

Cardiac Rehabilitation Knowledge & Attitudes of Cardiology Fellows

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In the United States, cardiac rehabilitation (CR) is vastly underutilized with only 19-34% of eligible patients participate. Lack of physician endorsement and referral to CR is a significant modifiable barrier that often stems from lack of CR knowledge. Studies show that physicians, of varying specialties, lack the necessary knowledge of CR and referral processes significantly limiting their endorsement but none have isolated cardiology fellows. Cardiology fellows spend a significant amount of time treating eligible patients, making them critically important to increasing participation at teaching hospitals where referral is lowest. University of Pittsburgh Department of Medicine (DOM) Cardiology Fellows were surveyed and interviewed to assess cardiology fellows' knowledge (what they know about CR) and attitudes (what they think about CR), and their perceived facilitators and barriers to CR endorsement and referral. The fellows had low knowledge scores regarding eligibility, benefits and what CR entails. In regards to attitudes, the fellows believe in the benefits of CR, local CR programs and cost-effectiveness. Furthermore, fellows state they do not refer patients to CR because they forget or are unaware how to refer. Barriers to endorsement and referral included: logistics of CR operations, limited communication, limited time with patients, presumed patient barriers, intrinsic fellow barriers, understanding referral processes, and multiple hospital rotations. Facilitators to endorsement and referral included: evidence-based outcomes, patient-centered outcomes, ease of access to order-sets, and reminders. The findings of this study present in-depth thought processes regarding lack of CR knowledge, and barriers to CR endorsement and referral that were previously unknown in cardiology fellows.

Addressing these specific barriers through fellowship education programming may increase endorsement and referrals. Additionally, targeting the specific thought processes that lead to these perceived fellow barriers could ultimately lead to improved CR participation.

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Preface

I have been working on cardiac rehabilitation (CR) for over 12 years and have enjoyed every second of it. As I've worked in various hospitals I have come to the realization that CR is not on the minds of many practitioners and this is demonstrated through lackluster referral and participation rates of patients that are eligible. I have been at the University of Pittsburgh and VAPHS for almost three years now where I have become a viable part of the CR team. I have experienced multiple fellows and residents rotate through the hospital and this is how I became interested in what the cardiology fellows know and think about CR. This was a tremendous experience working with them and learning what they know and think.

In truth, I could not have achieved this level of success without a fantastic support system. First, my beautiful wife Billie, and all of the support and encouragement you have given me. Throughout this process there have been many trials and tribulations with all of the stress that has accompanied this process. You have been behind me through all of it. Secondly, my two beautiful daughters Riley and Rubee. You are my world. Every time it felt too tough, I was too tired, and I thought about giving up, I thought about making you proud and showing you that hard work is worth it! Third, my mother-in-law and father-in-law Bill and Deannie, who always let me know how proud of me you are. You've always treated me like your son and this has meant so much to me. Finally, my committee members who have provided me with advice, support, and constructive criticism. Dr. Hickey, Dr. Goss, and Dr. Fertman, you have made me a better writer and researcher. Thank you all for your unwavering support. I hope I have made you all proud.

1.0 Problem Area

The prevalence of cardiovascular disease (CVD) is on the rise. Increased longevity and escalating effects of risk factors that accumulate over a lifetime have created increased prevalence of CVD (Arena et al., 2012). Cardiac Rehabilitation (CR) is an effective secondary and tertiary prevention intervention in the management of this disease. CR is a comprehensive exercise, education, and behavior modification program designed to improve the physical and emotional condition of patients with heart disease.

1.1 Introduction

CR significantly reduces morbidity and mortality by up to 25% over a period of one to two years when compared with usual care (Grace et al., 2008). The same study showed that CR reduces mortality by up to 34% in Medicare patients. After a heart attack, or myocardial infarction (MI), patients that participate in CR are 53% less likely to die from any cause and 57% less likely to experience cardiac-related mortality than those who do not participate in CR (Sumner, Harrison, & Doherty, 2017). Other health benefits associated with CR include improved adherence with medication, increased exercise performance and reduction in risk factors (Kotseva, Wood, De Backer, & De Bacquer, 2012). Furthermore, CR improves the ability to perform daily living activities (Johnston et al., 2011), psychosocial symptoms, and health-related quality of life (Pinto, Sunsiger, Farrell, Marcus, & Todaro, 2013).

1.2 Statement of Problem of Practice

Despite the known benefits of CR, research demonstrates that it is underutilized and there is a deficit in the referral and participation rate in outpatient CR (Pack et al., 2015; Pack et al., 2014; Arena et al., 2012; Higgins et al, 2008). A recent study by Aragam et al. (2015) demonstrates referral rates of 59.2%-66.0% while participation rates were 20%-30%. Other research demonstrates participation rates as low as 8-10%. Furthermore, less than 30% of patients participate in CR following a MI (Pack et al., 2013). Work by Boyden et al. (2010) and Doll et al. (2015) demonstrate even lower participation rates among Medicare patients who are older and tend to have more limitations.

Multiple studies have utilized qualitative methods to examine specific reasons why eligible patients do not participate in outpatient CR (Aragam et al., 2015; Pack et al., 2014, 2015; Arena et al., 2012; Higgins et al., 2008; Jackson, Leclerc, Erskine, & Linden, 2005;). The results of these studies demonstrate that demographic concerns (i.e., age, gender, number of comorbidities, socioeconomic status and insurance coverage), distance and transportation, and lack of endorsement from physicians all collectively lead to the underutilization of CR.

1.3 Context

The VA Pittsburgh Healthcare System (VAPHS) is an integrated healthcare system that serves veterans throughout the tri-state area of Pennsylvania, Ohio, and West Virginia. There are two clinical care facilities in Pittsburgh and five community-based outpatient clinics. VAPHS also serves as a tertiary referral center for the western half of VA Healthcare training veterans from

Altoona, Butler and Erie in Pennsylvania and Clarksburg, West Virginia. VAPHS is home to a regional cardiac surgery and heart catheterization center. VAPHS upholds academic affiliations with 170 health educational programs including University of Pittsburgh School of Medicine.

The University Drive campus is an acute care facility and has 146 operating beds distributed between medicine, surgery, neurology and critical care. Outpatient services are also available at this campus. At the H.J. Heinz campus there is a 262-bed community living center as well as an ambulatory care center that offers dental, primary care, pharmacy and rehabilitation outpatient services.

The VAPHS CR department is located at the University Drive campus and is one of only two VA CR programs in Pennsylvania. The department began taking referrals on July 21, 2015. Since that time there have been 586 inpatient referrals and 1,084 outpatient referrals. The outpatient CR services include facility-based CR, hybrid CR, home-based CR and referrals to non-VA facility-based programs. The CR department situates itself under Therapy Services in the Medical Service Line (MSL). Outpatient CR services generally treats between 30-50 patients per week. The two primary referral sources for CR are: the cardiology department which employs 12 cardiologists and multiple cardiology fellows housed in the MSL and the Cardiothoracic Surgery department housed in the Surgical Service Line employing one surgeon, two physicians' assistants, and multiple fellows and residents.

2.0 Review of Scholarship and Professional Knowledge

2.1 Barriers

Recommendations for CR usually occur when a patient is hospitalized for their cardiac disease or seen in their physician's office for a follow-up appointment. Currently, eligibility requirements for enrollment in CR are MI, percutaneous intervention (PCI), coronary artery bypass grafting (CABG), valve replacement or repair, stable angina, peripheral vascular disease (PVD) and stable chronic systolic heart failure (HF). CR staffing is variable between hospitals and outpatient clinics. This creates a disconnect between patients hospitalized in acute care settings and patients in outpatient settings.

In a review of 32 studies assessing referral predictors, Jackson et al. (2005) found that two of the strongest predictors of referral and attendance to CR were the ease of physical access and availability of transportation to the facility. This same review of literature found that one of the strongest predictors of non-participation was a long travel distance to the CR facility. A majority of CR programs are located in urban areas making participation 30% less likely people living outside of these areas (Velencia, Savage, & Ades, 2011). Even those that live in urban areas experience significant barriers in travel time. Higgins et al. (2008) found that travel time was an independent predictor of non-participation citing that as travel time increased by one-minute attendance decreased by 14%. Most CR centers reside in urban areas causing increased rush hour times. To further emphasize this point Higgins et al. (2008) demonstrated a 77% decrease in participation in CR with every 10-minute increase in travel time.

