provide best practice recommendations for nursing in the CR setting with a goal of improving access, adherence, and outcomes for patients who have experienced AMI. Coronary artery disease, a risk factor for AMI, affects more than 16 million people in the United States, making best practice guidelines for CR even more imperative. This thesis will explore the latest research regarding CR exercises, health education, and program delivery routes. After reviewing the literature, a set of best practice recommendations will be created, combining new interventions with existing recommendations.

CHAPTER 2

Review of Literature

Chapter two will address scientific literature regarding current findings in CR practice. A review of current literature was conducted in the CINHAL Plus database. The search parameters included peer reviewed articles that were published within the last 10 years. Key words used in the search of literature search included “cardiac rehab or cardiac rehabilitation” in addition to “exercises,” “resistance training,” “home-based,” “telehealth,” and “COVID-19.” Articles were selected based on their ability to provide high levels of evidence for innovative and effective CR practices. Additionally, articles were selected on their ability to increase access and adherence as an alternative to the traditional CR format. A total of seven articles met the selection criteria and were included for review. The level of evidence in the selected articles ranges from level II to level VI with most articles falling under the level II category. The evidence-based articles included in this review will be used to formulate best practice recommendations to increase access, adherence, and improve patient outcomes in CR.

Exercise Interventions

A meta-analysis of quasi-experimental studies by Gerlach et al. (2020) studied whether treadmill-based or cycling-based programs would be more efficient in increasing functional capacity (measured by VO2 peak) in the CR setting. The VO2 peak refers to peak oxygen consumption by the tissues, and it is used as an indicator of aerobic fitness (Gerlach et al., 2020). The analysis included 23 studies with over 600 patients. All patients were over 18 years old, had either coronary artery disease or chronic heart failure, and were enrolled in a CR program that used single modality continuous exercise (either treadmills or cycle ergometers) (Gerlach et al., 2020). Overall, the study found that CR using a single modality was effective at increasing

functional capacity ($p < .0001$). Between the two groups, the cycling-based program was found to have a greater impact on increasing functional capacity than the treadmill-based program ($p < .001$) (Gerlach et al., 2020). This analysis was strengthened by its use of studies that included randomization and by use of specific inclusion criteria. However, it was limited by a relatively small number of selected studies that met inclusion criteria with many of the studies having small sample sizes. In addition, the analysis found there were high levels of statistical heterogeneity between the studies included (Gerlach et al., 2020). The findings from this research are important because single-modality programs can create more opportunities for CR when elaborate gyms are not available. Additionally, this study demonstrates that when patients are unable to use a treadmill due to balance/gait issues, a cycling-based regimen can be an effective alternative (Gerlach et al., 2020).

While single-modality programs may produce promising results, current guidelines recommend a mix of aerobic and resistance training in CR programs (Balady et al., 2007). A randomized control trial conducted by Turban, Culas, & Deley (2014) aimed to compare elastic band resistance training with traditional weight-based training in the CR setting. The study participants included 18 patients recruited from an ambulatory CR program. Half were randomly assigned to complete resistance training with elastic bands while the other half used weight machines. Both groups completed two sessions per week with four sets of 12 contractions for each muscle group worked (Turban et al., 2014). The study found that both modalities elicited significant improvements in the 6-minute waking test and the 200m walking test ($p < 0.05$). Additionally, there were significant increases in elbow and knee extensor muscle strength from both groups ($p < 0.05$), as measured by an evaluation of knee and elbow extensor maximal strength before and after completing the program. Finally, peak workload was measured by

having patients perform a symptom-limited exercise test, a significant increase was reported from both groups ($p < 0.05$) (Turban et al., 2014). For each of these three measurements, there were no significant differences in effectiveness between the weight machine and elastic band groups. The results of this study indicate that elastic bands are as effective as standard weight machines when used for resistance training in CR programs (Turban et al., 2014). These results are important because elastic bands are economical and easy to transport which may allow CR programs to expand or easily offer at-home programs. Limitations to this study included use of a small sample size and technical difficulties that prevented measurement of gas-exchange during the symptom-limited exercise test (Turban et al., 2014).

