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MODIFIERS OF THE EFFECTS OF DIFFERENT DIMENSIONS OF SOCIAL
SUPPORT ON CARDIAC REHABILITATION ADHERENCE

By

Melissa Amraotkar

B.A., Indiana University, 2006

B.S.N., Spalding University, 2011

A Dissertation

Submitted to the Faculty of the
School of Nursing of the University of Louisville

In Partial Fulfillment of the Requirements

For the Degree of

Doctor of Philosophy in Nursing

School of Nursing
University of Louisville
Louisville, Kentucky

May 2024

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DEDICATION

This dissertation is dedicated to my loving husband, Alok. And to my beautiful children,
Avinash and Avni Amraotkar, who are the lights of my life.

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This dissertation was possible thanks to many people who supported me along the way. First, I want to thank my dissertation Chair, Dr. Lynne Hall, for her kind guidance and for sharing her expertise in nursing research. Thank you for your continuous support on this mind-expanding experience. I am so grateful that you believed in me and encouraged me to take it to the next level. Thank you to my dissertation committee members, Drs. Lynn Roser, Lee Ridner, Shuying Sha, and Abdur Khan. Each of you brought a crucial unique piece to this project. I appreciate each of you.

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and Avni, you both came into my life during this experience. You changed my life and became my why.

ABSTRACT

MODIFIERS OF THE EFFECTS OF DIFFERENT DIMENSIONS OF SOCIAL SUPPORT ON CARDIAC REHABILITATION ADHERENCE

Melissa Amraotkar

March 3, 2024

Introduction: Cardiovascular disease (CVD) is a leading cause of mortality worldwide. Cardiac Rehabilitation (CR) is a Class I, level A indication for treatment and prevention further complications of CVD. The attendance rate for CR in the U.S. is very low, especially among female patients. Dimensions of social support, sex of the support provider, and the quality of primary intimate relationship are associated with health-promoting behavior and may influence CR adherence in patients.

Purpose: The purpose of this study was to examine the relationship between dimensions of social support and CR adherence, and whether these relationships were moderated by factors such as sex of the support provider and type of primary intimate.

Method: A longitudinal, observational study was conducted with a sample of 56 adults attending CR. Multiple regression was used to assess the relationships between dimensions of social support and CR adherence. Moderated multiple regression was used to evaluate modification effects of sex and type of primary intimate on the association between dimensions of social support and CR adherence.

Results: Sex of the CR participant significantly moderated the association between emotional/informational support and CR attendance ($p = .02$). There was a significant negative relationship between emotional/informational support and CR adherence for female participants only ($\beta = -.56$; $p = .05$), but the association between emotional/informational support and CR adherence participants was not significant in males ($\beta = .13$; $p = .43$).

Conclusion: Sex of the CR participant modified the relationship between emotional/informational support and CR adherence. Though the results for the other aims were non-significant, the results inform future research on this topic. The small sample size limited generalizability. Many participants had characteristics, aside from social support, that are associated with greater CR enrollment and adherence. Moderation analysis typically has low statistical power. The limitations of this study highlight the difficulty of analyzing data on CR adherence. Further research is needed with a larger sample of female CR participants and different types of primary intimate relationships to determine precisely how social support dimensions affect CR adherence.

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CHAPTER I

INTRODUCTION

The purpose of this longitudinal, observational study was to examine the relationships between various dimensions of social support and cardiac rehabilitation (CR) adherence in individuals with cardiovascular disease (CVD). In addition, the influence of sex of both the participant and the primary intimate, and the relationship of the primary intimate to the participant were evaluated as potential modifiers of those relationships. CVD is a leading cause of mortality worldwide (American Heart Association [AHA], 2017a) and is responsible for one out of every three deaths in the United States (U.S.) (National Heart Lung and Blood Institute, 2018). CR is a Class I, level A indication for treatment of and prevention of further complications of CVD (Smith et al., 2011; Wenger, 2008). The current attendance rate for CR in the U.S. is very low (Ades et al., 2017; Doll et al., 2015), especially among female patients (Samayoa et al., 2014; Supervia et al., 2017). Tangible social support and emotional/informational social support are associated with CR attendance (Grace, Gravely-Witte et al., 2009; Hagan et al., 2007; Marzolini et al., 2008; Resurrección et al., 2017). The quality of one's primary intimate relationship is positively associated with health-promoting behaviors (Kiecolt-Glaser & Newton, 2001; Trief et al., 2004). Sex of both the support recipient and the support provider, and the type of relationship between the two may influence the effectiveness of social support (Belle, 1982; Cutrona, 1996; Li et al., 2014; Seeman & Berkman, 1988; Xu & Burleson, 2001).

Cardiac rehabilitation, considered to be an important method of secondary prevention of CVD, applies primary preventive measures to avoid future cardiac events and/or further complications in patients previously diagnosed with CVD (Balady et al., 2011). CR is designed to provide psychological and physical support to prevent further progression of cardiac disease or potentially reversing disease (Aldana et al., 2003; Bellmann et al., 2020). The comprehensive approach of CR includes components of supervised exercise, heart-healthy lifestyle education, and stress reduction counseling (American Heart Association, 2016). The primary goal of CR is to slow the progression of CVD and to reduce the incidence of further damage to the cardiac muscle tissue (Savage et al., 2011), which left untreated can lead to heart failure and exacerbation of heart failure. In addition, CR programs aim to improve strength, overall health, and quality of life (Mayo Clinic Staff, 2017). There are numerous benefits related to CR participation including reduction in CVD mortality and improved health related quality of life (Anderson et al., 2016).

Despite the many benefits associated with attending CR, enrollment and subsequent attendance rates remain poor in the United States and worldwide (Turk-Adawi & Grace, 2015). National rates of CR program enrollment, defined as attending the initial CR session, ranged from 10.3% - 35.5% of eligible adults (Ades et al., 2017; Beatty et al., 2018; Fang et al., 2017; Peters & Keeley, 2017). CR program completion rates ranged from 5.4% - 26.9% in Medicare beneficiaries (Doll et al., 2015; Ritchey et al., 2020). CR adherence has a dose-response benefit, and the mortality risks decrease significantly with each additional attended session (Martin et al., 2012; Santiago de Araujo Pio et al., 2017). Known barriers and facilitators to CR attendance are social

(Gaalema et al., 2015; Parashar et al., 2012), biological (Supervia et al., 2017), health belief-related (Almerud-Österberg et al., 2011; De Vos et al., 2012), health-related (Armstrong et al., 2014), financial (Dankner et al., 2015; Shanmugasegaram et al., 2013), healthcare-related (Dunn et al., 2017; Grace et al., 2012), and logistical (De Vos et al., 2012) in nature. While women suffer from cardiac events requiring hospitalization at a similar rate as men, they are continuously underrepresented at CR programs (Colbert et al., 2015). Moreover, women are less likely than men are to be referred to CR (Gravelly et al., 2014; Supervia et al., 2017). One reason for this is that women are less likely to receive a strong endorsement of CR from their healthcare provider when compared with men (Smith et al., 2022). Subsequently, women are less likely to enroll and eventually complete CR (Supervia et al., 2017). Smith et al. (2022) cite musculoskeletal issues, comorbidities, problems with transportation, and caretaking responsibilities as sex-specific barriers to CR adherence in women.

The terms *adherence*, *participation*, and *attendance* have been used interchangeably to describe the number or percentage of CR sessions attended. *Adherence* is frequently used to describe CR attendance (Gaalema et al., 2016; Karmali et al., 2014; Ruivo et al., 2017; Siegmund et al., 2017). It can also mean how closely a CR participant follows the guidelines of the program (Bock et al., 1997; Fix & Bokhour, 2012), and it can refer to the degree to which CR professionals follow established guidelines of administering a CR program (Goud et al., 2010; Lewin et al., 1998). Some studies define *participation* as attending at least one CR session (McIntosh et al., 2017; Park et al., 2017), meaning that attending a single CR session is equivalent to attending some or all prescribed CR sessions. Conversely, some studies used the term *attendance* to

indicate CR completion (Colbert et al., 2015) which excludes attendance of all CR sessions except one. Other studies used the term *attendance* to indicate CR adherence sessions attended (Beckie & Beckstead, 2010; Clark et al., 2012; Pedersen et al., 2018). Some studies used *attendance* and *adherence* interchangeably (Daly et al., 2002; Mehta et al., 2016). For this study, the term *CR adherence* was used to describe the number of CR sessions completed divided by the number of sessions prescribed.

Social support is positively associated with CR attendance (Marzolini et al., 2016; Pogossova et al., 2015; Supervia et al., 2017). A lack of perceived social support is associated with a larger number of barriers to attending CR, such as problems with transportation, in individuals with mobility deficits (Marzolini et al., 2016). A larger social network is associated with higher likelihood of attending CR (Campkin et al., 2017; Molloy et al., 2008). Higher levels of received social support are associated with better emotional well-being in CR participants (Blikman et al., 2014) which may play a role in CR adherence. However, it is important to note that men are more likely than women to enroll and subsequently attend CR. A meta-analysis of studies of CR enrollment among men and women concluded that women were 36% less likely to enroll in a CR program (Samayoa et al., 2014). Colbert et al. (2015) reported that women were 25% less likely to receive a referral to CR, and of those who were referred to CR women were 27% less likely to attend CR, which was defined as attending at least 12 CR sessions. Therefore, existing studies that include both male and female CR patients have a greater representation of male than female participants, and subsequently more data on men than women.

There are various definitions and measures of different dimensions of social support. Perhaps most integral to the definition of social support is the aspect of belonging to a social network that provides supportive behavior, including psychological and tangible aspects (Al-Dwaikat & Hall, 2017; Cobb, 1976; Kahn & Antonucci, 1980). Some studies of social support use the term to refer to the social network (Berkman & Syme, 1979; Christakis & Fowler, 2007; House, 1987; Kim et al., 2015). Others focused on how social support is perceived by the recipient of social support (Cobb, 1976; Freeborne et al., 2019; Greco et al., 2014). Feeney and Collins (2015) suggest that researchers conceptualize social support as an interpersonal process, specifically focusing on how relationships affect ‘thriving.’ Furthermore, some researchers have focused on qualitative aspects of social support such as the quality of the primary intimate relationship (Hall & Kiernan, 1992). Social support frequently is subdivided into four dimensions: *emotional*, *tangible* or *instrumental*, *informational*, and *appraisal* (Ates, 2016; House, 1981; Langford et al., 1997; Lett et al., 2005; Weiss, 1974; Wu et al., 2018).