Furthermore, most eligible patients need to return to work within a short period of time. Patients are less likely to participate in CR when they have employment obligations (Jackson et al., 2005; Pack et al., 2014). Patients can return to work, depending on their diagnoses and intervention, anywhere from 2-12 weeks from discharge. The national average from discharge to initial outpatient CR appointment is 35 days (Pack et al., 2013). This misses most of these patients because they are already back to work. Pack et al. (2013) found that for each day between discharge and initial appointment time, there was a 1% decrease in participation. Various studies focusing on early appointment times versus standard appointment times demonstrate better attendance in the patients with early appointment times (Aragam et al., 2015; Grace et al., 2011). This is a difficult task when programs cannot accommodate appointment times because of staffing and center size. This also becomes a significant barrier when physicians delay medical clearance for eligible patients.

Automatic referral improves participation in CR. One study investigated automatic referral to CR upon discharge, hospital staff referring eligible patients, both automatic referral and staff referral and usual care where staff made the decision (Grace et al., 2011). They found that automatic referral coupled with collaboration by hospital staff leads to higher participation. In a study by Pack et al. (2013), appointment times within two weeks of discharged were utilized demonstrating a significant improvement in participation rates. In this same study, Pack et al. (2013) found a 56% relative improvement when physicians endorsed CR and recommended light or modified duty in returning to work.

Age is also a barrier to CR participation (Ruano-Ravino, et al., 2016; Hutchinson, Meyer, & Marshall, 2015; Brown et al., 2009; Stiller & Holt, 2004). Peak age of participation is between 50-65 and participation declines significantly after the age of 70 (Ruano-Ravino, et al., 2016). The

same study shows that further decline continues after the age of 80 and participants tend to be 10 years younger than non-participants. A similar trend was shown where no females over the age of 80 referred to CR in their single center study and only 43% of men over 80 were referred (Hutchinson, Meyer, & Marshall, 2015).

There is a gender bias with men being referred over women (Stiller & Holt, 2004). Additionally, when patients had the same clinical profiles, men are more likely to be referred to CR than women (Stiller & Holt, 2004). Multiple systematic reviews found gender referral bias and none observed higher participation rates in women (Ruano-Ravino et al., 2016). Furthermore, cardiologists and primary care physicians refer women far less than men because of varying perceptions of risk and benefits for men versus women (Stiller & Holt, 2004). In a similar qualitative study, women reported that they lack the time to attend CR because of multiple family obligations (DeVos et al., 2013).

Physician referral has a significant impact on overall participation in CR. Lack of physician referral and/or endorsement is the number one barrier to CR participation in multiple studies (Dunn, et al., 2017; Ghisi, Polyzotis, Oh, Pakosh, & Grace, 2013). Endorsement is best described when a healthcare provider, especially a physician, takes time to discuss the therapy being prescribed (Arena et al., 2012). When a physician takes time to discuss CR with a patient participation rates improve. Multiple studies show that endorsement of CR increases participation rates despite barriers (Arena et al., 2012; Jackson et al., 2005; Pack et al., 2014). Furthermore, patients can develop a mismatch of expectations versus realities their physician does not talk discuss the benefits of CR. This makes future work crucial to expand the knowledge of all health care providers, especially physicians, regarding the substantial benefits of CR and to identify and address barriers associated with reduced participation.

2.2 Physician Endorsement

Lack of physician endorsement is a significant barrier to participation in CR (Arena et al., 2012; Jackson et al., 2005; Ghisi et al., 2013; Pack et al., 2014). Physician endorsement may be the most important determinant in participation (Duncan, Natarajan, & Schwalm, 2016). Furthermore, patients are willing to overcome travel barriers and adjust work schedules with strong physician endorsement (Arena et al., 2012). This demonstrates that physician endorsement unquestionably becomes an integral part in patient participation in CR.

Despite the knowledge that patients will overcome barriers with physician endorsement, endorsement and referral remain low. In one study, more than half of Arkansas cardiologists surveyed referred between one in five eligible patients to CR (Suter, Bona, & Suter, 1992). In the same study, 6% of the physicians surveyed reported referring over 20 patients in the year. At the time of this study, 25% of people living in Arkansas had cardiovascular disease meaning a majority of eligible patients were not being referred which negatively impacts participation.

Physician endorsement is unequivocally an independent barrier to CR attendance and strength of endorsement matters (Ghisi et al., 2013). CR participation is significantly increased by the strength of recommendation (Ghisi et al., 2013). Similarly, patients who enroll in CR perceived moderately strong physician recommendation, while those who do not enroll perceive either weak recommendation or no recommendation at all (Ades, Waldmann, & McCann, 1992). Despite the presence of all other barriers patients are twice as likely to attend CR when a strong endorsement is provided by a physician (Duncan, Natarajan & Schwalm, 2016).

There are many reasons why physicians do not endorse CR. Primary care physicians refer patients to CR far less than cardiac specialists (Grace, Grewal, & Stewart, 2008). The primary care physicians in this study admit that they're less likely to endorse CR because of a lack of familiarity

with programs and will only refer eligible patients if referral forms are provided by an allied health professional, such as an exercise physiologist. The same physicians also reported that it was the job of another physician to refer patients to CR. Ghisi et al. (2013) found similar results where cardiac specialists are far more likely to refer patients, and patients that see a cardiologist or cardiac surgeon are 50% more likely to participate.

Additionally, if physicians perceive their patients to have barriers to participation they are less likely to endorse CR. Ghisi et al. (2013) found that physicians most frequently identified geographic access, patient motivation and patient knowledge of their own disease as reasons for non-referral. Likewise, physicians do not endorse CR to older patients because they do not feel that they would be motivated to participate (Grace, Evindar, Abramson, & Stewart, 2008).

Lastly, the author of this paper conducted a recent unstructured interview with a cardiologist at the Veterans Administration Pittsburgh Health System, the physician alluded to the fact that during his fellowship he never prescribed CR. This was because he lacked the knowledge about CR, and it was never discussed when going over treatment plans with staff cardiologists. Furthermore, he stated that there are no incentives for referring patients to CR, like there are when prescribing medications. Therefore, physicians do not routinely do it. The interview was finished by the physician stating that there was never any discussion regarding CR throughout medical school which is where the lack of awareness could emanate from (G. Kellar, personal communication, February 21, 2017). This is likely representative of most fellows.

2.3 Physician Decision Making Models

Endorsement is not something that physicians consciously give (Reyna, 2008). According to this same study, there are four major approaches to medical decision making and endorsement that physicians use for certain therapies, procedures or medication. These approaches are the theory of reasoned action, transtheoretical model, fuzzy trace theory, and shared decision making. Theory of reasoned action, transtheoretical model, and fuzzy-trace theory are the three prominent models that physicians currently utilize (Reyna, 2008).

The first, theory of reasoned action, suggests that decisions are made because of attitudes and subjective norms. For instance, a physician decides based on their attitude related to a certain behavior and a judgement of whether that behavior is a beneficial thing to do. This is determined by two behavioral beliefs about the outcome of the behavior and evaluations of the expected outcome (Spring, 2008). The theory relies solely on physician's attitudes towards CR. If they have negative attitudes towards it they will be less likely to recommend it, despite the known benefits available to patients.

The second model is the transtheoretical model which asserts that decisions are made according to where the patient is in their readiness to change (Reyna, 2008). The benefits of a certain therapy, procedure, or medication are to be emphasized in this theory, especially in the earlier stages of change. When patients know that a change is needed to improve or modify a condition, physicians are to endorse this need for change and prescribe accordingly. This theory assumes that physicians are not only familiar with, but are also able to determine what stage of change their patient is in, and then able to intervene accordingly. CR staffs are well versed in the stages of change and specific intervention for that stage. This again demonstrates the importance of getting the patient in the door.

The fuzzy-trace theory is where physicians make decisions on information with a bottom-line meaning and verbatim details (Reyna, 2008). These decisions are evidence-based and follow very specific algorithms which the physician follows verbatim (Spring, 2008). This theory can cause mistreatment because if a patient is low risk, a physician is less likely to prescribe interventions targeting secondary or tertiary prevention. However, patients that are eligible to participate in CR are in a state of exacerbation which means that if this theory were to be utilized, it should follow evidence-based guidelines.

The fourth model has become prominent in recent years is shared decision making. In shared decision making the physician and patient make decisions as a team. This involves recognizing and acknowledging that a decision is required, knowing and understanding the best available evidence, and incorporating the patient's values and preferences into the decision (Lagare & Witteman, 2013). This model is very patient specific and it relies on medical evidence, the provider's clinical expertise, and unique attributes of the patient and his or her family. The shared decision making may not only benefit the patient and improve their experience but may also increase the use of appropriate evidence by their physician (Lagare and Witteman, 2013). This model seems to make the most sense when working to increase the participation rate in CR. The barriers of the patient and physician are well known and it seems that sharing the decision making can improve outcomes. Furthermore, this makes sense because healthcare providers consistently tell patients to not only be aware of decisions that are being made, but to be actively involved (Lagare & Witteman, 2013).