A randomized trial conducted by Prabhakaran et al. (2020) sought to determine whether yoga would be an effective alternative to traditional CR in patients who had experienced AMI. The studied population included 3,959 patients aged 18-80 across various medical centers in India. Only patients who had experienced an AMI within 14 days and did not regularly practice yoga were eligible (Prabhakaran et al., 2020). Half of the patients were assigned to the yoga group while the other half received enhanced standard care (ESC). Those assigned to the yoga group completed the Yoga-CaRe program which was specifically developed by yoga and CR experts. This program was piloted and refined before use in the trial. The ESC group received three sessions of educational advice, but no formal exercise intervention. Major cardiovascular events (MACE) and self-rated health were recorded from both groups. MACE was defined as death from any cause, nonfatal MI, nonfatal stroke, or emergency cardiovascular hospitalization (Prabhakaran et al., 2020). The trial found that the incidence of MACE in the yoga group was lower; however, the results were not statistically significant. The Yoga-CaRe program reduced the odds of having poor self-rated health at 12 weeks to a greater extent than the enhanced

standard care ($p < 0.001$). Additionally, the Yoga-CaRe group experienced a greater return to their pre-infarct activities as compared to the ESC group ($p < 0.05$) (Prabhakaran et al., 2020). Limitations of this study include a lack of elderly female patients represented in the sample, and an inability to compare the yoga-based program to a traditional CR program due to a lack of CR facilities in India. In conclusion, this study found that yoga-based CR was more beneficial than no CR in improving self-rated health and return to pre-infarct activities in patients who experienced AMI (Prabhakaran et al., 2020). These findings offer a promising alternative for AMI patients when traditional CR programs are not available or when attending one is not feasible.

Program Delivery and Patient Education

New models of CR delivery are being considered, as traditional in-person programs are not accessible for all patients. Technology is often paired with home-based models to encourage patient adherence. A randomized control trial conducted by Varnfield et al. (2014) tested if a home-based CR using a smartphone-based Care Assessment Platform (CAP) was effective in comparison to traditional center-based programs. The studied population included 160 post-MI patients in four CR centers across Australia (Varnfield et al., 2014). Half of the sample population was randomly placed into the traditional program while the other half was placed into the home-based program. The traditional program consisted of two exercise sessions and one educational session per week for six weeks. Alternatively, each home-based participant was given a smartphone preinstalled with a health diary and an activity monitoring application, a blood pressure cuff, and a scale (Varnfield et al., 2014). Participants in the home-based group attended weekly phone consultations with trained mentors. The home-based participants aimed for 30 minutes of moderate activity most days of the week, with walking being the primary form

of exercise. After six weeks of structured programs, participants from both groups were encouraged to continue maintaining exercise and health practices developed throughout the program during a six-month self-management phase. During this period, participants in the home-based group could keep their smartphones and monitoring devices.

The home-based CR program had significantly higher rates of uptake (1.3 times higher), adherence (1.4 times higher) and completion (33 percent higher) in comparison to the traditional CR program (Varnfield et al., 2014). Additionally, the home-based CR was as effective as the traditional program in increasing functional capacity as measured by a six-minute walking test at six weeks and six months. Both groups had significant improvements in the six-minute walking test at the six-week mark which was maintained at the six-month evaluation (Varnfield et al., 2014). Only the home-based CR group showed significant decreases in anxiety scores as measured by the Depression Anxiety Stress Scales (DASS) as well as decreases in psychological distress as measured by the Kessler 10 Psychological Distress Scale (K10) (Varnfield et al., 2014). The largest limitation to this study was its small sample size due to considerable dropouts, additionally the patients were not able to be blinded to the intervention due to the nature of the study (Varnfield et al., 2014). In conclusion, home-based cardiac rehabilitation using an innovative smartphone-based program was found to increase patient uptake, adherence, and completion of a CR program while continuing to provide lasting health benefits (Varnfield et al., 2014).