In this study social support is operationalized as *tangible support*, *emotional/informational support*, and *the quality of the primary intimate relationship*. Tangible support refers to material or physical aid that benefits the recipient (Langford et al., 1997). Tangible support has a positive relationship with CR attendance and medication adherence in patients who experienced acute coronary syndrome (Molloy et al., 2008). Inability to obtain reliable transportation or reassignment of informal caregiving duties, which are examples of tangible support, was cited by women as reasons for not attending CR (Resurrección et al., 2018). Furthermore, male CR participants were more likely than female participants to cite work responsibilities as a

barrier to CR attendance (Grace, Gravely-Witt, et al., 2009). Emotional/informational support occurs when one feels cared for, empathized with, loved, or through trust-building interactions (Langford et al., 1997). An intervention of emotional/informational support from nurses resulted in greater CR attendance in a mostly male sample (Cossette et al., 2012). Emotional support from other female participants in a CR program designed for women was cited as a facilitator of CR attendance (Rolfe et al., 2010). The primary intimate relationship is defined as the quality of the relationship with the most important person in one's life, the person to whom one feels closest (Hall et al., 1987). The quality of that relationship may have both positive and negative dimensions (Hall & Kiernan, 1992). Social support that an individual receives from this relationship may depend on the quality of this relationship (Hall & Kiernan, 1992). Interviews with CR attenders and CR non-attenders revealed that social support from an intimate relationship was an influential factor in CR attendance for men and women (Jackson et al., 2011). Though a specific relationship between the quality of the primary intimate relationship and CR attendance has not been evaluated, variations of intimate relationship quality are associated with health-promoting behaviors (Kiecolt-Glaser & Newton, 2001; Trief et al., 2004). Marital adjustment is positively associated with blood pressure medication adherence (Kiecolt-Glaser and Newton, 2001). Marital satisfaction is inversely related to weight gain after gastric restriction surgery in women (Kiecolt-Glaser and Newton, 2001). Positive marital interaction is inversely associated with substance abuse, particularly in men (Kiecolt-Glaser and Newton, 2001). Marital intimacy is positively associated with diabetes self-care adherence (Trief et al., 2004).

Positive and negative aspects define the quality of the primary intimate relationship (Hall & Kiernan, 1992). Positive aspects of social support provided by the primary intimate relationship are those that are helpful to the well-being of an individual (Ates, 2016). Other aspects of this relationship may be unhelpful or even harmful (Hall & Kiernan, 1992). Negative social support can be directly negative or inadvertently negative, in which case it is termed *problematic support*. Problematic support occurs when the intention is to provide support, but the recipient perceives the support as non-supportive (Revenson et al., 1991). In other words, it is a mismatch of support provided versus support received. Recipients of such support may perceive it as a force of control (Revenson et al., 1991). Interestingly, Rook (1984) reported that negative social support was a stronger predictor of well-being than positive social support. Higher quality of the primary intimate relationship is associated with positive health outcomes (Hall et al., 1987; Hutti et al., 2015; Yang et al., 2017). Problematic social support is associated with increased depression (Coty & Wallston, 2010). A higher rating of control behavior from a spouse was associated with worse mental and physical health in both men and women (Franks et al., 2006).

Women and men provide social support in different ways. Social support provided by women is perceived as more effective than support provided by men (Rendall et al., 2011; Williamson & O'Hara, 2017), and is associated with positive health outcomes (Cutrona, 1996; House et al., 1988; Kristofferzon et al., 2003; Stringhini et al., 2012; Stronge et al., 2019). This may be due to differences in the types of support that women and men provide. Supportive relationships with women are described as more intimate, emotionally sensitive, and congruent with the amount and type of support that is desired

(Kahn et al., 2011; Williamson & O'Hara, 2017). Bodenmann et al. (2015) suggests that women are more effective at regulating the emotional distress of others. Lack of adequate emotional social support is associated with increased risk of mortality (Berkman et al., 1992).

Social support is provided by various members of the patient's social network such as a spouse or domestic partner, parent, sibling, adult child, friend, healthcare professional, or clergy (Abbey et al., 1985; Dean et al., 1990; Hall et al., 1985). Spousal support has a positive relationship with healthy lifestyle behaviors (Stephens et al., 2013), including CR attendance (Franks et al., 2006; Hong et al., 2005), but sometimes only in men (Franks et al., 2006; Loprinzi & Crush, 2018). Moreover, the effects of marriage on positive health outcomes are stronger in men than in women (Rendall et al., 2011; Taylor, 2007). Supportive relationships with adult children are associated with more frequent exercise in parents (Thomas et al., 2019). Adult daughters are more likely than adult sons to provide support to elderly parents (Taylor, 2007). This may be due to mothers and adult daughters having more frequent contact than with fathers or adult sons (Fingerman et al., 2020). Problematic intergenerational support is detrimental in the psychological well-being of older women and men (Silverstein et al., 1996). Close female friends are important sources of support for women (Taylor, 2007).

Efforts to investigate and develop strategies to address low rates of CR program attendance in CVD patients yielded in a significant stride towards finding solutions. The Million Hearts Initiative, a collaborative effort of the Centers for Disease Control and Prevention and the Centers for Medicare & Medicaid Services aims to increase the CR attendance rate in eligible patients from 20% to 70% by the year 2022 (Ades et al., 2017).

This campaign deemed a goal of 70% as more realistic than 100% which considers social and physical barriers to attendance. Moreover, Chindhy et al. (2020) propose that a home-based CR, either alone or in combination with center-based CR, would address many barriers to CR attendance.

Social support provided by women is associated with healthy lifestyle behaviors in both men and women (Bodenmann et al., 2015; Lowenthal & Haven, 1968; Mirowsky & Ross, 2003). Men receive more positive health benefits than women do as the recipients of social support (House et al., 1982). Spousal relationships are beneficial to health outcomes and health behavior in both women and men, but the effects are stronger in men (Rendall et al., 2011; Taylor, 2007). Spousal support provided by wives is associated with CR attendance, but support provided by husbands to wives is not (Franks et al., 2006), which is reflective of the literature that women provide more effective social support in times of stress (Neff & Karney, 2005). Support from adult children to elderly parents is associated with healthy lifestyle behaviors (Thomas et al., 2019). While there is ample evidence of the relationship between social support and CR adherence, details of how social support is given and received remain unclear. Little is known about what role that sex, type of relationship of the patient as well as the supporters play in the association between social support and CR adherence. Hence, in this study associations between various dimensions of social support and cardiac rehabilitation (CR) adherence in individuals with cardiovascular disease (CVD) were examined. In addition, the influence of sex of both the participant and the primary intimate and the relationship of the primary intimate to the participant were evaluated as potential modifiers of those relationships. The specific aims were to:

Aim 1: Evaluate the associations between different dimensions of social support (tangible social support, emotional/informational social support, and the quality of the primary intimate relationship) with CR adherence.

Hypothesis 1: Tangible social support, emotional/informational social support, and the quality of the primary intimate relationship are positively associated with CR adherence.

Aim 2: Evaluate the role of sex of the CR patients and sex of the primary intimate in the relationships between different dimensions of social support and CR adherence.

Hypothesis 2a: Social support is positively related with CR adherence in males but not females.

Hypothesis 2b: The relationship between social support and CR adherence differs by the sex of the primary intimate.

Aim 3: Determine if the type of primary intimate modifies the relationships between different dimensions of social support and CR adherence.

Hypothesis 3: The relationship between social support and CR adherence differs by the type of primary intimate relationship.

CHAPTER II

REVIEW OF LITERATURE

Cardiac Rehabilitation Attendance

There are numerous benefits related to CR attendance in individuals who have CVD, which encompasses one or more of the following conditions: high blood pressure, coronary heart disease (CHD), stroke, congestive heart failure, and atrial fibrillation (American Heart Association, 2017a). Documented benefits include: a 31% decrease in hospital readmission one year following an initial hospitalization (Ades et al., 2017; American Heart Association, 2013); lower mortality for one to three years following hospitalization for a cardiac event (Ades et al., 2017); a reduction in CVD mortality (Anderson et al., 2016); decreased depressive symptoms (Lavie et al., 2016; Milani & Lavie, 2007); decreased anxiety (Herring et al., 2010); a reduction in psychological stress (Lavie et al., 2016); improved health related quality of life (Anderson et al., 2016); and improved adherence to prescribed cardiac medications (Suaya et al., 2009). Despite these benefits, CR is poorly attended (Ades et al., 2017; Doll et al., 2015).

The focus of this study is on Phase II outpatient CR which occurs at a hospital or cardiologist's office after an eligible participant is discharged from inpatient hospital services. Individuals who participate in a Phase II outpatient CR program are expected to meet the following expected outcomes, per the American Heart Association (AHA): dietary and exercise plan adherence; meeting blood pressure goals; lipid management; diabetes management; complete abstinence from smoking; psychosocial and stress

management; functional independence per individual goals; reduced symptoms; and improved cardiorespiratory fitness, flexibility, and strength (Balady et al., 2007). Most of the CR research is focused on Phase II CR and is commonly shortened to CR under the assumption that the reader understands that it refers to Phase II CR. Phase III outpatient CR is attended by Phase II CR graduates and their family members as a maintenance program. The goal is to continue their exercise regimen but with less monitoring from healthcare professionals. Health insurance plans typically do not cover this phase of CR (Aetna, 2019). CR program participation requires a prescription from a physician (Aetna, 2019) or from a nurse practitioner or physician's assistant, based on regional laws (American Association of Cardiovascular and Pulmonary Rehabilitation [AACVPR], 2019), which is ordered during hospitalization or at a follow-up appointment. The prescription for CR typically is written for 36 sessions within a 36-week interval from start to finish which aligns with coverage provided by Medicare Part B and most private insurances (Medicare Rights Center, 2019). Upon CR program enrollment, the participant is assessed for fitness ability and risk factors of exercising (U of L Health, 2019). Programs are individualized for each participant, and include the use of cardiorespiratory and weight equipment, education, dietitian consultation, and group counseling that includes coping skill development (U of L Health, 2019). Participants are monitored via cardiac telemetry during exercise sessions, and nurses are readily available to provide assistance if necessary (U of L Health, 2019). CR differs from a gym membership in that it also provides counseling for stress reduction, smoking cessation, healthy dietary options, and medication adherence (AHA, 2013).

Goals for graduating from CR vary between CR facilities. Some facilities focus primarily on functional capacity and aim to increase METs by at least 40%, which is deemed a clinically significant improvement per the American Association of Cardiovascular and Pulmonary Rehabilitation (AACVPR) (Cleveland Clinic, 2021). This professional organization sets standards for cardiac and pulmonary rehabilitation programs. Others take a more holistic view of the patient and assess all goals of CR, such as stress management (Ullah et al., 2023). Individuals may graduate earlier than the initially planned 36 sessions if their healthcare provider decides they have made adequate progress toward their CR plan.