These theories make a physician's knowledge regarding available therapies extremely important. Lack of information regarding the eligibility and benefits of CR are a significant barrier to referring patients to a program (Dahhan et al., 2015). When distributing a questionnaire to

cardiologists and cardiology fellows over 38.5% of these physicians reported that they were not aware of CR being a Class I indication after cardiac intervention (Dahhan et al., 2015). This demonstrates the lack of awareness and knowledge of the clinical benefits of CR. This makes theories of medical decision mute if physicians are naïve to the therapy.

2.3.1 Physician In-Training Learning

The aforementioned decision-making models are not simply taught in medical school then reinforced by supervising physicians during their post medical school training. These models are molded from attitudes and beliefs during their clinical training. Roberts et al. (2011) found that attitudes about healthcare can often be shaped during a residency program. It is difficult to shape attitudes about outpatient settings, such as CR, when research has shown that there is a need for a greater emphasis in outpatient training (Holmboe et al., 2005). This same study also states that residency clinics of academic medical centers, such as VAPHS, see patients that are extremely complex leading to the resident becoming overwhelmed that leads to difficulty in developing knowledge in the outpatient arena.

For most treatment of obesity is done in an outpatient setting. Similar to CR, interventions and counseling for obesity are underutilized because physicians lack the knowledge and experience surrounding this morbidity (Jay, Schlair, Caldwell, Kalet, Sherman & Gillespie, 2010). This study also showed when implementing a multi-modal obesity counseling curriculum, residents in the intervention group provided significantly higher quality obesity counseling. Another study found that physicians that had any obesity training while in medical school or in their residency had improved knowledge, counseling and referral to the appropriate evaluations.

The key is to determine if there is an optimal time in a physician's training to implement an intervention that can make the greatest impact on knowledge, attitude and belief.

2.4 Conclusion

Despite the demonstrated benefits of CR and it being an AHA Class 1 recommendation in the treatment for CVD, it remains underutilized. Understanding lack of physician endorsement and lack of physician conformity to demonstrated evidence-based guidelines that begins in a physician's training is essential to create interventions that increase participation rates in CR. Despite the known barriers to physician endorsement of CR, knowledge regarding interventions for improvement needs further explored. Inquiry is needed to assess an in-depth description of fellows' CR knowledge and attitudes and how they impact endorsement. Insight to gain an understanding of perceived realities constructed by trainees, as well as examining the trainees' beliefs as to the nature of this specific problem is warranted.

Research demonstrates that physician endorsement has the power to overcome the known patient barriers. This has created a need for greater physician education about CR, but when should this education start? Physicians are highly respected by patients, thus are able to provide endorsement and recommendation. Interventions need to be created to educate physicians, when they are most apt to develop their own way of practicing, on all the aspects of CR including referral processes. If physicians can become more aware of the impact CR early in their career it would make medical decision-making processes more applicable to the field of CR. The benefits of CR are well known and work moving forward needs to be aimed at making interventions to increase physician knowledge and improving beliefs, ultimately leading to increased endorsement.

Physicians allow their personal beliefs to impact their decisions for their patients (Grace et al., 2004). Physicians' beliefs and practices begin to mold when they are in their residency and fellowship programs. Research to this point has been conducted mainly on independently practicing physicians who are no longer in their training. One could conclude that these physicians are set in their attitudes and practices. It would be most impactful to assess fellows' knowledge, attitudes and practices prior to them having a significant amount of information from supervising physicians. Ultimately, this is where there is a significant gap in literature. Furthermore, lack of fellow endorsement and referral may be one of the most modifiable barriers to CR participation and teaching hospitals are where referral rates are the lowest (Aragam et al., 2015). Research to address these gaps are timely. If knowledge and attitudes can be assessed prior to fellows practicing independently, interventions can be created to improve knowledge, attitudes, endorsement, and referral.

3.0 Methods

3.1 Inquiry Questions

This study is driven by two inquiry questions:

- 1. What are the attitudes and knowledge base of cardiology fellows in regards to CR?*
- 2. What are facilitators and barriers to cardiology fellows' CR endorsement and referral?*

3.2 Inquiry Design

To answer the above inquiry questions a needs assessment utilizing a mixed methods approach was conducted with the University of Pittsburgh's Department of Medicine (DOM) Cardiology Fellows. This fellowship specialty was chosen because they treat the highest number of patients that are eligible for, and would benefit from CR. Physician's knowledge (what they know about CR), attitudes (what they think about CR), treatment and referral patterns begin to form during their residency and are further enhanced during their fellowship. This design was determined to be the most appropriate to assess fellows' knowledge, attitudes, and behaviors towards CR as well as learning facilitators and barriers to fellows' CR endorsement and referral. Surveying fellows and assessing current knowledge and attitudes enhances the ability to create an intervention where most appropriate in their training to elicit the greatest benefit. Interviews

enhance the assessment by learning the thought processes of fellows' perceived facilitators and barriers for CR endorsement and referral.

3.2.1 Setting

The primary setting of this inquiry was the University of Pittsburgh's DOM housed in Scaife Hall. The location of the fellows for this inquiry is unique in that they rotate through multiple hospitals within the University of Pittsburgh Medical Center (UPMC) system as well as VAPHS. UPMC and VAPHS are teaching hospitals that consistently have residents and fellows rotating through the various campuses. Each resident and fellow have attending physicians supervising them, otherwise known as independently practicing physicians.

The primary investigator of this inquiry is a Without Compensation (WOC) employee at VAPHS and has been in the CR department for three years. VAPHS has seven attending cardiologists that supervise a total of 25 general cardiology (GC) fellows, and five advanced cardiology fellows. The GC fellows have clinics with their attending cardiologists ½ day per week, every other week. In these clinics, the fellows see patients who are eligible for CR whether it be for a follow-up from an inpatient stay or a visit for a new eligible diagnosis. Fellows also spend time in cardiac catheterization, consult, and imaging services. Each rotation creates opportunities to refer eligible patients to CR.

In a VAPHS CR quality improvement project referral data was assessed. From August 1, 2015- September 30, 2017 there were 346 open-heart surgeries performed and 100% of these patients were referred to CR. From October 2017- July 2018 there were 246 stents placed and only 82 (33%) of these patients were referred to CR. From October 2016-July 2018 there were 709 eligible non-surgical diagnoses, such as heart failure (HF), that were admitted to VAPHS and only

334 of these (47%) were referred to CR. Furthermore, during a quality improvement survey completed in the VAPHS CR department of referred patients from December 2017- February 2019, 91 out of 238 referred patients (38%) stated that their physician did not talk to them about what CR is demonstrating that 62% of referred patients didn't have CR endorsement from the physician that referred them.

3.2.2 Sample

Cardiology fellows are physicians that have completed a residency in internal medicine and want to train in a cardiology specialty. There are thirty University of Pittsburgh DOM Cardiology Fellows (nine first-year fellows; eight second-year fellows; eight third-year fellows; five advanced fellows) were contacted for the two phases of this inquiry. The fellowship is a three-year program, with the option of a fourth-year advanced fellowship in advanced heart failure, interventional cardiology, clinical cardiac electrophysiology and advanced cardiac imaging.

As previously stated, in addition to a heart catheterization rotation and clinics at VAPHS, fellows also have rotations and clinics at UPMC hospitals. The rotations are in the various subdivisions of cardiology (i.e. cardiac catheterization, echocardiogram, electrophysiology) that are all capable of referring to CR. In addition to these rotations, during their second-year preventative cardiology rotation fellows have a CR site visit at UPMC's Shadyside campus. Please refer to Table 1.3 for the matrix of the cardiology fellowship curriculum.