While the previous study evaluated the model in which CR was delivered, the following study focuses on the delivery of patient education within a CR program. A cluster randomized control trial conducted by Zhang et al., (2019) aimed to determine if educating patients on links between endothelial pathophysiology and health behaviors could improve knowledge of

management of cardiovascular disease (CVD) and enhance perception of the CR program. The sample population included 94 new patients, divided into twenty-one orientation groups, referred to the CR program at St. Joseph's Hospital in Canada (Zhang et al., 2019). The CR orientation groups were then randomly assigned to receive either usual care (control) or usual care with causal information (intervention). Causal information involves explaining the mechanisms as to why or how outcomes occur (Zhang et al., 2019). The causal information presented included basic endothelial pathophysiology and how the changes that occur with CVD can be mitigated with exercise.

The orientation groups receiving the intervention had an additional 10-15-minute presentation regarding casual information and a two-page booklet covering endothelial pathophysiology (Zhang et al., 2019). After the information session, participants from both groups were assessed using a questionnaire to determine factual knowledge about CVD and an expert reasoning task designed to measure deep knowledge of CVD management (Zhang et al., 2019). The study found that after controlling for educational levels, the participants in the intervention group demonstrated deeper knowledge and greater factual knowledge about cardiovascular management that their counterparts in the control group. Additionally, participants who received the intervention rated the program as more credible than those in the control group (Zhang et al., 2019). Study limitations include a low participation rate and small sample size as well as failure to measure patient knowledge before the intervention. In conclusion, the results of this study indicate that presenting patients with causal information can affect their beliefs about CR, enabling them to better understand its importance (Zhang et al., 2019). It can be postulated that these effects would translate into increased adherence; however, further research is needed to confirm this prediction.

A randomized control trial conducted by Dale et. al (2015) tested a technology-based CR component in addition to traditional in-person CR. This study aimed to determine if the Text4Heart CR program, delivered through mHealth, would be effective at improving adherence to healthy lifestyle behaviors when used in addition to a traditional CR program (Dale et al., 2015). The studied population included 123 adults diagnosed with coronary heart disease (CHD) and recruited from in-patient care at two large hospitals in New Zealand (Dale et al., 2015). All participants were enrolled in a traditional CR program that included six sessions of an educational program and 16 sessions of supervised exercise. In addition, the intervention group was enrolled in the mHealth Text4Heart program which took place over 24-weeks (Dale et al., 2015). The participants in the intervention group received one text message per day, a pedometer, and access to a website with resources. The participants were encouraged to respond to the messages with their weekly pedometer step count as well as with questions for the healthcare team (Dale et al., 2015).

Outcomes were measured at three and six months using a self-reported health behavior score based on the European Prospective Investigation into Cancer (EPIC)-Norfolk Prospective Population Study (Dale et al., 2015). The health behaviors based on recommended guidelines included smoking habit, fruit and vegetable intake, alcohol intake, and physical activity. Medication adherence was recorded using the Morisky 8-item Medication Adherence Questionnaire. At the three-month mark, the intervention group was found to have significantly increased adherence to the measured health behaviors in comparison to the control group ($p = .03$); however, there results were not maintained at 6 months (Dale et al., 2015). Additionally, the intervention group had greater medication adherence scores ($p = .004$) (Dale et al., 2015).

Overall, the participants received the technology-based component of the program very well. Eighty-five percent of participants in the Text4Heart program reported reading their text messages, and 90 percent reported that text messaging was a good method of program delivery (Dale et al., 2015). Limitations of this study include a limited sample size and the use of self-reported outcomes which could lead to recall bias. In conclusion, the Text4Heart intervention significantly improved participant adherence to health behaviors and medication regimen at three months when used in conjunction with a traditional CR program (Dale et al., 2015). Further research is needed to determine whether this finding has clinical relevance and whether changes to the program could extend results past three-months.