While CR uses a multidimensional approach for secondary CVD prevention, exercise is a major component of the program. The Physical Activity Guidelines Advisory Committee (2018) of the U.S. Department of Health and Human Services recommends that adults engage in weekly aerobic activity of at least 150 minutes at moderate-intensity or 75 minutes at vigorous-intensity, along with two or more days of strength training. In addition, the report states that for individuals who cannot meet this goal, light-intensity physical activity in lieu of a sedentary state is effective in reducing the risk of mortality. According to the Office of Disease Prevention and Health Promotion (ODPHP) (2016), more than 80% of Americans, regardless of CVD status, do not adhere to the recommended amount of physical activity. CR is a program designed with an outcome of incorporating exercise into daily life, beyond the clinical setting.

Social Factors and CR Attendance

Social factors contribute to the likelihood of attending CR. Social support is related to effective behavior change in the face of a stressor (Berkman et al., 2000), in

this case a cardiac event. A lack of social support (Marzolini et al., 2016; Pogosova et al., 2015; Supervia et al., 2017), being unmarried (Parashar et al., 2012), and a low educational level (Kotseva et al., 2013; Parashar et al., 2012; Weingarten et al., 2011) are associated with lower rates of CR attendance. A systematic review of barriers to CR participation in women found that a lack of support from friends and family is associated with lower rates of CR enrollment (Supervia et al., 2017). Less social isolation is associated with higher CR utilization (Blair et al., 2014). Singh et al. (2022) reported that family support, role of primary caregiver, and peer support were cited as the most common themes in a systematic review of qualitative studies about social support in women attending CR. A systematic review of qualitative CR attendance studies in women reported that family support and peer support were cited as influential for program completion, whereas caregiving responsibilities were associated with CR program non-completion (Singh et al., 2022).

Cigarette smoking is associated with a higher rate of CR referral, enrollment, and completion (Gaalema et al., 2015; Parashar et al., 2012). It is important to note that smoking rates are higher in lower-SES patients (Albert et al., 2006; Gaalema et al., 2015), therefore, low-SES and smoking may be covariates in their relationship with CR participation, as low-SES influences both likelihood of smoking and CR participation (Hiscock et al., 2012; Mead et al., 2016; Parashar et al., 2012). Similarly, educational level, which was associated with CR adherence (Williamson et al., 2021), is possibly a covariate in the relationship between low-SES and CR adherence. Study participants who reported smoking prior to hospitalization were less likely to attend CR if they reported a higher number of friends and family members who also smoked, suggesting a

relationship between social environments and number of CR sessions attended (Bolívar et al., 2021).

Demographic Characteristics and CR Attendance

Sex and gender affect likelihood of attending CR. Women are less likely than men to be referred to (Gravely et al., 2014; Li et al., 2018; Supervia et al., 2017), attend (Dankner et al., 2015; Parashar et al., 2012; Samayoa et al., 2014; Soo Hoo, Gallagher, & Elliott, 2016; Supervia et al., 2017), and complete CR (Supervia et al., 2017). Women, regardless of attendance status, are more likely than men to cite the tiring and painful nature of exercise as a barrier to attending CR (De Vos et al., 2012; Firoozabadi et al., 2023; Grace, Gravely-Witte et al., 2009). Grace, Gravely-Witte et al. (2009) proposed that gender differences in exercise capacity, burden of comorbidities, and exercise preferences should be considered for women who are eligible for CR. Similarly, Grande and Romppel (2011) reported gender differences in motivations for recovery after an acute myocardial infarction; men were more motivated by improving physical endurance when compared with women. Firoozabadi et al. (2023) concluded that persons eligible for CR should be informed that exercise may be tailored to fit their personal needs, to address women's concerns with exercise expectations during the CR program that may be out of their reach or preference. Non-attending women are more likely than men to attribute hereditary factors as the cause of their CVD (Almerud-Österberg et al., 2011), a belief which is associated with low perceived control regarding an individual's ability to alter the course of CVD (Claassen et al., 2010). Conversely, De Vos et al. (2012) reported that men who did not complete CR held the belief that they could handle their cardiac problems on their own without CR. This was partially attributed to an association

between CR non-enrollment and poor knowledge of risk factors (De Vos et al., 2012), noted in an earlier study (Redfern et al., 2007). Moreover, in patients who were hospitalized for acute coronary syndrome, men were 2.4 times more likely than women to perceive themselves as cured when evaluated one week after leaving the hospital, which demonstrates an unrealistic perception of their health condition (Waring et al., 2016). Men were more likely to cite work as a barrier to participating than women (Grace, Gravely-Witte et al., 2009). Likewise, men rated reducing strain at the workplace as a top priority when surveyed about motivations for recovery after experiencing acute myocardial infarction (Grande & Romppel, 2011). Firoozabadi et al. (2023) also reported that men who were eligible for CR, but did not attend, rated work responsibility as a greater CR barrier compared with women who did not attend CR. It should be noted that most of the women were unemployed, and naturally, work responsibility was a unique barrier for men in this sample. Therefore, caution should be taken when generalizing this finding (Firoozabadi et al., 2023). Furthermore, this study noted that men were more likely than women to report that they already exercised at home or in the community, further emphasizing a need for patient education that CR is a comprehensive approach to secondary heart disease prevention rather than a singularly exercise improvement program.

Older age is associated with lower rates of CR attendance (Dankner et al., 2015; Grace, Shanmugasegaram et al., 2009; Kotseva et al., 2013). Older patients cited more barriers to CR attendance, particularly, exercise discomfort, lack of perceived need for CR, lack of knowledge regarding CR availability, lack of strong physician endorsement of CR, and existing comorbidities (Grace, Shanmugasegaram et al., 2009). Benefits of

physical activity in older adults include the maintenance of functional status (Schopfer & Forman, 2016) and improved quality of life (Langhammer et al., 2018).

Non-white patients, with the exception of Southeast Asians (Findlay et al., 2017), are less likely to attend CR than white patients (Parashar et al., 2012). Furthermore, Li et al. (2018) reported that hospitalized Asian, Hispanic, and Black patients were respectively 50%, 36%, and 20% less likely to receive a CR referral when compared to hospitalized white patients. In a sample of 107,199 individuals with a CR-qualifying diagnosis, non-White individuals had lower probabilities of attending CR: Hispanic (43%), Asian (31%), and Black (19%) (Garfein et al., 2022). In a review of CR utilization disparities by race, ethnicity, sex, and SES, Mathews and Brewer (2021) observe that persons in racial and ethnic minority groups are more likely to have a higher number of negative social determinants of health, thus, resulting in lower CR participation. Similarly, Mead et al. (2016) proposed that the effects of barriers to CR attendance are related to socioeconomic status (SES) and are felt more strongly by racial minorities. This is a concerning trend, considering that African Americans are at higher risk for major cardiac events post-CVD diagnosis (Mathews et al., 2022). In addition, African Americans exhibit an earlier onset of CVD risk factors, with a cumulative burden that poses a serious threat to their health over time (Carnethon et al., 2017). Mathews et al. (2022) cite that African Americans receive fewer CR referrals because they are (a) more likely to be treated with medical management, rather than advanced cardiac procedures; (b) more likely to be insured by Medicaid or non-insured; and (c) live in regions with too few CR facilities or CR facilities already at capacity. In addition, lack of healthcare

provider knowledge about benefits of CR and implicit bias among clinicians contribute to low CR referral in African Americans (Mathews et al., 2022).

Patient Health Status and CR Attendance

Research regarding CR participation in patients with comorbidities aligns with other research in persons with comorbidities, in that they pose barriers to lifestyle adjustments. Comorbidities, such as diabetes, previously diagnosed CVD, chronic obstructive pulmonary disease, and end-stage renal disease, create a barrier for persons eligible to participate in CR programs and are subsequently associated with lower CR participation (Armstrong et al., 2014; De Vos et al., 2013; Doll et al., 2015; Weingarten et al., 2011). Furthermore, physical pain and orthopedic limitations prevent patients from attending CR (Ades et al., 2017).

Overall, depression is positively associated with CR non-adherence (Casey et al., 2008; Rao et al., 2020; Resurrección et al., 2019). Individuals with depression may experience fatigue as a side effect of depression medication or directly from depression itself (Fava et al., 2014), which may limit their CR adherence. Paradoxically, Krishnamurthi et al. (2019) report an incongruence with previous studies, finding that individuals with depression were more likely to participate in CR programs. One possibility for these results is that individuals with depression may have existing connections to healthcare professionals, leading to more opportunities for enrollment (Krishnamurthi et al., 2019). Moreover, it is important to note the limitation that depression may be underdiagnosed (Handy et al., 2022), with greater rates in Black and Hispanic communities (Blue Cross Blue Shield, 2022). Traditionally, CR participation is associated with decreased symptoms of depression (Ades et al., 2017; Türen et al., 2024;

Yohannes et al., 2010), but several studies, including a meta-analysis, did not find a significant association (Bellman et al., 2020). Hopelessness is positively associated with CR non-attendance in individuals who experienced acute coronary syndrome (Dunn et al., 2009). Furthermore, motivation plays a role in an individual's decision of whether to attend CR. Thow et al. (2008) assessed different types of motivation related to CR participation. Participants valued CR as a means of preventing health problems as opposed to motivation related to competition, challenge, weight loss, physical appearance, and social recognition.

In contrast, Park (2017) found that a history of ischemic heart disease was positively associated with number of CR sessions attended (Park, 2017). Patients with a known history may consider their disease as chronic as opposed to acute which may explain why they were more inclined to participate in CR. Other literature supports the notion that perception of a cardiac event as acute, and low risk for future events, is associated with a lower likelihood of lifestyle change (Everett et al., 2016). Patients may view themselves as cured of disease once initial symptoms (e.g., chest pain, nausea, fatigue, etc.) subside, although this was not consistent in patients with only hypertension or patients diagnosed with peripheral artery disease (PAD) (Parashar et al., 2012).

Access to Care and CR Attendance

Healthcare factors affect CR attendance. Upon the advent of widespread use of electronic medical records (EMR), automatic referrals for CR were enacted by many hospitals, and are associated with greater CR enrollment (Grace et al., 2012). Automatic referrals to CR occur within an order set in the EMR when a healthcare provider is treating an eligible patient. As prescriptions are required to attend CR, this practice has

improved CR access for patients who historically were less likely to receive a referral to CR including ethnic minorities, women, and elderly adults (Balady et al., 2011).