Table 1.3. General Cardiology Track Curriculum Matrix

GENERAL CARDIOLOGY TRACK					
YEAR 1		YEAR 2		YEAR 3	
Consults	Stress Nuclear	EP	Stress Echo	Stress Nuclear	Electives*
TTE	Cath (Presby)	CCU	TEE	Pavilion	Research
EP	Consults	Cath (Presby)	Children's/ACHD		Completion of Level II/III Req
CHF	TTE	Prevention/Vascular	Stress Nuclear		* ELECTIVE OPTIONS: OR Echo Shadyside EP Shadyside Cath TEE Stress Echo CMR Vascular Women's Cardiology
CCU	Research	Stress Nuclear	Cath (VA)		
Cath (VA)	Stress Nuclear	Research	CMR		
Continuity Clinic (½ day per week); alternate weeks at VA/Presby					
Vacation/Holiday Time					
Conferences (AHA/ACC/other)					

3.2.3 Instruments

Survey research was the best fit for assessing the knowledge and attitudes of the fellows. The survey utilized was grounded in previous work by Duncan, Natarajan & Schwalm (2016) and Dahhan et al., 2015 and was adapted, with permission, from them. It primarily measures knowledge and referral patterns to CR attitudes towards CR. Both survey tools were originally developed from extensive review of literature and discussions with key stakeholders. The original surveys were piloted to samples of residents, fellows and staff from various centers. The measurements from these two surveys were utilized to develop the current seven-question survey tool creating the constructs of knowledge and attitudes towards CR.

Question one of the survey asked the respondents current year in fellowship. If the respondent answered “advanced” to question one they were directed to question one(a) that asked for their advanced specialty. If the respondent chose one-three to question one they were directed to question two, skipping one(a). All respondents were asked question two inquiring if they’ve had a CR site visit. Questions three through six measured CR knowledge (i.e. indication, eligibility

criteria, CR benefits and what CR entails). Attitudes towards CR was assessed in question seven. For more detail refer to Appendix C for the specific questions and constructs.

Interviews allow for a better understanding within the context of perceived facilitators and barriers for CR endorsement and referral. The development of the interview questions were also grounded from previous work assessing knowledge and barriers ground the questions in the development of this seven-question interview protocol (Duncan, Natarajan & Schwalm, 2016; Dahhan et al., 2015). The first four questions are situated within the construct of endorsement inquiring about the fellows' beliefs, facilitators and barriers to CR endorsement. Questions five and six were situated in the construct of referral inquiring about the fellows' perceived facilitators and barriers to referring eligible patients to CR. Finally, the fellows were asked, in closing, if there was anything that they would like to add that was not already discussed focusing on opinions aimed at increasing awareness. Initial probes were developed from the work of Natarajan & Schwalm (2016) and Dahhan et al., 2015. However, probes evolved as the interview process progressed. For the specific interview protocol refer to Appendix D.

3.2.4 Data Collection

The study was approved by the University of Pittsburgh's IRB (Study 18100056) and by the University of Pittsburgh's DOM Cardiology Fellowship Director, with recommendation and modification. Following these approvals, the survey was distributed to 30 Cardiology Fellows (including Advanced Fellowship) via email utilizing the online survey platform Qualtrics. Email addresses of fellows were obtained from the University of Pittsburgh's DOM Cardiology Fellowship website. The survey was available for six weeks and weekly follow-up emails were

sent to all of the fellows whether they had taken the survey or not. Because of the confidential nature of the survey, respondents versus non-respondents were unknown.

After the survey component was concluded emails were sent to all 30 DOM Cardiology Fellows to schedule an interview. A follow-up email was sent 1 week after the initial email to non-respondents. Interviews were conducted, with the fellows that responded, via face-to-face interviews and phone interviews. Initially all interviews were to be conducted face-to-face, however, due to fellow schedules an IRB modification was made to include phone interviews. Phone interviews did not change the overall quality of the interview. Face-to-face interviews were conducted when possible with phone conversations occurring if there was no convenient time for the fellow. With the assistance of DOM staff, the face-to-face interviews were scheduled and conducted between 12:00pm-1:00pm in a private conference room at Scaife Hall in the DOM whereas phone interviews were conducted at various times throughout the day where the investigator was also in a private room. The interviews were audio recorded using a digital recording device, the Sony ICD-BX140 Voice Recorder. The interviews took place during a three-week period of time and averaged between 10-15 minutes.

3.2.5 Data Analysis

The analysis consisted of two parts that were carried out sequentially: survey and interview. The survey had three parts assessing demographic questions (year of fellowship and CR site visit), knowledge (CR indication, eligibility to CR, benefits of CR, and what CR entails) and attitudes towards CR. Each knowledge question had multiple correct and incorrect response possibilities that are weighted equally. The overall aggregate score for knowledge categories is the sum of correct responses minus incorrect responses. Total knowledge scores for CR indication, CR

eligibility criteria, benefits of CR and what CR entails were one, seven, six and five respectively. A higher score indicates increased knowledge. Correct answers were based on current Medicare, American Heart Association (AHA), American College of Cardiology (ACA) and American College of Cardiology Foundation (ACCF) guidelines (Medicare, 2018; Anderson et al., 2016; Schopfer & Forman, 2016; Smith et al., 2011; Leon et al., 2005). Attitudes were assessed with 13 statements in question seven utilizing a seven-point Likert-type scale (1= strongly disagree; 7= strongly agree). The seven-point scale was used because it is shown to provide a more accurate measure of a participant's true evaluation and are more appropriate for electronically-distributed questionnaires (Finstad, 2010).

All responses were transferred from Qualtrics to IBM SPSS Statistics software (version 24.0.0; IBP Corporation, Armonk, NY). No identifying information associated to the respondents was collected. Descriptive statistics were run and mean responses were calculated for the fellows in each knowledge section. Descriptive statistics and mean responses were also calculated for the statements used to assess attitudes. For the purposes of explanation of results, fellows' attitudes were also summed and placed into two categories: 1. Disagree to any extent, and 2. Agree to any extent.

Analysis using grounded theory of the interviews was an ongoing, iterative process that continued throughout the study. Immersion into the data began immediately following the interviews to comprehend the meaning of responses in their entirety. This initial review was conducted the day of the interview when the interviews were transcribed verbatim into Microsoft Word files. A process of manual coding then occurred and thematic analysis was used to derive emergent themes (Braun & Clark, 2006). Organization of the data then occurred to uncover additional links between concepts and experiences in the themes. A single coder was used and for

quality control purposes the test-retest method was utilized (Gorden, 1992). The material was coded initially then 1 week later, without viewing the previous codes, the primary investigator re-coded the same material to assure agreeance. While perfect independence of the coding wasn't used, the time lapse between each coding maximized reliability.

Because the framework of the interview protocol was adapted and designed from validated literature, a deductive approach was utilized to assist in the development of the initial code structure and initial probes. Great care was taken to avoid forcing data into these pre-determined categories, however it allowed for new inquiries to benefit from and build on previous insights. When information power was achieved analysis was finalized (Malterud, 2016).

4.0 Results

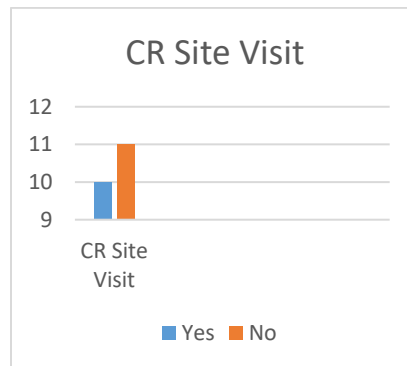
4.1 Surveys

Twenty-one surveys were returned representing a response rate of 70%. Respondents varied throughout their year of fellowship. See table 1.4. Over half of the fellows reported not having a CR site visit. See figure 2.4.