A quality improvement project utilizing retrospective chart review conducted by Prasada, Rambarat, Winchester, & Park (2020) sought to document outcomes of implementing a home-based cardiac rehabilitation (HBCR) program at a Veterans Affair Medical Center. The studied population included 231 CR-eligible veterans at Malcom Randall Veterans Affairs Medical Center. A total of 136 veterans completed the HBCR program while 95 received usual care and did not participate in any CR program (Prasada et al., 2020). The HBCR program took place over 12 weeks and was overseen by two full-time nurses. The participants were provided with resistance bands, peddler, pedometer, BP cuff, weight scale, and educational materials detailing a cardiac-healthy diet (Prasada et al., 2020). Participants exercised for up to two hours per day and attended a weekly 30-60 minute consultation with a registered nurse (RN) monitoring for compliance with exercise training.

Measured outcomes for participants in the HBCR program included Life's Simple 7 assessment (measure of overall cardiovascular health), 6-minute walk test (measure of overall physical status), Duke activity status index (DASI) (measure of functional ability), and the 36-

Item Short Form Health Survey (SF-36) (measure of health-related quality of life) (Prasada et al., 2020). Between the HBCR group and the Usual Care group, medical records were monitored for death, MI, and readmission to the VA hospital for heart failure within one year. The data analysis found significant improvements in the Simple 7 ($p < 0.0001$), DASI ($p = 0.0005$), 6-minute walk test ($p = 0.0215$), SF-36 physical functioning ($p = 0.0014$), SF-36 bodily pain ($p = 0.034$), and SF-36 vitality ($p = 0.015$) in comparison to before completion of the HBCR program (Prasada et al., 2020). One-year survival and MI rates were not significantly different between the usual care and HBCR groups; however, admission to the hospital for heart failure was significantly reduced in the HBCR group ($n = 9$ versus $n = 17$, $p = 0.005$) (Prasada et al., 2020). Additionally, 72 percent of veterans who completed HBCR reported that they were "very satisfied" with the program.

This study is limited by the nature of the study design as a quality improvement project with retrospective data collection rather than a controlled research trial. This design limits the amount and type of data that could be collected as well as the ability to control for outside variables. In conclusion, this quality improvement program demonstrated significant improvements in measured patient outcomes before and after completing the program as well as a reduction in hospital readmissions in comparison to eligible patients who did not complete the HBCR program (Prasada et al., 2020). In addition, the researchers reported an estimated 50 percent cost reduction from providing HBCR in comparison to the costs associated with covering in-person community-based CR for veterans (Prasada et al., 2020).

Conclusion

The articles reviewed in chapter two addressed many alternatives to traditional CR programs that serve to increase access and adherence while improving outcomes among patients who have experience AMI. The articles featured in the literature review focus on exercise interventions as well as program delivery and patient education methods used for CR. The literature suggests that there are many options for increasing patient access and adherence to CR programs, including the use of single modality-based programs, technology-based programs, home-based program delivery, and enhanced patient education (Gerlach et al., 2020; Prasada et al., 2020; Varnfield et al., 2014; Zhang et al., 2019).

Home-based CR and technology-based applications for CR were supported by the most evidence in this review. Home-based care that utilizes technology is especially relevant to the current pandemic because many hospitals had to limit face-to-face rehabilitation services. Home-based care can help to prevent transmission of the virus to vulnerable patient populations at a high risk for morbidity and mortality related to COVID-19 (Bryant & Sharafkhaneh, 2020). The COVID-19 pandemic makes it imperative than an evidence-based protocol for home-based CR is developed. One common weakness of all included studies was the small sample size, and several utilized self-reported patient data to measure outcomes which could lead to recall bias. Additionally, more randomized control trials are needed to verify the preliminary evidence currently available in the literature.

CHAPTER 3

Best Practice Recommendations: Cardiac Rehabilitation

The purpose of this thesis was to create a set of best practice guidelines for the care of AMI patients in the cardiac rehabilitation setting. Much of the literature reviewed in chapter two focused on alternatives to traditional CR that can be used to increase CR attendance and adherence. The following recommendations, included in Table 1, are for nurses and other healthcare professionals to use when looking to improve upon or institute a CR program at their hospital. The following recommendations can also be used for healthcare professionals to better understand the types of CR interventions that can improve participant outcomes. It is important that healthcare professional know all the available options for CR so that they can refer patients to a program that will work best for them, encouraging attendance. The best practice recommendations will combine the American Heart Association's Core Components of Cardiac Rehabilitation with evidence unearthed during the review of literature from chapter two. Recommendations for practice from the America Heart Associations Core Components of Cardiac Rehabilitation are presented first in the table, followed by new recommendations based on the findings of this literature review. Together this information can serve to create a guide for increased participation in CR, increased adherence to the CR program, and improved outcomes after program completion.