Unfortunately, this practice is not universal practice for all healthcare systems. In a study using registry data and Medicare claims of 48,993 hospital patients, Li et al. (2018) reported that only 40% of eligible patients received referrals to attend CR. Perceived strength of the provider's endorsement for CR is one of the most influential determinants of CR attendance (Ades et al., 1992; Dunn et al., 2017; Ghanbari-Firoozabadi et al., 2020). This refers to how strongly the patient perceives that the provider believes the patient will benefit from attending CR. Cardiac specialists (cardiologists and heart surgeons) in a low-resource setting cited a shortage of time with patients, lack of sufficient awareness of CR, and skepticism of CR benefits as barriers to adequate endorsement of CR (Ghanbari-Firoozabadi et al., 2020). It is important to note that nurse practitioners and physician assistants have a limited scope of prescribing CR, based on regional laws, and a physician must directly supervise the CR facility, according to Medicare guidelines (AACVPR, 2019). To ensure that patients understand all the benefits available through CR in their recovery, some hospitals use a CR liaison which is associated with an increase in CR attendance (Grace et al., 2011; Johnson et al., 2010; Soo Hoo et al., 2016). This liaison, usually a nurse, either is consulted to discuss CR with a patient while they are hospitalized or will contact them by phone to plan for their enrollment. In the case that an individual did not receive a referral from their physician while hospitalized, they can contact CR facilities to find out if they are eligible, and the staff can procure an order from a supervising physician. A combination of automatic referral and use of a CR liaison is associated with double the CR enrollment rates

compared with usual methods of referral (Gravelly-Witte et al., 2010). To ensure better rates of CR attendance, the first outpatient CR session should begin within 10 days of hospital discharge, as there is a depreciation of attendance likelihood associated with each extra day of wait (Russell et al., 2011). Unfortunately, the median wait time to begin CR is 35 days (Pack et al., 2013).

Many of the barriers to CR attendance are related to patients' financial constraints. A low base income is associated with low attendance rates (Dankner et al., 2015; Shanmugasegaram et al., 2013). Uninsured patients are less likely to attend CR (Parashar et al., 2012). Likewise, having an insurance plan that requires a co-payment for each CR session, which is typically \$20 but can be as high as \$60 (Appleby, 2016), creates a barrier to attendance (De Vos et al., 2012). Gaalema et al. (2016) innovatively addressed this barrier by offering financial incentives to Medicaid beneficiaries for each completed CR session. The group receiving financial incentives completed all 36 CR sessions at a significantly higher rate compared to the group who did not receive incentives. Paradoxically, Suaya et al. (2007) reported of a particularly low CR attendance rate of 5.2% in people who were dually insured through Medicare and Medicaid which fully covers all costs associated with CR and has no copayment requirement. Furthermore, the inability to afford transportation and/or parking to attend CR is cited as a barrier (Dhaliwal et al., 2017).

Other logistical factors were cited as barriers to CR attendance. Longer commute times from home to the CR facility is associated with CR non-attendance (De Vos et al., 2012; Gaalema et al., 2014; McDonall et al., 2013; Shanmugasegaram et al., 2013) and creates a barrier particularly for rural patients. Women cite caregiving responsibilities for

an ill spouse or for grandchildren as a barrier to attending CR (Grace, Gravely-Witte et al., 2009). There is extensive literature regarding the relationship between caregiving and neglecting one's own personal health (Given et al., 2011; Verma et al., 2016).

CR adherence is an important area to explore because it is associated with improved exercise capacity, lipid profile, BMI, body fat percentage, quality of life, depression, and anxiety (Lavie et al., 2014; Wenger, 2008; Yohannes et al., 2010). Despite these known benefits from participating in CR programs, adherence rates are poor (Ades et al., 2017; Doll et al., 2015). While there are various known barriers to CR adherence, the current study explored social support because of its relationship with effective behavior changes in the face of a stressor (Berkman et al., 2000), in this case a cardiac event. Past studies have linked social support with CR enrollment and completion (Marzolini et al., 2016; Molloy, Perkins-Porras, Bhattacharyya et al., 2008; Pullen et al., 2009; Supervia et al., 2017).

Social Support

Social support typically is divided into two components: *structural* or the amount of social contacts and interactions within the social network and *functional* or the actual support provided (Lett et al., 2005). *Functional* social support, a multidimensional concept, is further divided into *perceived* and *received* functional social support, with the former being the social support perceived to be available by the support recipient and the latter the actual support received (Lett et al., 2005). Lack of functional social support is linked to cardiac and all-cause mortality (Barth et al., 2010). A high level of social support is associated with lower mortality (Holt-Lunstad et al., 2010).

There are different dimensions of functional social support; however, the most common definition includes *emotional*, *instrumental*, *informational*, and *appraisal* dimensions (Ates, 2016; House, 1981; Langford et al., 1997; Lett et al., 2005; Weiss, 1974; Wu et al., 2018), with instrumental called *tangible* by some researchers (Lett et al., 2005). *Emotional* social support occurs when the recipient perceives he or she received empathy, love, and trust, and that he or she is cared for. *Instrumental* social support is the receiving of tangible assistance such as transportation to a medical appointment. *Informational* social support assists the recipient with problem-solving. *Appraisal* social support aids in the recipient's self-evaluation. Previous studies support a positive relationship between these four dimensions and health (Barrera, 1986; DiMatteo, 2004; Schaefer et al., 1981; Uchino et al., 1995). Some researchers also include a *companionship* dimension (Herz, 2015; Kim et al., 2018) which is support that provides a sense of belonging within the support recipient. In a meta-analysis, Kaplan et al. (1977) proposed that a better understanding of social support dimensions may lead to the development of more valid measurement tools and focused interventions aiming to increase social support.

Tangible support. This dimension of social support, which is described as material help (Gjesfjeld et al., 2008; Langford et al., 1997), is exemplified by actions such as taking someone to an appointment, preparing meals, and helping with daily chores (Gjesfjeld et al., 2008). Direct or indirect examples of tangible support in the context of CR are: driving the CR participant to their CR sessions, helping them financially with copayments needed for CR sessions, preparing meals, assisting with childcare, and helping with household chores. Lack of tangible support in the form of

caretaking responsibilities created a barrier to CR enrollment (Grace, Gravely-Witte et al., 2009) and adherence (Resurrección et al., 2018) for women. Transportation and family responsibilities were cited by women as barriers to CR completion (Marzolini et al., 2008). Furthermore, in a longitudinal cohort study of CAD patients, those who reported a lack of tangible support were 3.2 to 6.5 times more likely to die within one year of follow-up from the initial interview, which took place 8 to 22 months following a cardiac event, than participants who had sufficient tangible support (Woloshin et al., 1997). McKenzie et al. (2018) reported that men tend to seek out social relationships that provide tangible support and to solicit tangible support from other men. Reevy and Maslach (2001) reported that more masculine and self-confident men and women were more likely to receive tangible support.

Emotional/informational support. Emotional support, which is aid that results in the recipient to perceive that they are loved, cared for, or empathized with (Sherbourne & Stewart, 1991), is exemplified through actions of listening to problems, providing advice during a crisis, and providing a safe channel for someone to confide in (Gjesfjeld et al., 2008). Pertinent to this study, emotional support may appear as receiving encouragement to enroll in a CR program, having someone to talk to about fears related to heart disease, and having someone with whom to laugh. Hagan et al (2007) reported that encouragement from family members to attend CR influenced participants' likelihood of attending CR. Similarly, interviews with CR practitioners regarding their perceptions of the family's role in supporting individuals following MI showed a theme of family encouragement was important for CR attendance (Birtwistle et al., 2021). In a systematic review, Resurrección et al. (2017) reported that women who felt guilty for

spending time away from family during CR sessions were less likely to attend CR. Emotional support is inversely related to depression (Brinker & Cheruvu, 2017; Strine et al., 2008), which is three times more common in people after they experience a myocardial infarction (Williams, 2011). Furthermore, depression is positively related to lack of motivation (Miller & Markman, 2007), which is a barrier to CR program attendance (Dunlay et al., 2009). Both men and women are more likely to request emotional support from women than from men (McKenzie et al., 2018). Wong et al. (2014) reported that emotional support had a stronger effect on the psychological and physiological health of women compared to tangible and informational support. Femininity is associated with seeking and receiving emotional support from women (Reevy & Maslach, 2001). In the current study, emotional support and informational support were combined into one variable to match the corresponding subscale of the MOS-SSS. Sherbourne and Stewart (1991) merged the two dimensions of social support into a single subscale due to overlap of items when evaluating the psychometrics of the MOS-SSS. Informational social support is defined as advice, information, and suggestions provided from one individual to another (Holt-Lunstad & Uchino, 2008).

The quality of the primary intimate relationship. There are no studies of the relationship between the quality of the primary intimate relationship and CR attendance. While the mere presence of an intimate, also called a confidant, is associated with good mental and physical health (Lowenthal & Haven, 1968), the quality of these relationships varies in terms of positive and negative aspects (Revenson et al., 1991; Rook, 1984). The intimate is defined as the most important person in one's life, the person to whom one feels closest (Hall et al., 1987). Naturally, the quality of the relationship affects the

effectiveness of support received. Higher primary intimate relationship quality was associated with fewer depressive symptoms among low-income mothers with young children (Hall et al., 1985). Marriage has a protective effect for spouses, but interestingly, single people experience less distress than unhappily married people (Glenn & Weaver, 1981; Kiecolt-Glaser & Newton, 2001). Social support typically is considered as a positive resource that an individual can enact during times of stress, but negative aspects of relationships can be detrimental to the health of an individual. The term *problematic support* is used when the intention is not to cause harm, but harm is received as a result (Dracup, 1994; Revenson et al., 1991). For instance, individuals who experienced chest pain in the presence of family members were more likely to delay the trip to the ER than if they were in the presence of friends (Dracup, 1994). Dracup suggests that this phenomenon occurs due to reassurance from family members to allay their loved one's fears. Regardless of the intention behind negative interactions, they cause distress within the receiver of them (Lincoln, 2000), as negative social interactions are more influential of well-being than positive social interactions (Rook, 1984).

Relationship quality, whether between romantic partners, family members, or friends, has a positive association with health outcomes and health behaviors. There is a vast amount of research supporting a positive association between marital quality and health outcomes (Holt-Lunstad et al., 2008; Kiecolt-Glaser & Newton, 2001; Umberson et al., 2006). In a meta-analysis, Robles et al. (2014) observed larger effect sizes on the association between marital quality and health in studies that consisted of a higher proportion of women in the samples. Marital quality is linked with health behavior. Trief et al. (2004) reported that marital quality was positively related with adherence to self-

management in individuals who have diabetes. Kiecolt-Glaser and Newton (2001) reported that negative dimensions of marriage are indirectly related to health behavior. Brazeau and Lewis (2021) evaluated health behaviors in married couples over the course of 12 years and reported that relationship strain was more harmful to health behaviors in females than in males. Family relationship quality, evaluated as a system, is associated with health outcomes and health behavior. Grevenstein et al. (2019) reported that the quality of family relationships was positively related to well-being. In addition, family relationship quality was positively associated with treatment adherence in individuals with cystic fibrosis (DeLambo et al., 2004). In a longitudinal study of women aged 60 years and over, Harvey and Alexander (2012) reported that positive friendship support has a direct relationship with physical activity. Measuring the quality of the primary intimate relationship differs from the prior studies, because it removes the presumption that a specific relationship, such as a spousal relationship, is uniformly the most important relationship to an individual.