Table 2.4. Year in Fellowship

Year in Fellowship	Number
1	8
2	6
3	5
Advanced	2

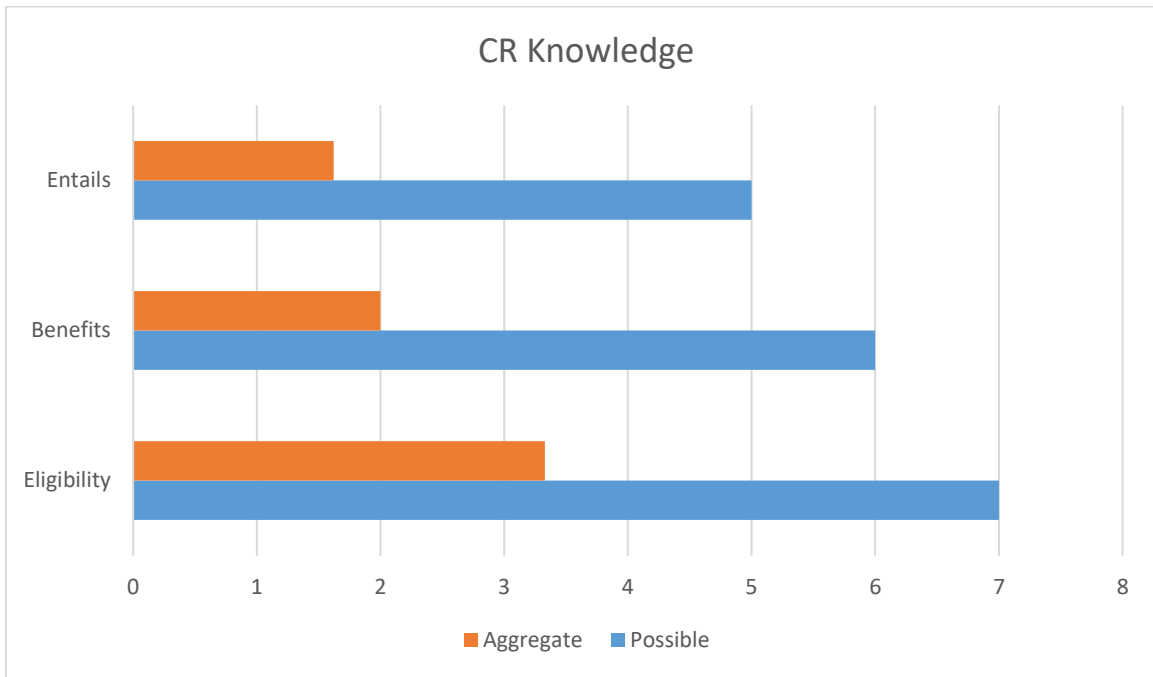
Table 3.4. CR Site Visit



In terms of knowledge, 20/21 (95%) of the fellows are aware that CR is a Class Ia indication. Aggregate scores for eligibility requirements 3.33 (48%), benefits of CR 2.0 (33%) and

what CR entails 1.62 (32%) were all significantly low based on fellows’ responses in those categories. See table 3.4 for mean scores.

Table 4.4 Mean Aggregate Knowledge Score Versus Possible Score



In general, fellows had the least amount of knowledge in what CR entails as 57% had an aggregate score of one or zero where zero fellows received 5/5. Within eligibility requirements and benefits of CR, over 50% of the fellows received less than 50% in terms of aggregate score. In addition, only three and two fellows received perfect knowledge scores in eligibility requirements and benefits of CR, respectively.

CR is very well received by the fellows in terms of their attitudes. See Table 4.4.

Table 5.4 Fellows' Attitudes Towards CR (Seven-point Likert Scale)

Attitude	Mean	Std. Deviation
Lack time	2.91	1.92
Unfamiliar with guidelines	3.91	1.38
Unsure who to refer	3.67	1.39
Skeptical of benefits	1.48	0.93
Skeptical of local programs	1.62	0.97

Co-morbidities hinder participation	2.57	1.47
Another MD's responsibility	1.91	1.14
Less likely to refer older	2.24	1.45
Inconvenient	2.48	1.47
Patients won't go	3.67	1.65
Not cost-effective	1.76	0.83
Sometimes forget	4.38	1.83
Unfamiliar with referral process	4.48	1.81

Fellows disagree with the statements that they're skeptical of CR benefits (1.48), skeptical of local CR programs (1.62). Furthermore, they disagree with the statement that CR is not cost-effective (1.76). In terms of their attitudes towards why their patients aren't referred to CR, fellows agree that they sometimes forget about CR (4.38) and agree that they're unfamiliar with the referral process (4.48). However, fellows disagree with the statement that the referral process is inconvenient. In terms of referral placement, the fellows disagree that CR referral is the responsibility of another physician (1.91). Additionally, fellows disagree that they lack the time to make referrals or discuss CR with their patients (2.91). Furthermore, fellows disagree that they are less likely to refer patients to CR who have more comorbidities (2.57) or are older (2.24).

4.2 Interviews

Following two emails to the thirty University of Pittsburgh DOM Cardiology Fellows requesting an interview, seventeen responded and scheduled an interview which were then subsequently completed over a three-week period of time. Key themes were identified concerning fellows' belief of CR, perceived facilitators and barriers to endorsement and perceived facilitators

and barriers referral. Each of these themes is described along with illustrative quotations below (fellow number following each quotation corresponds with the individual fellow that made the statement).

4.2.1 Endorsement

All seventeen fellows stated they spent time speaking with their patients about CR and all seventeen fellows affirmed they believe in CR. All of the fellows mentioned they spend anywhere between 30 seconds and 3 minutes talking with their patients about CR. Most times, how much time spent depended on the patient, as F6 stated “I play off of their interest level.” Time spent was also dependent on the fellows’ perceived knowledge, “I don’t know much about it, honestly. I say it’s like physical therapy but guided on cardiovascular health. I don’t spend time saying much more” (F16). Other times the amount of time is dependent on the location their clinic is at, “I spend less time down here (UPMC) talking about cardiac rehab than I do up the hill (VAPHS)” (F4).

Three themes emerged regarding how they spend the 3 minutes or less talking about CR: benefits to the patient, attempted description of CR and inquiry of the patient. Every fellow interviewed mentioned benefits to the patient such as improved function, decreased mortality, and the fact that they tend to feel better. One fellow said, “It’s more worthwhile than some medications” (F15), and another stated, “It’s just as important as medications” (F13).

“It’s like having a personal trainer” stated one fellow (F9) in their description of CR to their patients. A comparable statement was given by a second fellow stating that CR is, “...being done in a room with PT equipment” (F14). They also endorse to their patients that participation elicits encouragement from. As many patients are anxious about participation they explain that participation is safe due to the monitored nature of CR. Others explained that they talk to their

patients about the components of CR but most couldn't go into more detail as to what the components were, "I don't know very much about cardiac rehab" (F11).

Fellows are inclined to leave participation as more of an option as opposed to a part of recovery. The interest of the patient relates to how hard they push a patient to attend. The fellows frequently ask if the patient is interested in participating, they ask about barriers to participation and inquire if they've ever attended. How hard they push depends on the answers to the above questions and only a handful of fellows stated that they push "hard". "I push decently hard but won't force them" (F12), one fellow said then another stated, "I make a pitch but not much more" (F9). Patient barriers do play a significant role with how hard the fellows push, "If a patient states a barrier, that's it" said one (F9).

4.2.1.1 Facilitators to Endorsement

Initially, asking fellows what they believed in about CR and what they perceived facilitated their endorsement of CR were two separate, but similar questions. However, as interviews transpired it became clear that the themes that make the cardiology fellows believe in CR are based on a foundation of what facilitates their endorsement. Unequivocally the fellows demonstrate that evidence-based outcomes and patient-centered outcomes facilitate their CR endorsement. See table 5.4. Putting it simply, one fellow said, "I believe in everything about cardiac rehab. It's easy to endorse!" (F12). Decreased mortality, morbidity and hospitalizations were all evidence-based subthemes that a majority of the fellows mentioned facilitated their ability endorse, while patient-centered outcome were increased quality of life and function. This is true whether the fellows are personally aware of the data or not, "I haven't read the studies myself" (F10) and "I really haven't

seen the data myself” (F11). One fellow called CR a “safety net” (F4) for their patients while others mentioned improvements in depression, function and confidence of their patients.

4.2.1.2 Barriers to Endorsement

Four themes emerged for barriers to CR endorsement: logistics of how CR operates, limited communication, limited time with patients and presumed patient barriers. See table 5.4. Every fellow specified lack of awareness of the day-to-day operations of a CR program. One said, “I don’t know what cardiac rehab actually is” (F4), and “We all know it’s good but what is exactly done? A lot of fellows don’t know” (F8) said another. Additionally, some explained how they give an overview but when asked specific questions they are not comfortable going into detail, “I can’t answer follow-up questions” (F16). When questions cannot be answered one simply stated, “I refer them to talk to someone else for more specific information” (F1).

Secondly, limited communication was a barrier to endorsement. They emphasized a lack of interaction with CR programs and/or staff that led to a lack of feedback. This caused many to feel “uninformed” (F8). One fellow mentioned they consistently have contact with drug reps facilitating endorsement of various medications but have never interacted with CR staff. “(There are) other priorities” (F6) explains one fellow regarding the limited time with patients. This eludes to the fact that at times a CR discussion is not a priority during short clinic visits.

Finally, there are presumed patient barriers to endorsement. Insurance, motivation, work obligations, distance, compliance issues and ambulation issues were all topics that barriers to endorsement. “I’m less likely to mention it if they use a walker, have trouble walking or are sedentary” (F7) admitted one fellow. “It’s like smoking cessation” (F3 & F4) two fellows explained making this comparison because a lot of patients “don’t want to hear about it.”