Table 1:

Best Practice Recommendations for Cardiac Rehabilitation

Recommendation	Rationale	References	Level of Evidence
Provide the following for all participants in CR programs: • baseline patient assessment • nutritional counseling • risk factor management (lipid, blood pressure, weight, diabetes, and smoking management) • psychosocial interventions • physical activity advisement • exercise training	These components ensure that goals can be created, and participant progress can be monitored. Risk factor management is essential to managing cardiovascular disease with the end goal of reducing disability and promoting an active lifestyle.	Balady, G. J., Williams, M. A., Ades, P. A., Bittner, V., Comoss. P., Foody J. A., … Southard, D. (2007). Core components of cardiac rehabilitation/secondary prevention programs: 2007 update. *Circulation, 115*(20), 2675–2682. doi: 10.1161/CIRCULATIONAHA.106.180945	Level I
Provide aerobic exercise 3-5 days per week for 20-60 minutes using one or more of the following: • walking • treadmill • cycling • rowing • stair climbing • ergometry	Improves cardiovascular function and reduces patient global cardiovascular risk.	Balady, G. J., Williams, M. A., Ades, P. A., Bittner, V., Comoss. P., Foody J. A., … Southard, D. (2007). Core components of cardiac rehabilitation/secondary prevention programs: 2007 update. *Circulation, 115*(20), 2675–2682. doi: 10.1161/CIRCULATIONAHA.106.180945	Level I
		Varnfield, M., Karunanithi, M., Lee, C.-K., Honeyman, E., Arnold, D., Ding, H.,	Level II

		Smith, C., & Walters, D. L. (2014). Smartphone-based home care model improved use of cardiac rehabilitation in postmyocardial infarction patients: Results from a randomised controlled trial. *BMJ Heart, 100*(22), 1770–1779. doi: 10.1136/heartjnl-2014-305783	
		Gerlach, S., Mermier, C., Kravitz, L., Degnan, J., Dalleck, L., & Zuhl, M. (2020). Comparison of treadmill and cycle ergometer exercise during cardiac rehabilitation: A meta-analysis. *Archives of Physical Medicine & Rehabilitation, 101*(4), 690–699. doi:10.1016/j.apmr.2019.10.184	Level I
Provide resistance exercise 2-3 days per week with 10 – 15 repetitions and 1-3 sets of different exercises for the upper and lower body using one or more of the following: • elastic bands • weight machines • calisthenics • hand weights, free weights, or dumbbells • wall pulleys	Increases muscular endurance and strength while improving overall cardiovascular fitness.	Balady, G. J., Williams, M. A., Ades, P. A., Bittner, V., Comoss. P., Foody J. A., … Southard, D. (2007). Core components of cardiac rehabilitation/secondary prevention programs: 2007 update. *Circulation, 115*(20), 2675–2682. doi: 10.1161/CIRCULATIONAHA.106.180945	Level I
		Turban, C., Culas, C., & Deley, G. (2014). Effects of a short-term resistance program using elastic bands or weight machines in cardiac rehabilitation. *Science &*	Level II