Some research indicates that there are differences in health outcomes and health behaviors based on the sex of both the social support provider and the recipient. The effect of social connectedness on mortality is stronger for men than for women (Berkman & Syme, 1979; Hill et al., 2016; House et al., 1982). Social support provided by women has a stronger effect on well-being in men than social support provided to women by men (Cutrona, 1996; Stronge et al., 2019). While women acknowledge that social support is an important factor contributing to CR enrollment (Supervia et al., 2017), and subsequent attendance (Daly et al., 2002; Pullen et al., 2009), men are more likely than women to attribute their recovery after a myocardial infarction to social support (Kristofferzon et

al., 2003). Interestingly, during the recovery phase following a cardiac event, women are more likely than men to report that they receive inadequate social support (Kristofferzon et al., 2003). Hankonen et al. (2010) reported that men at risk of developing type 2 diabetes mellitus are more likely than their female counterparts to report that they receive social support to encourage physical activity. In times of stress, women are more likely than men to provide effective social support to both women and men (Bodenmann et al., 2015; Neff & Karney, 2005; Taylor, 2007; Williamson & O'Hara, 2017). Taylor (2007) attributes this phenomenon, of women's capability of managing both their own stress as well as the stress of the recipient of the social support, to both a biological and nurturance reasoning. In times of stress, wives in heterosexual marriages cited receiving less support and more negative behaviors from their husbands, whereas husbands reported that they received higher amounts of support and no negative spousal behavior (Neff & Karney, 2005). Furthermore, in the context of stress, women are more likely to seek social support than men are (Taylor, 2007; Thoits, 1995). Overall, women are more likely than men to be the providers of effective social support, and men tend to gain more benefits than women as the recipients of social support.

The discrepancy in receipt of social support between men and women was coined as the *support gap hypothesis* of Belle (1982) and continues to be a prominent theme in social support research (Brock & Lawrence, 2009; Ellis & Davis, 2017; Holmstrom & Lim, 2023; Xu & Burleson, 2001). The support gap hypothesis asserts that women receive less tangible and emotional social support than men receive (Belle, 1982). Xu and Burleson (2001) tested this hypothesis in a sample of American and Chinese married couples. There were no differences between men and women in the amount of support

they received, but women reported higher levels of desired emotional support than they received, suggesting a discrepancy in desired support levels in men and women. Ellis and Davis (2017) explored the support gap hypothesis in gay, lesbian, and heterosexual couples. Men and women in same-sex couples reported higher levels of satisfaction with the amount of support they received, when compared to heterosexual couples, further supporting the findings of Xu and Burleson (2001). Interestingly, Brock and Lawrence (2009) reported that both underprovision and overprovision of social support were associated with marital decline. Underprovision of support was more frequently cited by participants, but overprovision of support had a stronger association with marital decline (Brock & Lawrence, 2009). Holmstrom and Lim (2023) use the support gap hypothesis to argue that improving the quality of esteem support in a close relationship can improve perceived partner responsiveness.

One theory for why women are more effective than men at providing social support to others (Bodenmann et al., 2015; Cutrona, 1996) lies within the nature of being biologically female (Taylor et al., 2000). Taylor et al. (2000) proposed that hormonal responses to stress, particularly oxytocin, evolved to increase in women as a means of protecting mothers and children because oxytocin promotes social bonding (Carter et al., 1992). Levels of oxytocin during stressful times are enhanced by (Acevedo-Rodriguez et al., 2015; Chibbar et al., 1995) or dependent upon estrogen (Carter et al., 1992), a hormone that is more pronounced in women than in men (Feldman et al., 2007; Taylor et al., 2000). Oxytocin, a moderator of the stress response, catalyzes both positive and negative relationships (Taylor 2007) which as a result makes good relationships better and bad relationships worse.

Social support is provided by various members of the patient's social network such as a spouse or domestic partner, parent, sibling, adult child, friend, healthcare professional, or clergy (Abbey et al., 1985; Dean et al., 1990; Hall et al., 1985). Spousal support has a positive relationship with healthy lifestyle behaviors (Stephens et al., 2013), including CR adherence (Franks et al., 2006; Hong et al., 2005; Zhang et al., 2023), but sometimes only in men (Franks et al., 2006; Loprinzi & Crush, 2018). Moreover, the effects of marriage on positive health outcomes are stronger in men than in women (Rendall et al., 2011; Taylor, 2007). It is important to note that women are generally older than men when they have their first cardiac event, and many of these women do not have spouses for support (Grace et al., 2002a; King & Reis, 2012). It is common for older women to receive social support from adult daughters and female friends (Grundy & Read, 2012; Moremen, 2008). Supportive relationships with adult children are associated with more frequent exercise in parents (Thomas et al., 2019). Adult daughters are more likely than adult sons to provide support to elderly parents (Taylor, 2007). Problematic intergenerational support is detrimental in the psychological well-being of older women and men (Silverstein et al., 1996). Close female friends are important sources of support for women (Taylor, 2007).

There is a long history of research asserting that marital relationships are beneficial for survival (Brazeau & Lewis, 2021; Durkheim, 1951; House et al., 1988; Kiecolt-Glaser & Newton, 2001; Rendall et al., 2011; Tatangelo et al., 2017; Taylor, 2007), particularly for men (Ahnlund & Frodi, 1996; Berkman & Breslow, 1983; House et al., 1988; Umberson, 1992). Men living alone are more likely to be depressed than their female counterparts, and married women are more likely to be depressed than

married men (Ahnlund & Frodi, 1996). Men primarily rely on support that is provided by a spouse, whereas women use support that is provided from various members of their social network including their spouse (Ahnlund & Frodi, 1996). Naturally, men who receive little spousal support are three times more likely to drop out early from CR (Andrew et al., 1981). Li et al. (2014) reported that marital support had a greater effect on decreasing negative affect in a sample of elderly Chinese men and women, compared with support from friendships and non-spousal family relationships. A dyadic effect often occurs within marital relationships such as when one spouse maintains a healthy lifestyle or makes positive health changes, the other spouse is likely to follow suit (Falba & Sindelar, 2008; Hong et al., 2005). This phenomenon may occur due to role modeling. Observing a spouse make a behavior change, then choosing to enact the change within yourself is an act of role modeling, which is described as a vehicle for behavior change by Pender et al.'s (1988) Health Promotion Model (HPM). Furthermore, a more physically active partner is more likely to employ methods to change the less active partner's behavior (Umberson et al., 2018), which may result in an actual improvement in physical activity. In a quasi-experiment study, a couples-based exercise program was compared with traditional CR to improve CR attendance in China (Zhang et al., 2023). The intervention group of couples had significant improvements in exercise adherence when compared with the control group (Zhang et al., 2023).

Women and men provide and receive social support differently depending on the type of relationship of which social support is exchanged. Umberson et al. (2018) proposed a “gender-as-relational perspective” towards how social support and control are exchanged in marital relationships. This perspective asserts that acts of support or control

are acted out differently based on gender and whether an individual is in a heterosexual or homosexual marriage. For instance, women in heterosexual marriages are more likely than their husbands to use direct, indirect, supportive, and coercive methods to influence behavior change in their partners, although this does not hold true in homosexual marriages of men or women (Umberson et al., 2018). Umberson et al. (2018) suggests that the discrepancy in number of efforts to change a partner's behavior is related to a greater variation in health behaviors between men and women. Kahn et al. (2011) reported that women are more likely to provide emotional and tangible support for adult children and elderly parents than men are. Furthermore, men are more likely to provide the same types of support to adult children rather than elderly parents (Kahn et al., 2011). Chesley and Poppie (2009) reported that men and women provide equal amounts of non-financial tangible support to parents and in-laws, but that women provide more emotional support to their parents and in-laws than men do. In addition, there are unique cultural influences that are involved with social support among men and women. In many Asian cultures, it is expected that elderly parents will co-reside with their adult children, whereas this is less of a norm in many Western countries where independence is more valued (Jeon et al., 2007; Samanta et al., 2015). Jeon et al. (2007) reported that living alone, as opposed to living in multigenerational households with adult children, was significantly related to depressive symptoms in elderly Korean men, but not women. This may be attributed to the higher expectations of elderly Korean mothers, but not fathers (Jeon et al., 2007).

Adult children, particularly daughters (Grundy & Read, 2012; Taylor, 2007), are likely to provide intergenerational support to elderly parents (Evandrou et al., 2018;

Seeman & Berkman, 1988). The higher the number of adult children, the greater the amount of tangible support received by adults who need assistance with activities of daily living (Grundy & Read, 2012). In addition, the presence of an adult daughter has a positive relationship with receipt of tangible support (Evandrou et al., 2018), particularly in women (Grundy & Read, 2012). Fingerman et al. (2020) reported that adult daughters and sons both provided support to their parents, but daughters provided more emotional support. Moreover, both mothers and fathers reported more negative relationship qualities with adult daughters than sons (Fingerman et al., 2020). Emotional support and strain in relationships between adult children and parents is associated with greater exercise frequency in parents (Thomas et al., 2019). Interestingly, strain was measured by perception of demands from adult children and how critical children are of parents' choices. These results are congruent with the idea that social control provided from adult children can be beneficial for the health of parents (Reczek et al., 2014). It should be noted that problematic support can arise from generational support, and result in harmful effects to the psychological health of parents (Silverstein et al., 1996).

Friendship and friendship quality is associated with physical health and mortality (Holt-Lunstad, 2017). Remarkably, some studies reported that social support provided by friends has a stronger effect on cardiovascular health outcomes when compared to social support provided by family members (Christenfeld et al., 1997; Holt-Lunstad et al., 2007). In a study of older Chinese adults, Peng et al. (2022) reported on an association between friendship and better cognitive functioning, particularly in widowed adults. Number of friends and quality of relationship were measured in this study of longitudinal survey data (Peng et al., 2022).

Conversely, health appears to influence both managing and sustaining friendships (Holt-Lunstad, 2017). Using data from the Framingham Heart Study, O'Malley and Christakis (2011) found several associations that led to initiation and maintenance of friendships. For example, smokers and people with similar BMIs were most likely to form relationships with one another; people who had similar BMIs were less likely to end friendships with one another; and existing friendships between smokers and non-smokers were least likely to end friendships (O'Malley & Christakis, 2011). Furthermore, Yang and Grol-Prokopczyk (2021) reported that the onset of severe pain, especially for men, was associated with a decrease in the number of friends.