Table 6.4 Endorsement Facilitators and Barriers

Endorsement Facilitators	Endorsement Barriers
<p>Evidence-based outcomes</p> <p>Patient-centered outcomes</p>	<p>Logistics of how CR operates</p> <p>Limited communication</p> <p>Presumed patient barriers</p> <p>Limited time with patients</p>

4.2.2 Referral

4.2.2.1 Facilitators to Referral

There were two main concepts that fellows perceive facilitate CR referral: ease of access to order-sets and reminders for referral in the order-set and my other healthcare providers. See table 6.4. Every fellow mentioned when an order set and/or reminders is part of referral, it significantly influences the actual placement. Referrals increase when CR is part of the order set. One fellow said, “We have to consciously not refer” (F4). The same fellow continued with, “You literally have to uncheck the box.” Others thought that more referrals would occur, “if it’s selected by default” (F14) for appropriate indications. “If the order set is up, I’ll check yes” (F17) answered one when asked about referring. One fellow went as far to say, “The less you can make the doctor think, the better” (F10).

4.2.2.2 Barriers to Referral

There were 4 clear barriers to referral: understanding the referral process, multiple hospital rotations, intrinsic fellow-barriers and presumed patient barriers. See table 6.4. Fellows explained communication, referral steps, where the order resides and difficulty of placement were all barriers

to understanding the referral process. “I have no idea how it works” (F8) and “I can’t answer questions about what happens after the referral is placed” (F13) were referral process issues that the fellows explained. Various hospital rotations, lack of time with patients and obligations within numerous medical service lines emerged as barriers from multiple hospital rotations.

Some thought it was undoubtedly their responsibility to refer saying, “Fellows are the most responsible for referral” (F14) and in concurrence another stated “It’s the fellows’ duty to refer” (F3). Some didn’t differentiate whether it was their responsibility or another physician’s by saying, “It’s all physician’s jobs to order” (F2). In contrast others believe recommending CR is their obligation but not actually referring, “We’re not in charge of placing the primary orders. We can only recommend” (F5). Others didn’t mention recommendation stating “It’s up to the residents to place inpatient orders” (F12), “I’m not the primary cardiologist” (F13), and “It should be the person discharging the patient” (F8).

Presumed patient barriers to referral included insurance and distance. Forgetting about CR and knowing who is eligible emerged as intrinsic fellow-barriers. “One reason we don’t do it is because we forget” (F10) and “If it’s not in the order set I forget about it” (F10). Reasons for forgetting were explained by one fellow, “I don’t think about it unless someone brings it to my attention” (F16). They went further stating, “Social work tells us when patients need physical therapy. Nobody talks about cardiac rehab.”

Table 7.4 Referral Facilitators and Barriers

Referral Facilitators	Referral Barriers
Ease of access to order-set	Understanding referral process
Reminders in order-set of other healthcare professionals	Multiple hospital rotations
	Intrinsic fellow barriers
	Presumed patient barriers

5.0 Discussion

Independent practicing physician endorsement has been researched for almost 30 years but no known published data exists isolating cardiology fellows. The present study demonstrates clear knowledge gaps and barriers to endorsement and referral by cardiology fellows. These knowledge gaps and barriers provide insight into why referral rates are lower at teaching hospitals. Fellows had low knowledge for indications for CR, benefits of CR and what CR entails. These findings complement previous work that demonstrated cardiologists have low general knowledge of CR (Moradi, Maleki, Esmailzadeh, & Abkenar, 2011; Ghisi, Contractor, Abhyankar, Syed, & Grace, 2018). Unlike previous work however, fellows clarified where these gaps in knowledge are. This becomes important because when CR knowledge is low it is less likely to be discussed with patients. The patient may misinterpret this to mean CR is inconsequential.

Nearly all fellows are aware that CR has a Class 1a designation. However, they recognize a deficit in knowledge around the logistics of CR. They consistently explained the inability to answer logistical questions (i.e. days per week, duration per session, duration of program, type of exercise, education, etc.) about CR. The inability to describe logistics led to a variable amount of time that fellows spent discussing CR with their patients. CR discussion, for many, lasted 1 minute or less. This is significant because Ades, Waldmann, McCann & Weaver (1992) found that the more time a physician discusses CR the more likely a patient is to participate.

Moreover, fellows felt that lack of knowledge extended to the referral. The varying referral processes throughout hospital rotations significantly impacted referral placement. Fellows consistently discussed the varying processes creating significant barriers to referral. Some also explained varying degrees of knowledge of processes depending on the hospital. Uncertainty

among physicians as to who is responsible for placing referral negatively impacts enrollment (Grace, Evindar, Abramson & Stewart, 2004). Fellows parallel this finding with a thought process that the responsibility varies by the inpatient service or rotation they're on.

Furthermore, fellows describe a sense of apprehension when referring because they're unsure the process after the referral is placed and are unable to explain these next steps to their patients. Fellows explicitly felt that having an order-set with reminders or "automatic checkmarks" facilitated their placement of a referral. Smith, Harkness & Arthur (2005) match the fellows' sentiments having found that when automatic referral is in place, participation increases. Though, simply increasing referrals may not be enough to significantly improve participation. Previous studies demonstrate that the strongest predictor of patient participation in those who are referred are physician endorsement (Ades, Waldmann, Polk, & Coflesky, 1992; Jackson, Leclerc, Erksine, Linden, 2005).

Half of the fellows explained having a CR site visit, however lack of communication was a specified barrier to endorsement. Despite these site visits, many fellows discussed having no interaction with CR staff. Even those that did talk about a site visit described it as being very informal with minimal staff contact. This minimal staff contact elicited little communication and didn't necessarily lead to facilitation of endorsement. In theory a CR site visit should produce increased knowledge and confidence.

Moreover, fellows expressed that CR is rarely a topic of conversation during team meetings or medical rounds creating a lack of awareness amongst them and other healthcare professionals. Coordination of a multidisciplinary team, during inpatient rounding, is the fundamental design of care for cardiac patients. In many instances fellows admitted to "forgetting" to talk about or refer patients to CR. CR referral is not always considered a priority compared to medication adherence

or physical therapy. Fellows explained that when patients need physical therapy a healthcare provider, such as a social worker, will approach for referral or when a patient could be on a particular medication a pharmacist gives the care team this information. This does not occur with CR which is unfortunate because the fundamental design of hospital care for cardiac patients entails coordinator between the physician and a multidisciplinary team.

Fellows often believe that they have little impact on actual participation. They cited insurance coverage, distance and patient motivation as reasons for not endorsing or referring patients to CR. In addition, more chronic patients and those with physical deficits were less likely to be referred despite evidence that these patients can benefit more. However, despite these barriers, patients would be more likely to attend CR if given a high strength of CR endorsement or encouragement (Resurreccion, D., Moreno-Peral, P., Gomez-Herranz, M., Rubio-Vaera, Pastor, L., Almeida, J. & Motrico, E., 2019). The amount of encouragement for participation was variable between fellows from very little to significant, paralleling previous work (Ades, Waldmann, McCann & Weaver, 1992; Scott & Allen, 2004). However, when fellows explained their thoughts behind the variability of the strength of encouragement, or how hard they pushed, for their patients to attend, the strength depended on the amount of interest the patient exhibited and number of perceived barriers the patient revealed. In some cases, fellows wouldn't even mention CR if patients seemed too debilitated again demonstrating a lack of knowledge because these patients may benefit most.

5.1 Strengths

The novelty of assessing cardiology fellows' in this inquiry is a strength. Cardiology fellows are critically important to increasing patient participation in university affiliated hospitals considering they spend a significant amount of time treating patients. Additionally, a 70% survey completion rate significantly lowered the risk of non-response bias in the analysis of the present study. Furthermore, the study was powered through the interview process having a narrow aim, dense sample specificity, established theory, strong quality of dialog and thematic cross-case analysis (Malterud, 2016).

Additionally, utilizing a mixed methods approach increased the rigor of the present study. This approach exposed discrepancies across analysis that would have been otherwise unknown. For example, the surveys suggested that fellows did not regard patient referral to CR to be inconvenient while semi-structured interviews suggested that fellows perceived the referral process to be a barrier. Additionally, through surveys the fellows reported they did not lack time to discuss CR or refer patients to CR while the interview process found fellows reporting lack of time being a barrier. These discrepancies are important to the study conclusions and need to be addressed further.