		Sports, 29(3), 143–149. doi: 10.1016/j.scispo.2013.07.005	
Provide the option to participate in home-based CR as an alternative to center-based CR	Home-based CR can be effective at improving patient adherence to the CR program as well as improving patient outcomes. Additionally, home-based CR may be a safer alternative due to the COVID-19 pandemic.	Varnfield, M., Karunanithi, M., Lee, C.-K., Honeyman, E., Arnold, D., Ding, H., Smith, C., & Walters, D. L. (2014). Smartphone-based home care model improved use of cardiac rehabilitation in postmyocardial infarction patients: Results from a randomised controlled trial. *BMJ Heart, 100*(22), 1770–1779. doi: 10.1136/heartjnl-2014-305783	Level II
		Prasada, S., Rambarat, C., Winchester, D., & Park, K. (2020). Implementation and impact of home-based cardiac rehabilitation in a Veterans Affair Medical Center. *Military Medicine, 185(*5/6), 859–863. doi: 10.1093/milmed/usz366	Level VI
		Bryant, M. S., Fedson, S. E., & Sharafkhaneh, A. (2020). Using telehealth cardiopulmonary rehabilitation during the COVID-19 pandemic. *Journal of Medical Systems, 44*(7), 1–2. doi: 10.1007/s10916-020-01593-8	Level VII
Provide technology-based support to	Technology can be used to increase patient adherence and success in the CR program.	Varnfield, M., Karunanithi, M., Lee, C.-K., Honeyman, E., Arnold, D., Ding, H., Smith, C., & Walters, D. L.	Level II

supplement CR programs	(2014). Smartphone-based home care model improved use of cardiac rehabilitation in postmyocardial infarction patients: Results from a randomised controlled trial. *BMJ Heart, 100*(22), 1770–1779. doi: 10.1136/heartjnl-2014-305783	
	Prasada, S., Rambarat, C., Winchester, D., & Park, K. (2020). Implementation and impact of home-based cardiac rehabilitation in a Veterans Affair Medical Center. *Military Medicine, 185(*5/6), 859–863. doi: 10.1093/milmed/usz366	Level VI

Summary of Best Practice Recommendations

Due to the proven ability of cardiac rehabilitation to reduce risk of hospital admissions by 31 percent and risk of cardiovascular death by nearly 30 percent, it is essential that nurses work alongside other healthcare professionals to increase access and participation (Agency for Healthcare Research and Quality, 2019). However, access to these programs is often limited, and only about 20 percent of eligible patients participate in a CR program after experiencing a qualifying cardiac event (Agency for Healthcare Research and Quality, 2019). The review of literature in chapter two uncovered many evidence-based methods to improve CR access and attendance, in turn improving patient outcomes. In Table 1, the established Core Components of Cardiac Rehabilitation as defined by the American Heart Association were combined with evidence uncovered in the review of literature.

Core components of CR include baseline patient assessment, nutritional counseling, risk factor management (including lipid, blood pressure, weight, diabetes, and smoking management), psychosocial interventions, physical activity advisement, and exercise training (Balady et al., 2007). When possible, CR programs should include both aerobic and resistance exercises (Balady et al., 2007). However, when the goal is increasing program access, research suggests that single modality interventions can also be effective at improving patient outcomes (Gerlach et al., 2020). These interventions specifically include cycling, treadmill, walking, yoga, and resistance band exercises (Gerlach et al., 2020; Zhang et al., 2019; Prabhakaran et al., 2020; Turban et al., 2014). Additionally, evidence suggests that home-based CR can be an effective route for program delivery (Varnfield et al., 2014; Prasada et al., 2020). The COVID-19 pandemic has made it imperative to develop evidence-based methods for delivering CR in participants' homes (Bryant et al., 2020). Technology offers a promising mode for both HBCR delivery and as a supplemental resource for increasing adherence to traditional center-based programs (Varnfield et al., 2014; Dale et al., 2015). Providing access to a yoga-based program was supported by a single high-quality study, but more research is needed before it can be considered a best practice recommendation (Prabhakaran et al., 2020). In addition, providing participants with causal information on endothelial pathophysiology was supported by a single study; however, more research is needed before this can be included as a best practice recommendation (Zhang et al., 2019).