Female friendships are important for the health of women (Moremen, 2008; Taylor, 2007). Female confidants provide emotional and instrumental support to women, which contribute to perceived health benefits in women (Moremen, 2008). Taylor (2007) reported that while men cite their wives as a primary source of support, women cite both their husbands along with a close female friend or relative. Female friends become especially important to widowed women. Men who remarry after the death of a spouse or after divorce have mortality benefits, though the same does not hold true in women (Li et al., 2023; Taylor, 2007). This may be because of existing sources of social support provided by female friendships, prior to widowhood (Shumaker & Hill, 1991). Interestingly, some studies reported that social support provided by friends has a stronger effect on cardiovascular health outcomes when compared to social support provided by family members (Christenfeld et al., 1997; Holt-Lunstad et al., 2007).

While friendship is often cited for its protective effects on health, it can also have negative consequences, such as causing stress and encouraging poor health behaviors

(Holt-Lunstad, 2017). In older Japanese adults, poor interaction with friends was linked with poorer health and worse well-being (Nakagomi et al., 2023). Poor interaction with friends increased the risk of dementia by 40%, which was further supported by Kuiper et al.'s (2015) systematic review and meta-analysis of social relationships with risk of dementia (Nakagomi et al., 2023).

Women are uniquely at risk of having an inadequate amount of social support available to them during CR (Gallagher et al., 2003), as women tend to experience their first cardiac event at an older age than when men do (Grace et al., 2002a; King & Reis, 2012). Because women have a higher life expectancy compared to men, they are more likely to be widowed at this time than if they had had their first cardiac event at the age when men do (Grace et al., 2002a). Men are more likely to have a spouse accompany them at CR than women are (Grace et al., 2002b). Furthermore, their adult children may live away from home when women have a first or subsequent cardiac event (Grace et al., 2002a). Women cite family responsibilities, such as caretaking of a sick spouse or grandchild, as a reason for CR dropout (Grace, Gravely-Witte et al., 2009; Marzolini et al., 2008; Yoo & Wenger, 2019). Incidentally, women are more likely to seek social support from healthcare professionals than men are (Grace et al., 2002a), making them a salient target for interventions. Furthermore, an RCT that tested a Motivational Interviewing intervention, a behavioral change method that uses elements of appraisal support (Miller & Rollnick, 2004), was significant for increasing CR adherence rates in women (Beckie & Beckstead, 2010). Similarly, Jackson et al. (2005) reported that women were more likely to cite appraisal support as a determinant of CR attendance than were men.

Health Promotion Model

Pender's Health Promotion Model (HPM) (2011), which is concerned with understanding underlying factors related to behavior change with the result of a healthier lifestyle (Pender, 2011), will underpin this study. The purpose of this model is to aid nurses in understanding determinants of health to modify the way they interact with patients to promote health behaviors. The initial model, created in 1988, evaluated exercise patterns in several populations, including cardiac rehabilitation participants (Pender et al., 1988). Three uses of the model are: (1) concept identification, (2) hypothesis generation, and (3) synthesizing research findings (Pender et al., 1988). Pender et al. (1988) proposed that interpersonal factors such as social support may moderate the effects of cognitive/perceptive mechanisms on health behavior. Regarding social support, Pender et al. propose that behavior change occurs when patients are exposed to modeling of the desired behavior, the change is expected, and the patient receives adequate support for the change. Support can be provided by family members, peers, and healthcare professionals. Social support is an interpersonal influence, along with social norms and role models, under the heading of behavior-specific cognitions and affect. Other components listed under this heading are: perceived benefits of action, perceived barriers to action, perceived self-efficacy, activity-related affect, and situational influences. Behavior-specific cognitions and affect are preceded by individual characteristics and experiences as expressed through prior related behavior and personal factors. In addition, health promotion effectiveness is influenced by immediate competing demands, preferences, and level of commitment to a plan of action. See Appendix A for

an adapted version of the model focused on the goals of this study including an expansion on functional social support.

The HPM was developed from Social Cognitive Theory (Bandura, 1998) and Expectancy Value Theory (Atkinson, 1957). The model was used as the theoretical framework in a variety of studies, including an evaluation of the effectiveness of an educational intervention for people with irritable bowel syndrome (Colwell et al., 1998), assessing health perceptions in African American women (Sadler et al., 2005), and describing the lifestyles of cardiac transplant recipients (Salyer et al., 2001). The HPM was used as the guiding framework in CR studies (Ottaviano et al., 2011; Rose et al., 2011; Sharp & Salyer, 2012), lending credence to the appropriateness of its use in this study.

Significance

This study tested the potential moderating effects of sex (male/female) of the CR attendee and their primary intimate on the relationship between social support and CR adherence. Though sex differences in the exchange of social support were explored previously (Bodenmann et al., 2015; Stringhini et al., 2012), and touched on in the context of marital relationships and CR enrollment (Franks et al., 2006), they have not been explored in the context of CR program adherence. This is especially pertinent because there are sex differences in CR program attendance (Samayoa et al., 2014; Supervia et al., 2017), and women are markedly less likely to complete the full CR program than are men (Supervia et al., 2017). Assessment of the roles that sex and relationship type play on the association between social support and CR attendance will provide knowledge for the development of tailored interventions to improve CR

adherence. In addition, the results of this study may be used in a clinical setting to identify CR participants who are at risk of early dropout from the program.

CHAPTER III

METHODS

Design and Sample

A longitudinal, observational study was conducted with a sample of 56 adults who were enrolled during their first through fifth CR session. The cut-off point at the fifth session was chosen to ensure the timely enrollment of participants and deemed early enough in their CR program to accurately assess them. Data on socio-demographic characteristics, independent variables, and moderator variables were collected at study enrollment. Data on the dependent variable, CR adherence, were collected at three to four months after study enrollment.

CR attendance literature states that women are an underrepresented group at CR. Convenience sampling was used with an emphasis on enrolling female CR participants. Prior to data collection, the CR manager was contacted to discuss characteristics of CR participants at the facilities used as study locations, which affirmed that these local facilities followed the trend of the literature in that many more men than women attend CR at these locations. On data collection days, the CR facility manager or staff leader was contacted by phone to find out both the number of participants and the sex of participants who were participating in each CR session that day. Sessions that included female participants were prioritized for data collection.

The inclusion criteria were: English-speaking and ability to read/write in English, age 18 and older, ability to consent, and attending the first through fifth CR session.

Participant exclusion criteria were medically unstable for CR and cognitive impairment.

Setting

Recruitment occurred at University of Louisville (U of L) Health cardiac rehabilitation centers located in the U of L Health Medical Plaza II and Medical Center Northeast. The U of L Health Medical Plaza II facility is located in a downtown urban setting and offers traditional CR and advanced CR treatment options. The Medical Center Northeast facility is in a suburban setting and offers traditional CR treatment.

Prior to IRB approval, the investigator met with the program manager at each study location to discuss details of coordinating study recruitment. This was done to ensure high efficiency of study recruitment and, most importantly, that recruitment did not interfere with the initial CR enrollment process.

Measures

Cardiac Rehabilitation adherence. CR adherence was measured by review of participants' charts four months after initial CR enrollment. The number of CR sessions attended was recorded. In addition, the number of prescribed CR sessions was recorded from the chart. This information was available from the initial CR plan of action. In this study, all CR participants were prescribed the traditional 36 CR sessions. If an individual graduated early from CR, their number of CR sessions attended replaced the initial 36 prescribed. Therefore, in this study, CR adherence was measured as the number of CR sessions attended divided by the number prescribed, initially or upon graduation. Previous studies of CR attendance have operationalized various time frames for

measurement of sessions attended, ranging from a prospective study of three months (Cannistra, Balady, O'Malley, Weiner, & Ryan, 1992) to a retrospective study of four years post initial CR enrollment (Armstrong et al., 2014). For the scope of this dissertation, adherence of CR sessions was operationalized over a period of 4 months, beginning at the first CR session attended.

Reason for cardiac rehabilitation early drop out. Study participants who did not complete all the recommended sessions of CR were contacted by telephone and asked why they were unable to complete the CR program as outlined in Appendix F. Participants' phone numbers were collected on the socio-demographic form (Appendix B).

Tangible support and emotional/informational support. Tangible and emotional/informational support was assessed using the Medical Outcomes Study Social Support Survey (MOS-SSS; Sherbourne & Stewart, 1991) (See Appendix D). The 19-item questionnaire assesses different dimensions of social support as well as a global measure of functional support. This multidimensional measure was developed to assess functional social support in a sample of 2,987 participants who were previously diagnosed with hypertension, diabetes, coronary artery disease, and/or depression (Sherbourne & Stewart, 1991). It has been used to assess social support across diverse demographics, encompassing various genders, races, ages, and sexual orientations (Al-Dwaikat et al., 2019; Stinchcombe et al., 2020; Tam et al., 2023). Responses are scored on a 5-point Likert scale ranging from 1 = none of the time to 5 = all of the time. Subscales of social support include: emotional/informational support (8 items), tangible support (4 items), affectionate support (3 items), and positive social interaction (3 items).

Informational support and emotional support were merged into a single subscale due to overlap of items (Sherbourne & Stewart, 1991). An additional item asks if the respondent has a person available who can “help you get your mind off of things.” An overall score of functional support is calculated by adding together the ratings from all items. Subscale dimensions are calculated by averaging the responses within each subscale. A higher score indicates a higher level of support. Initial testing of the measure yielded a high degree of internal consistency for the subscales ($\alpha = .91 - .96$), and for the overall scale ($\alpha = .97$) (Sherbourne & Stewart, 1991). Internal consistency reliability was supported by item-scale correlations that were all greater than .72.

Quality of the primary intimate relationship. The quality of the participant’s primary intimate relationship was measured using the 32-item Autonomy and Relatedness Inventory (ARI) (Hall, 1983) (see Appendix E). The ARI was developed using items selected from Schaefer and Edgerton’s (1982) Marital Autonomy and Relatedness Inventory with the addition of items by Hall (1983) to measure dimensions of support and listening. The primary intimate relationship is defined as the most important relationship in the person’s life, the person to whom the individual feels closest. The ARI measures both positive and negative relationship qualities from the perspective of the respondent on a 5-point Likert scale (Hall & Kiernan, 1992). The ARI measures the respondent’s perception of the intimate, also called the confidant, on each of eight subscales: acceptance (4 items), relatedness (4 items), support (4 items), listening (4 items), autonomy (4 items), control (4 items), hostile control (4 items), and detachment/rejection (4 items). Responses are scored on a scale of 1 = not at all like to 5 = very much like. An overall score is calculated by summing all item responses then subtracting 32 from the

total so that scores range from 0-128. A higher score indicates a more positive assessment of the relationship. The ARI was previously tested in a sample of 213 low-income mothers; Cronbach's α was .90 for the total scale (Hall & Kiernan, 1992). The ARI factored into two dimensions: positive and negative aspects of a dyadic relationship (Hall et al., 1987; Hall & Kiernan, 1992).