5.2 Limitations

While one might assume that the lack of generalizability is a significant limitation, the aim of the present study was to resonate not generalize. The findings of this inquiry may not be applicable to all cardiology fellows or cardiology fellowship programs. In qualitative research

trustworthiness rather than generalizability of the study findings, is an important feature of the research (Lincoln & Guba, 1985). Despite actions taken to minimize bias in the qualitative analysis there was only one coder allowing for interrogation of data validity and reliability. This study pursued trustworthiness through credibility and transferability. Rigorous methods of data collection and analysis enhance credibility

Credibility of the researcher is key. Prolonged engagement and observation, combined with “thick-description” and detail, adds to the credibility of the study (Patton, 1990). During the data collection process the primary investigator engaged in “bracketing”, a self-reflective process whereby the researcher recognizes their own a prior knowledge and assumptions and set them aside (Gearing, 2004) to improve credibility. Although the findings of this inquiry may not be applicable to cardiology fellowship programs as a whole, the reader may decide the extent to which these findings are transferable to other populations or groups with similar contexts and backgrounds. A third limitation is small sample size. This is the result of a single site trial where the fellowship program is limited to 30 cardiology fellows. The small sample size limited the statistical analysis that could be done because of an inadequate statistical power.

5.3 Implications

5.3.1 Implications for Inquiry

Fellows report they endorse CR. This endorsement however, seems to vary between individual fellows. For example, some fellows actively endorse CR by discussing CR with their patients while other fellows passively endorse CR by believing in the benefits but not relaying this

belief to their patients. Additionally, the strength of endorsement is variable and this greatly impacts patient participation. It is imperative that future inquiry better define endorsement (i.e. active versus passive), as well as define parameters to better measure the strength of endorsement. The better understanding of endorsement will allow for cardiology fellows, and other physicians, to become well-informed on the benefits of endorsement and how the strength of their recommendation impacts patient participation.

Another area of inquiry is CR endorsement and referral responsibility. For example, some fellows think that internal medicine residents are responsible for endorsing and placing CR referrals. Fellows explained that internal medicine residents spend a significant amount of time, and possibly more time, than fellows with hospitalized patients who are eligible for CR. This presents an opportunity to assess residents' CR knowledge and attitudes, and perceived facilitators and barriers to endorsement and referral. The DOM Internal Medicine Residents should be surveyed and interviewed to assess where opportunities are for increased knowledge, attitudes, endorsement, and referral. This inquiry would provide additional opportunity for CR endorsement and referral through residents. Additionally, this study should expand to multiple residency and fellowship programs throughout the country. While this study increased the understanding of gaps in CR knowledge, awareness, endorsement, and referral in Pittsburgh, it cannot be established that these gaps apply to all cardiology fellowship programs. Furthermore, the study could be expanded to other fellowship specialties that also treat eligible patients. These could include, but are not limited to pulmonary, endocrinology, and geriatric. Duplicating the current study in a multi-site, multi-fellowship trial would allow for more generalizability.

Finally, the current study utilized similar questions designed to elucidate facilitators and barriers to CR endorsement and referral through quantitative and qualitative methods. However,

it's clear that these two methods of questioning revealed conflicting results. It's possible the disagreement in perceived barriers between surveys and interviews are due to misinterpretation of the questions or the inability to fully clarify responses in a survey as compared to an interview. For example, the interviews allowed for the interviewer to probe for explanations of the fellows' responses while it's possible survey results didn't give the fellows an opportunity to expand on their responses. Future inquiry should aim to establish why there are differences between quantitative and qualitative inquiry when asking similar questions, and should address which method is more accurate and informative.

5.3.2 Implications for Practice

The current study is timely and should inform initiatives that are taking place now by guiding priorities of change. Existing initiatives are focused on systematic referral, order-sets, and opt-out referrals. While this is a critical step to increasing participation in CR, it does not completely address the gaps indicated by cardiology fellows. For example, the CDC and CMS have recently co-led The Million Hearts program which is a national initiative that aims to prevent one million acute cardiovascular events by 2022 (Centers for Disease Control and Prevention, 2018). The Million Hearts has set a national goal of 70% participation in CR for eligible patients. Systems change, referral, enrollment, and adherence are the focus of this initiative. However, the outline fails to address actionable strategies for improving CR awareness, knowledge, and endorsement among providers. Furthermore, the Agency for Healthcare Research and Quality (AHRQ) recently announced a three-year project designed to increase patient participation in CR (Agency for Healthcare Research and Quality, 2019). This initiative is geared towards partnering

with 100 hospitals to increase referrals. Their plan is to implement automated referrals and a trained CR liaison who will facilitate referral.

Fellows continually explained the benefit of order-sets/automatic referral and reminders for CR referral demonstrating the appropriateness at VAPHS. Current practice at VAPHS does not include an automatic referral following a stent or admission for heart failure. Additionally, insertion of a trained CR liaison into the multidisciplinary hospital rounds where fellows expressed that CR is not discussed would serve to increase CR awareness and knowledge. Furthermore, as patients are discussed the liaison should contribute information concerning eligible indications and benefits to individual patients.

Likewise, fellows stated that reminders are helpful and the CR liaison's involvement in medical rounds would serve as a referral reminder, enhance communication between disciplines, and allow fellows to gain a better understanding of what happens after referral. Current practice at VAPHS does not involve consistent communication between CR program and referring physicians. Additionally, the increased communication between disciplines would assure that fellows gain confidence in discussing CR with their patients because they can have continual insight of the transition from inpatient to outpatient CR. This should include updates for when the consult is received, the patient is scheduled, when the patient is assessed, and when patient begins and graduates from CR with outcomes. As explained in the current study fellows report that improved communication could enhance their CR recommendation.

Despite fellows visiting a CR department during their second year, communication and knowledge of day-to-day operations remained low. This necessitates a formalized CR site visit initiative that includes visits to all programs associated with the hospitals where they have rotations. These visits would begin during the first year of their fellowship and continue

throughout. During these visits an agenda would be in place and they can formally communicate with staff and patients, go through an evaluation process, and actively participate in sessions to obtain an understanding of the day-to-day logistics of patients and staff while also creating a rapport with CR staff.

In addition to formalized site visits, fellows consistently mentioned their daily noon conferences would be an advantageous time to have discussions about CR to increase their knowledge and improve awareness. Monthly lectures by an experienced CR professional can be developed to address the lack of knowledge concerning eligibility requirements and various referral processes. Additionally, it is possible that educating fellows on how to explain CR to a patient in a short amount of time (i.e. one minute) could increase the frequency that CR is discussed considering the short duration of patient contact that fellows reported.

This study has provided many important implications for inquiry and practice. The actionable strategies should be implemented over the next two years and rapidly tested in the local environment to assess improvement in fellows' CR knowledge, awareness, endorsement, and referral. While small scale interventions won't make immediate impact on overall CR participation at the population level, the results can be utilized to inform practice where implementation can begin on a larger scale.

Appendix A IRB Approval Letter

APPROVAL OF SUBMISSION (Exempt)

<i>IRB:</i>	STUDY18100056
<i>PI:</i>	Garrett Kellar
<i>Title:</i>	Cardiac Rehabilitation (CR) Knowledge & Attitudes of Cardiology Fellows
<i>Funding:</i>	None
<i>Date:</i>	November 7, 2018

On 11/7/2018, *the Institutional Review Board reviewed and approved the above referenced application through the administrative review process. The study may begin as outlined in the University of Pittsburgh approved application and documents.*

Approval

Documentation

<i>Review type:</i>	Initial Study
<i>Approval Date:</i>	11/7/2018

<i>Exempt Category:</i>	(2) Tests, surveys, interviews, or observation
<i>Determinations:</i>	
<i>Approved Documents:</i>	<ul style="list-style-type: none"> • Kellar Survey.docx • Kellar Interview Protocol.docx • Kellar_Recruitment Survey Script.pdf • Kellar_Recruitment Interview Script.pdf • Kellar_ Exempt Form.docx

As the Principal Investigator, you are responsible for the conduct of the research and to ensure accurate documentation, protocol compliance, reporting of possibly study-related adverse events and unanticipated problems involving risk to participants or others. The HRPO Reportable Events policy, Chapter 17, is available at <http://www.hrpo.pitt.edu/>.

If this trial meets the definition of a clinical trial, accrual cannot begin until it has been registered at clinicaltrials.gov and a National Clinical Trial number (NCT) provided. Contact ctgov@pitt.edu with questions.

Research being conducted in an UPMC facility cannot begin until fiscal approval is received from the UPMC Office of Sponsored Programs and Research Support (OSPARS). Contact OSPARS@upmc.edu with questions.

If you have any questions, please contact the University of Pittsburgh IRB Coordinator, Amy Fuhrman at fuhrman@pitt.edu.

Please take a moment to complete our [Satisfaction Survey](#) as we appreciate your feedback.