CHAPTER 4

Implementation and Evaluation

This chapter will outline the implementation and evaluation of an evidence-based hospital protocol for the delivery of cardiac rehabilitation. In the previous chapter, several best-practice recommendations were made for improving attendance and adherence to CR programs. Chapter four aims to create a feasible way to implement best practice recommendations into standard practice for post-AMI patients. If the patient's provider determines that he or she is a candidate for CR and makes a referral, then the nurse will be responsible for providing education and encouraging participation in a CR program at discharge. The protocol will be integrated into the electronic medical record (EMR). When a discharge order appears for an eligible AMI patient in the EMR, the new CR protocol will also appear. A sheet describing CR options and benefits will also be included in the discharge packet and thoroughly explained by the nurse at discharge. The nurse will document the patient's decision regarding CR and that data will be used to monitor the protocol's success. According to the evidence reviewed in this thesis, it is best practice to include an option for participation in both home-based and center-based CR to maximize participation and adherence. The patient can choose which option best suits their needs and schedule. Both the home-based and the center-based CR will include all the Core Components of Cardiac Rehabilitation as specified in the best practice recommendations in the previous chapter (Balady et al., 2007).

The Plan-Do-Study-Act (PDSA) cycle will be used for implementation and evaluation of the evidence-based protocol. The PDSA cycle is a proven tool used to test and refine a change according to the Institute for Healthcare Improvement (n.d.). The 'plan' and 'do' sections will specify the integration of the new protocol into hospitals while the 'study' and 'act' portions of

the cycle will be used to evaluate and act on the protocol's effectivity. After one cycle has been completed, the change will be refined based on feedback and results.

Plan. The 'plan' portion of the cycle involves creating an objective for the change, hypothesizing the results of the change, and developing a plan to test the change (Institute for Healthcare Improvement, n.d.). The plan will test the implementation of a CR protocol in a single hospital. The objective is to increase access and adherence to a CR program after discharge from the hospital post AMI. The planning phase will begin about a year before the change is implemented to ensure adequate time for the multi-step plan. The first component of the plan is to integrate best-practice recommendations into a comprehensive hospital protocol that creates a seamless transition between hospital care and a CR program that best fits the patient's needs and preferences. The planning portion will need to include an expert committee of cardiac unit nurses, nursing managers, cardiac rehabilitation nurses and staff, clinical nurse educators, physicians, physical therapists, IT staff, and any other primary stakeholders in the intervention. The committee will align the protocol with the needs of the specific hospital. The protocol will need to be approved by the hospital board and dispersed to all affected unit managers.

The second component of the plan involves creation of a home-based CR program. As most hospitals already have a center-based CR program on site or one that they refer patients to, it will be necessary for the expert committee to develop a home-based CR program that can deliver the same quality results. One suggestion for this program is to have the CR nurses record classes using the live video platform Zoom. Care providers will need to assess the technological needs of home-based CR participants at discharge. If the participants did not have a tablet or laptop computer, they will need to be loaned one from the hospital. Funding will need to be

obtained for the purpose of purchasing this technology. The IT department will assist with technology set-up during CR orientation. The nurses will conduct weekly check-ins via Zoom to assess patient progress. The nurses will refer to the EMR at each patient check in to document participant progress and compliance with the CR program.

The third component of the plan involves education for those that will be implementing the new protocol. Nurse educators will be responsible for educating the nurses on affected units on the changes to the EMR, on implementation of the new protocol, and on the details of the home-based CR program. They will also discuss the numerous health and economic benefits associated with participation in cardiac rehabilitation after AMI. Nurse managers on affected units will be responsible for hanging up posters reminding nurses to integrate the new CR protocol into their discharge plan for post-AMI patients.

The final component of the planning phase of the PDSA cycle is to develop a way to evaluate the change (Institute for Healthcare Improvement, n.d.). This will first be done by having the nurses complete an assessment at discharge regarding which, if any, CR option the patient selected and if their selection was influenced by program delivery route. This assessment will be documented in the EMR. The most important results are the CR attendance and adherence rates. The medical records from before the implementation of the new protocol will be evaluated to determine previous rates of CR attendance and adherence. After implementation of the protocol, the same data will be collected. Additionally, outcome measures will be compared between the center-based and home-based CR programs to ensure the newly developed home-based program is delivering high quality cardiac rehabilitation. The primary objective is to increase the number of patients attending CR programs after hospital discharge, as well as

increasing adherence until program completion. These statistics will be measured after the intervention is implemented to determine if the desired outcome has been achieved.