Type of primary intimate relationship. This information was measured from an existing item on the ARI (Appendix E). The relationship of the person named as the intimate will be determined using this question: who is the most important person in your life..., the person to whom you feel closest? This could be anyone: your spouse, a parent, a significant other, any relative or friend, or a helping professional such as a social worker or minister.

Sex of the primary intimate. This information was measured on the ARI (Appendix E) as an additional item that followed the item about the relationship of the primary intimate relationship is to the participant.

Personal and socio-demographic characteristics. Age, sex, race, marital status, education, employment, monthly household income, and type of health insurance were collected using an investigator-developed form (Appendix B). Age was assessed in years as reported by the participant. Sex was assessed with the options: male, female, or choose not to disclose. Items for race, marital status, education, employment, monthly household income were derived from standardized and previously validated tools from the National Health and Nutrition Examination Survey (NHANES) (Centers for Disease Control and Prevention, 2018).

Comorbidities. Comorbidities were assessed using the Charlson Comorbidity Index (Charlson, Pompei, Ales, & MacKenzie, 1987) (Appendix C). The 19-item questionnaire, which consists of 19 health conditions, is used to predict 1-year mortality risk. It was developed from a sample of hospitalized medical patients and validated in a sample of breast cancer patients (Charlson et al., 1987). This study used a chart review process to complete the questionnaire. Stavem, Hoel, Skjaker, and Haagensen (2017) reported that both chart review and administrative data process yielded congruous results in predicting mortality. Each study participant's electronic medical chart was reviewed for each of the listed conditions. A "yes" or "no" response was circled for each condition. Items are assigned weights which range from "0" to "6," based on relative risk estimates. A higher weight denotes a condition which contributes more to a mortality risk. The conditions of myocardial infarction, congestive heart failure, peripheral vascular disease, cerebrovascular disease, dementia, chronic obstructive pulmonary disease, connective tissue disease, ulcer disease, mild liver disease, and diabetes mellitus are given a weight of 1. Hemiplegia, moderate/severe renal disease, diabetes with end-stage organ damage, any tumor, leukemia, and lymphoma are given a weight of 2. Moderate/severe liver disease is given a weight of 3. Metastatic solid tumor and acquired immunodeficiency syndrome are given a weight of 6. Scores are summed, with total scores ranging from 0 to 29. A higher score denotes a higher risk of mortality in the next one year.

Protection of Human Subjects

Human subjects' approval to conduct the study was obtained from the Biomedical Institutional Review Board (IRB) of the University of Louisville and U of L Health. All study documents were reviewed and approved by the IRB prior to study commencement.

Risks from this study were minimal. Potential study participants were reminded that they were not required to participate in this study and that they could withdraw their consent at any time during the study. Participants were informed that they would likely not receive any direct benefits from taking part in this study. In addition, care was taken to prevent disruption at both CR locations. Potential participants were approached only after the CR manager or shift leader gave approval.

The consent form and study plan were explained thoroughly to the participants. Data collection occurred in a private space within the CR facility. Participants were informed that their identifying data would be kept confidential and not be included in study results.

All potential participants who met the inclusion criteria for the study were approached for participation. Participants signed the consent voluntarily. A modest gift card of \$10 was given as an incentive for participation in the study.

Procedure

Participant screening and enrollment. The investigator reviewed the daily log of enrolled patients from the CR facilities on data collection days to identify potential participants who meet the inclusion/exclusion criteria (Appendix H). Recruitment occurred at the UofL Health Medical Plaza II and the UofL Health Medical Center Northeast locations to maximize demographic variability of the sample. The Medical Health Plaza II location provides services to individuals from many different locations, whereas the Medical Center Northeast location provides services primarily to persons who live in the surrounding community. Those who met the inclusion/exclusion criteria were approached in a private place within the CR facility in accordance with patient

privacy and HIPAA regulations immediately after they had completed the initial CR session or prior to starting a session if deemed appropriate by the facility staff leader. They were provided with a brief summary about the purpose and nature of the study. Those who wanted more details about the study or who verbally agreed to participate were given a copy of the approved informed consent document. This was reviewed with potential participants, and they were given sufficient time to read it and ask questions. Next, written informed consent was obtained. A second signed copy was placed in the patient's medical chart to comply with HIPAA and other data access regulations. No data collection occurred prior to obtaining written informed consent from study participants. Upon completion of the survey, each participant was compensated with a \$10 gift card to show appreciation for the participants' time.

Data collection. Once written informed consent was obtained, data were collected from multiple sources (e.g., asking the study participant, reviewing medical records, etc.). Data collection occurred in a private location within each CR facility. Questionnaires were provided with instructions to participants on how to fill them out. Assistance with completing the forms was available if the participant needed it. Participants completed the MOS-SSS, the ARI, and the socio-demographic form. Information was collected on the participant's full name, address, phone number, email, emergency contact information, primary care doctor (if any), and treating cardiologist (if any). These steps ensured that the investigator could contact the participants for follow-up three to four months later. The estimated time for survey and form completion was approximately 10 to 30 minutes. Existing data (e.g., medical history, medications history, contact

information, etc.) was accessed retrospectively from the medical record by the investigator.

Data management. Each participant was assigned a unique ID number. All data were stored in a password protected, SharePoint file that complied with the IRB and the Department of Health and Human Services (HHS) regulations for Protection of Human Research Subjects. A list of participants by ID number was kept separately from the data.

Data Analysis

Data were analyzed using SPSS, version 29 (IBM Corp., 2022). An alpha of .05 or less was considered as statistically significant. Upon the completion of data entry, the data were examined for out-of-range values and missing values. Missing values were assessed as missing completely at random (MCAR), missing at random (MAR), or missing not at random (MNAR). Little's MCAR test was used to assess if data were MAR or MCAR (Little, 1988). Multiple imputation was used when values were missing from the data. This method was used to avoid loss of information (Sterne et al., 2009). Data were assessed for MNAR by examining the data for patterns. Continuous variables were assessed for normal distribution using the Kolmogorov-Smirnov test, Q-Q plots, and histograms. Frequencies were run for categorical variables to ensure appropriate cell counts for data analysis. When counts were below 10, they were combined with other groups in a meaningful way. Descriptive statistics were calculated using means and standard deviations for continuous variables and frequencies and proportions for categorical variables.

Descriptive statistics and Cronbach's alphas were computed for the emotional/informational support and tangible support subscales of the MOS-SSS and the

ARI and its subscales. Descriptive statistics included mean scores, standard deviations, the actual range of scores, and the potential range of scores. Since Specific Aim 3 involved the sex and the type of primary intimate relationship as listed in the ARI, characteristics of the primary intimate were assessed.

Aim 1: Evaluate the associations between different dimensions of social support (tangible social support, emotional/informational social support, and the quality of the primary intimate relationship) with CR adherence.

Hypothesis 1: Tangible social support, emotional/informational social support, and the quality of the primary intimate relationship are positively associated with CR adherence.

Multiple linear regression was used to evaluate the relationships of tangible support, emotional/informational support, and the quality of the primary intimate relationship with CR adherence. Scatterplots were used to assess a linear relationship between the independent variables (emotional/informational support, tangible support, and the quality of the primary intimate relationship) and the dependent variable (CR adherence). Normality of the residuals was assessed using a Q-Q plot and the goodness-of-fit test, Kolmogorov-Smirnov. Multicollinearity among the independent variables was assessed by review of the correlation matrix. To meet the assumption of no multicollinearity, the correlation coefficients should be less than .80. The assumption of heteroscedasticity was assessed using scatterplots of the residuals. After the assumptions were checked, multiple linear regression was conducted using the Enter method.

Aim 2: Evaluate the role of sex of the CR patients and sex of the primary intimate in the relationships between different dimensions of social support and CR adherence.

Hypothesis 2a: Social support is positively related with CR adherence in males but not females.

Hypothesis 2b: The relationship between social support and CR adherence differs by the sex of the primary intimate.

Multiple linear regression was used to assess whether the individual relationships of tangible support, emotional/informational support, and the quality of the primary intimate relationship with CR adherence were modified by sex of the CR participant or sex of the primary intimate. In regression models, interaction terms evaluate if there is a change in effect size of the relationship of any of the independent variables with the dependent variable depending on the level of the modifying variable (Cohen, Cohen, West, & Aiken, 2003). Each of these potential modifiers, sex of the CR participant and sex of the primary intimate, was assessed in separate models for each dimension of social support.

Aim 3: Determine if the type of primary intimate modifies the relationships between different dimensions of social support and CR adherence.

Hypothesis 3: The relationship between social support and CR adherence differs by the type of primary intimate relationship.

Multiple linear regression was used to assess whether the individual relationships of tangible support, emotional/informational support, and the quality of the primary intimate relationship with CR adherence were modified by the type of primary intimate relationship. The type of primary intimate relationship was collapsed into three categories (spouse or significant other, adult child, or other). The “other” category included friends,

siblings, a mom, and a nephew. The type of primary intimate relationship was assessed in separate analyses for each dimension of social support.

CHAPTER IV

RESULTS

Sample Characteristics

Only two CR participants who were approached to participate declined. Both CR participants who refused to participate stated that they needed to leave immediately/did not have time to participate in study. The sample consisted of 56 adults who participated in cardiac rehabilitation. Among them, 41 (73.2%) were recruited from the UofL Health Northeast site, and 15 (26.8%) were recruited from UofL Health Downtown. CR referral diagnoses for study participants were: percutaneous coronary intervention (PCI) ($n = 23$; 41.1%), coronary artery bypass surgery (CABG) ($n = 11$; 19.6%), myocardial infarction (MI) ($n = 4$; 7.1%), heart valve repair or replacement ($n = 14$; 25.0%), congestive heart failure (CHF) ($n = 3$; 5.4%), and risk factor modification ($n = 1$; 1.8%). The participant who was referred to CR for risk factor modification was self-pay. Table 1 shows the socio-demographic characteristics of the participants. The participants' age ranged from 26 to 88 years with a mean of 66 years ($SD = 13$). The mean age of female participants was 64.4 years as compared to 67.2 years in male participants ($p = .48$). Females' age ranged from 26 to 87 years, whereas the range in males was 34 to 88 years. The mean score of the participants' Charlson Comorbidity Index (CCI) was 3.61 ($SD = 1.89$); scores ranged between 0 to 9. A CCI score of 3-4 indicates a moderate burden of comorbidities and an increased risk of mortality. Most participants were male (73.2%), white/non-Hispanic (83.9%), married (62.5%), highly educated (66% college degree or higher), and

retired (60.7%). Seven (46.7%) of the female participants were married, three (20%) were divorced, four (26.7%) were widowed, and one (6.7%) was never married. Among male participants, 28 (68.3%) were married, three (7.3%) were living with a partner, four (9.8%) were divorced, one (2.4%) was separated, three (7.3%) were widowed, and two (4.9%) were never married. The top three diagnoses of the participants were myocardial infarction (MI), congestive heart failure (CHF), and diabetes mellitus. All had health insurance. The mean number of CR sessions attended was 25.85 ($SD = 11.34$) with a range of 1 session to 36 sessions. Twenty-two of the 56 participants attended all 36 prescribed CR sessions. Table 2 lists the reasons why 34 participants did not attend all 36 CR sessions. Of the three who were put on hold by their physician, one was male and two were female.