Appendix B Recruitment Letter/Consent

Dear DOM Cardiology Fellow,

I am conducting an inquiry as a doctoral student in the University of Pittsburgh's Health and Physical Activity Program. The focus of this study is to gain a better understanding of your knowledge and attitudes towards cardiac rehabilitation (CR) and improve referral and participation rates. Completion of this study will fulfill the dissertation requirements for my doctoral degree, but it is also my hope that it contributes to the limited research regarding residents' and fellows' knowledge and attitudes towards CR.

You have been chosen to be a participant in this inquiry based on the fact that you are a Department of Medicine Cardiology Fellow and are capable of talking to your patients about CR and ultimately referring them to CR. I would greatly appreciate your consideration to be a part of this study as, in years to come, I hope to be moving beyond this initial inquiry to create a program to better inform residents and fellows about CR.

This study will explore your current knowledge and attitudes towards CR, as well as asking if you have any ideas on how to improve referrals to CR. This will work to uncover knowledge gaps that will allow for a future program to address these gaps.

I will be using an online response website called *Qualtrics* to gather your anonymous responses. You will answer questions with multiple answers, rate answers to various questions and also respond to an open-ended, free-text question. I will then collect the data and analyze it to assess commonalities and differences in responses.

There are no direct benefits for participation in this study, nor is there any compensation attached. Your participation is purely voluntary, and you may choose to discontinue the inquiry study at any time. There are no risks associated with participation. Approval from the Institutional Review Board (IRB) at the University of Pittsburgh and your program director was previously requested and granted prior to this invitation.

Should you wish to receive results of the study, you may request a copy by emailing me at ggk3@pitt.edu. Your information will be anonymous and will not be connected to your names. Even your de-identified information will be treated as confidential. The data collected will only be available to me as the researcher, as well as my Advisor and Committee Chairperson, Dr. Carl Fertman. If you have questions or concerns about the study, you can also contact Dr. Fertman at carl@pitt.edu for additional information.

It is my hope that you choose to participate in this study, but I will certainly understand should you not want to move forward with being a part of this inquiry.

Should you agree to participate, please print a copy of this email and sign the bottom indicating that you've received this informed consent letter, are participating voluntarily, and grant me permission to utilize your de-identified data as part of the study's reports.

Thank you in advance for your consideration and willingness to contribute to this study.

Respectfully,

Garrett Kellar

Health and Physical Activity Doctoral Candidate

Attest:

I, _____, understand the terms of participating in this inquiry and

(Print Name)

am willing to accept this opportunity fully.

SignatureDate

Appendix C Cardiology Fellow Cardiac Rehabilitation (CR) Knowledge and Attitudes Survey

Thank you for taking the time to participate in this short survey to assess your knowledge and attitudes about cardiac rehabilitation (CR)! Specifically, we are interested in your knowledge about indications/eligibility for CR, benefits of CR, what CR entails and general attitudes towards CR. This survey should only take about 5 minutes. This survey is for the purpose of research and Garrett Kellar's Dissertation of Practice at the University of Pittsburgh. There are no foreseeable risks associated with participation nor are there any direct benefits. Information obtained will be kept confidential and used for the purposes of this dissertation. This survey is voluntary and you can withdrawal at any time. You will not receive any payment for participation. You do not have to answer any questions that you are comfortable answering. If you have any comments, questions, or concerns, please contact Garrett via phone at: 814-771-1819 or email: ggk3@pitt.edu.

Do you agree to participate?

Yes

No

Q1 What year in fellowship are you?

1 (19)

2 (20)

3 (21)

Advanced (22)

Skip To: Q2 If What year in fellowship are you? = 1

Skip To: Q2 If What year in fellowship are you? = 2

Skip To: Q2 If What year in fellowship are you? = 3

Q1a What is your advanced fellowship specialty?

- Heart Failure (1)
- Interventional (2)
- Electrophysiology (3)
- Cardiac Imaging (4)

Q2 Have you had a CR site visit at any hospital?

- Yes (15)
- No (16)

Q3 According to the American Heart Association (AHA), post-PCU and MI CR is a

- Class I indication (1)
- Class IIa indication (2)
- Unsure about the class (3)
- There is indication (4)

Q4 Which of the following patients meet criteria for referral to CR? (Choose all that apply)

- STEMI/NSTEMI (1)
- Stable Angina (2)
- Unstable Angina (3)

- Post-CABG (4)
- Post-Valve Replacement/Repair (5)
- A-Fib (6)
- Post-Ablation (7)
- Post-PCI (8)
- Systolic HF (HFrEF) (9)
- Diastolic HF (HFpEF) (10)
- Congenital Heart Disease (11)
- High-Grade Heart Block (12)
- ICD (13)
- Transplant (14)
- Post-Pacemaker/Resynchronization Therapy (15)

Q5 What is your understanding of the benefits of CR in patients with CAD? (Choose all that apply)

- Improves hospital re-admission rates (1)
- Can reduce all-cause mortality by 20-30% (2)
- Can reverse atherosclerosis (3)
- Reduces need for anti-hypertensive and anti-lipid medications (4)
- Reduces nonfatal recurrent MI (5)
- Improves morbidity and mortality (6)
- Improves lipid profiles (7)
- Improves medication adherence (8)
- Greatest benefits to those (9)

Q6 What is your understanding of what CR entails? (Choose all that apply)

- Exercise participation (1)
- Exercise counseling and education (2)
- Return to work counseling and education (3)

Nutritional education (4)

Social work involvement (5)

Medication titration (6)

Long term follow-up (7)

Smoking cessation (8)

A stress test prior to acceptance to program (9)

Patients are mostly responsible to pay a portion of the program cost (10)

Unsure of other components (11)

Q7 Please rate the following with respect to your general attitude towards CR. (1= Strongly Disagree, 7= Strongly Agree)

	Strongly Disagree (1)	Disagree (2)	Somewhat disagree (3)	Neither agree nor disagree (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
I lack the time to make referrals or discuss CR with my patients. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am unfamiliar with CR guidelines. (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am unsure of which patients to refer. (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am skeptical of CR benefits. (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am skeptical of local CR programs. (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am concerned about patients' comorbidities hindering participation. (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel referral should be the responsibility of another physician. (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am less likely to refer older patients. (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

It is inconvenient to refer patients. (9)

I feel patients are unlikely to attend despite referral. (10)

CR is not cost effective. (11)

I sometimes forget about CR. (12)

I am unfamiliar with referral processes. (13)

Appendix D Cardiology Fellow Cardiac Rehabilitation (CR) Endorsement/Referral

Interview Guide

Introduction to the interview:

Thank you for agreeing to participate in this interview. Before we begin I want to remind you that the purpose of this interview is for research and for Garrett Kellar's Dissertation of Practice at the University of Pittsburgh. We want to understand your attitudes towards CR and your perceived supports and barriers to CR endorsement and referral. This interview should only take about 10 minutes. You will not receive any payment for participation. The interview will be audio-recorded. Information obtained will be kept confidential and used for the purposes of this research dissertation. You will not be referred to by name during the interview and audio-recordings will be kept in a secure location and will only be accessed by the investigator. There is a risk of breach of confidentiality and there is no direct benefit to you. This interview is voluntary and you can withdrawal at any time and you do not have to answer any questions that you are uncomfortable answering. If you have any comments, questions, or concerns, please contact Garrett via phone at: 814-771-1819 or email: ggk3@pitt.edu.

Do I have your permission to proceed with the research questions? ____ Yes ____ No
Do I have your permission to audio record this interview? ____ Yes ____ No

Question(s)	Probe(s)
<i>Endorsement</i>	
<p>Do you talk to your patients about CR?</p> <p>Do you honestly believe in CR?</p> <p>What do you feel are supports to endorsing CR?</p> <p>What do you feel are barriers to endorsing CR?</p>	<p>If you talk to your patients about CR, how hard do you push them to attend?</p> <p style="padding-left: 20px;">--What is they're local?</p> <p style="padding-left: 20px;">--What is they're not local?</p> <p>What is your understanding of the CR programs in the hospitals you rotate through?</p> <p>Have you spoken to or observed CR staff?</p>
<i>Referral</i>	

<p>What do you feel are supports for CR referral?</p> <p>What do you feel are barriers to CR referral?</p>	<p>What do you know about the CR referral process?</p> <p>Are you aware of the referral processes in the hospitals that you've rotated through?</p> <p>Would you say that insurance coverage plays a role in you referring patients to CR?</p> <p>Do you feel that it is your responsibility to refer patients to CR or do you feel it's another physician's duty?</p>
<i>Closing</i>	
<p>Is there anything else that you would like to mention that we haven't already discussed?</p>	<p>Could you please tell me more about...</p> <p>I'm not quite certain what you mean by...</p>

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