Do. The 'Do' portion of the cycle involves implementing the test on a small scale while documenting observations and beginning analysis of the data (Institute for Healthcare Improvement, n.d.). The first step of implementation involves distributing the approved protocol to the affected cardiac units and educating the nurses. After completing training regarding the new protocol, implementation will first take place with a pilot group at a single hospital. A single cohort will be recruited to the home-based CR program and a single cohort will be recruited to the center-based program. Both cohorts will be recruited using the new discharge protocol. The two programs will run concurrently. The nurses running the center-based program will use Zoom to capture in-person content for the home-based group. The CR nurses will also use Zoom to conduct weekly check-ins with the home-based patients. Standard outcome measures will be recorded in the EMR and compared between the groups. Statistics will be collected in the EMR regarding general CR attendance and adherence and compared to pre-protocol statistics.

Study. The 'study' portion of the cycle involves analyzing and comparing data and reflecting on the results of the tested change (Institute for Healthcare Improvement, n.d.). During this phase, the committee members will review medical record data from before and after the implementation of the new CR protocol. This data will be used to determine if any improvements in CR attendance and adherence have resulted from the intervention. In addition, outcome measures from the pilot home-based program and the concurrent center-based program will be analyzed and compared. This data will be used to ensure the new home-based program is producing comparable results to the established center-based program. The committee will

analyze the first set of data after the first cohort has finished the program, approximately three months after implementation. Another analysis will occur at six months and at twelve months.

The initial data analysis at the three-month mark will focus on comparing the outcome measures between the two programs. If, at this time, the outcomes for the home-based program participants are significantly less than the center-based participants, revisions will be made to the home-based program before the next cohort begins. At the six-month mark, data analysis will also focus on attendance and adherence. If more patients are starting a CR program after discharge from the hospital and more patients are completing the full program, then the protocol can be maintained as it was written. If the protocol is failing to increase attendance and adherence at the twelve-month mark, changes will need to be made. Lastly, the committee will create a summary of the data collected during the initial implementation period to reflect on implementation of the CR protocol and home-based program at their hospital.

Act. The ‘act’ portion of the test involves improving upon the change based on the data gathered after the implementation of the intervention (Institute for Healthcare Improvement, n.d.). The data analyzed during the ‘study’ phase will direct the ‘act’ phase. Possible areas for discussion include the Zoom format used in the home-based program, protocol ease-of-use, and the amount of education given to nurses before protocol implementation. The committee will also consider any feedback received from nurses and other healthcare providers involved in implementation efforts. The committee will reflect on whether the overall objective was met: did the intervention increase access and adherence to CR programs while improving outcomes in patients who have experienced acute myocardial infarction (AMI)? If this outcome was not met, additional PDSA cycles will need to be completed after revisions are made to the interventions.

Thesis Strengths and Limitations

The strength of this thesis lies in the thorough review of literature that included many different types of interventions for improving cardiac rehabilitation. Additionally, this thesis is strengthened by its pertinence. The home-based cardiac rehabilitation suggestion is especially relevant due to current restrictions imposed by the COVID-19 pandemic. Statistics support the need for increased access and adherence to CR programs, and this thesis offers a possible solution to a complex problem. However, there are also limitations to this thesis. The literature search revealed a limited number of articles related to the selected topic. More research needs to be conducted on ways to improve access and adherence to CR programs. Additionally, much of the literature that was utilized offered small sample sizes and limited levels of evidence. Lastly, providing technology for the home-based program could be costly and may prove challenging to implement.

Summary

The purpose of this thesis was to create a set of best nursing practice recommendations for cardiac rehabilitation in post-AMI patients. The overarching goal of this thesis was to increase access and adherence to CR programs while improving patient outcomes. The review of literature offered many options for improving outcomes, access, and adherence in the cardiac rehabilitation setting. Evidence-based best practice recommendations were developed by combining current guidelines from the American Heart Association with research suggesting innovative approaches for improving CR access and delivery. The evidence supported home-based programs and the use of technology in the delivery of CR. The PDSA cycle was used to describe how an evidence-based protocol could be created and implemented from the identified best practice recommendations. The implementation of this protocol and creation of a home-

based CR program will create make healing and recovery more accessible for all patients who have experienced AMI.

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