Of the 10 participants who did not complete CR, six (60%) were males, eight (80%) were white non-Hispanic, four (40%) were married, five (50%) had attended some college, three (30%) were retired, and four (40%) had private insurance. Within this group, the average age was 51.1 years ($SD = 15.7$), and the average CCI score was 3.3 ($SD = 2.8$).

Descriptive Statistics for the Main Study Variables

Table 3 shows the mean total scores and subscale scores for the independent and dependent variables. The mean total score for overall social support, as measured by the MOS-SSS, was 86.48 ($SD = 17.45$), indicating a high level of social support among study participants. For the MOS-SSS subscales, Cronbach's alphas in this sample ranged from .93 for the affectionate subscale to .96 for both tangible and positive social interaction subscales. Cronbach's alpha for the overall MOS-SSS was .96.

Table 4 displays the categories for the sex of the primary intimate and the type of primary intimate relationship. Most were female (78.6%, $n = 44$), and the most common relationship type was spouse/significant other (67.9%). Within the spouse/significant other group, two CR participants listed their primary intimate as the same sex. The mean total score for the quality of primary intimate relationship as measured by the ARI was 103.95 ($SD = 16.46$), indicating a high level of quality of the primary intimate relationship; the highest score among the subscales was that of the support subscale ($M = 14.91$, $SD = 1.81$). Cronbach's alpha for the ARI subscales ranged from .59 for the autonomy subscale to .80 for the hostile control subscale. Cronbach's alpha for the overall ARI was .92.

Table 1*Demographic Characteristics of the Cardiac Rehabilitation Participants (N = 56)*

Variable	n (%)
Sex	
Male	41 (73.2)
Female	15 (26.8)
Race	
Hispanic	1 (1.8)
White/non-Hispanic	47 (83.9)
Black/non-Hispanic	5 (8.9)
Asian	2 (3.6)
Other/Multiracial	1 (1.8)
Marital Status	
Married	35 (62.5)
Living with Partner	3 (5.4)
Divorced	7 (12.5)
Separated	1 (1.8)
Widowed	7 (12.5)
Never Married	3 (5.4)
Education Level	
High School Graduate	8 (14.3)
Some College	11 (19.6)
College Degree	16 (28.6)

Table 1 Continued

Variable	<i>n</i> (%)
Graduate Degree	19 (33.9)
Employment	
Full-time	11 (19.6)
Part-time	5 (8.9)
Unemployed	2 (3.6)
Disabled	4 (7.1)
Retired	34 (60.7)
Health Insurance	
Medicare	33 (58.9)
Medicaid	5 (8.9)
Private Health Plan	32 (57.1)
No Health Insurance	0 (0)
Other	9 (16.1)
Monthly Household Income	
\$800 – \$1,649	4 (7.1)
\$1,650 – \$2,899	3 (5.4)
\$2,900 – \$4,599	7 (12.5)
\$4,600 – \$6,249	7 (12.5)
\$6,250 and over	21 (37.5)
Don't know or prefer not to disclose	14 (25.0)

Table 1 Continued

Variable	<i>n</i> (%)
Medical History	
Myocardial Infarction	15 (26.8)
Congestive Heart Failure	10 (17.9)
Peripheral Vascular Disease	4 (7.1)
Cerebrovascular Accident or Transient Ischemic Attack	7 (12.5)
Chronic Obstructive Pulmonary Disease	3 (5.4)
Diabetes Mellitus	13 (23.2)
Moderate to Severe Chronic Kidney Disease	5 (8.9)
Solid Tumor, Localized	4 (7.1)
Lymphoma	2 (3.6)
Number of CR Sessions Attended	
1-9	7 (12.5)
10-19	10 (17.9)
20-29	7 (12.5)
30-36	29 (51.8)
Put on hold by physician	3 (5.4)
CR Adherence (rate of completion)	
Completed (36 sessions or early graduation by physician)	43 (76.8)
Did not complete (drop out)	10 (17.9)
Put on hold by physician	3 (5.4)

Table 2*Reasons for Not Attending 36 Cardiac Rehabilitation Sessions (N = 34)*

Reason	<i>n</i> (%)
Graduated cardiac rehabilitation early	10 (29.4%)
Medical issues	3 (8.8%)
Started exercising at gym instead	4 (11.8%)
Financial reasons	3 (8.8%)
Work commitments	2 (5.9%)
Transportation issues	1 (2.9%)
Mental health	1 (2.9%)
Relocating to a new city	1 (2.9%)
Caretaking demands	1 (2.9%)
Did not want to go anymore	1 (2.9%)
Put on hold by their physician	3 (8.8%)
No response when called	4 (11.8%)

Table 3

Descriptive Statistics and Cronbach's Alphas for the Medical Outcomes Study – Social Support Survey (MOS-SSS) and the Autonomy and Relatedness Inventory (ARI) and Their Subscales (N = 56)

Variable	Mean	SD	Actual Range	Potential Range	Cronbach's Alpha
Medical Outcomes Study					
– Social Support Survey (MOS-SSS)					
Emotional/ Informational Subscale	84.70	18.42	6.25-100	0-100	.95
Tangible Subscale	88.28	24.28	12.50-100	0-100	.96
Affectionate Subscale	92.11	18.76	0-100	0-100	.93
Positive Social Interaction Subscale	85.41	22.43	25-100	0-100	.96
MOS-SSS Total Scale	86.48	17.45	23.68-100	0-100	.96
Autonomy and Relatedness Inventory (ARI)					
Autonomy Subscale	12.29	2.45	7-16	0-16	.59

Table 3 Continued

Variable	Mean	SD	Actual range	Potential Range	Cronbach's Alpha
Listening Subscale	13.39	2.51	5-16	0-16	.75
Acceptance Subscale	13.30	2.11	7-16	0-16	.64
Support Subscale	14.91	1.81	7-16	0-16	.72
Relatedness Subscale	13.48	2.06	7-16	0-16	.64
Detachment/Rejection Subscale	13.75	2.99	5-16	0-16	.69
Control Subscale	10.77	3.76	2-16	0-16	.77
Hostile Control Subscale	12.05	3.82	0-16	0-16	.80
ARI Total Scale	103.95	16.46	57-128	0-128	.92

Table 4

Type of Primary Intimate Relationship Identified on the Autonomy and Relatedness

Inventory (ARI) (N = 56)

Variable	<i>n</i> (%)
Type of Primary Intimate Relationship	
Spouse/Significant Other	38 (67.9)
Adult Child	9 (16.1)
Friend	3 (5.4)
Sibling	3 (5.4)
Mom	1 (1.8)
Nephew	1 (1.8)
Did Not Answer	1 (1.8)

Bivariate Correlations

Table 5 displays the Pearson product-moment correlations among the three independent variables and one dependent variable. There was a significant moderate positive correlation between emotional/informational social support and tangible social support. There were significant weak positive correlations between the quality of the primary intimate relationship with both emotional/informational social support and tangible social support.

Multiple Linear Regression Results

Specific Aim 1: Evaluate the associations between different dimensions of social support (tangible social support, emotional/informational social support, and the quality of the primary intimate relationship) with CR adherence.

Multiple linear regression with simultaneous entry was used to assess the relationships of tangible social support, emotional/informational social support, and the quality of the primary intimate relationship with CR adherence. Emotional/informational social support and tangible social support were evaluated in separate models due to the significant moderate positive correlations with one another. Table 6 displays the relationships between emotional/informational social support and the quality of the primary intimate relationship with CR adherence. Age and marital status were included in this model as covariates because both were independently associated with CR adherence. The model explained a significant amount of the variance in CR adherence ($F [4,47] = 8.80, p < .001, R^2_{Adjusted} = .38$). A total of 38% of the variance in CR adherence was explained by the model; however, controlling for age and marital status, the independent

variables, emotional/informational social support and the quality of the primary intimate relationship, were not significantly related to CR attendance.

Table 5*Intercorrelations among Independent Variables and Dependent Variable (N = 53)*

Variable	1.	2.	3.	4.
1. Emotional/Informational Social Support	-			
2. Tangible Social Support	.62**	-		
3. Quality of the Primary Intimate Relationship	.46**	.30*	-	
4. CR Adherence	-.02	.15	-.12	-

* $p < .05$, two-tailed. ** $p < .01$, two-tailed

Table 6

Multiple Linear Regression of the Relationships of Emotional/Informational Social Support and the Quality of the Primary Intimate Relationship with CR Adherence (N = 53)

Variables in the model	Unstandardized		Standardized	<i>t</i>	<i>p</i>
	coefficients		coefficients		
	b	<i>SE</i>	β		
(Constant)	-.04	.32		-.12	.91
Emotional/Informational Social Support	7.61	.002	.01	.04	.97
Quality of the Primary Intimate Relationship	-.002	.002	-.12	-.98	.33
Age	.02	.003	.62	5.63	< .001
Marital Status	.10	.07	.16	1.40	.17

Model Summary $F(4, 47) = 8.80, p < .001, R^2_{Adjusted} = .38$

Table 7 shows the relationships between tangible social support and the quality of the primary intimate relationship with CR adherence. Age and marital status were both considered as covariates for this model, but ultimately, marital status was eliminated because it was correlated with tangible support. The model explained a significant amount of the variance in CR adherence ($F [3,48] = 11.05, p < .001, R^2_{Adjusted} = .37$). A total of 37% of the variance in CR adherence was explained by the model, but like the previous model, only age was significant. Neither tangible social support nor the quality of the primary intimate relationship was significantly associated with CR adherence.

Specific Aim 2: Evaluate the role of sex of the CR patients and sex of the primary intimate in the relationships between different dimensions of social support and CR adherence.

Moderated multiple regression (MMR) was used to assess the potential modifying effect of sex of the CR participant on the relationship of each individual dimension of social support and CR adherence. This specific type of regression analysis is useful to assess the effect of moderation/interaction of an external variable on the hypothesized relationship. To evaluate the influence of sex of the CR participant on the relationship between emotional/informational support and CR adherence, an MMR model was created consisting of emotional/informational support, sex of the CR participant, and the interaction between emotional/informational support and sex of the CR participant, where CR adherence was the dependent variable. The interaction of emotional/informational support and sex of the CR participant was significant ($\beta = -2.19; p = .02$) (Table 8). This indicated that sex of the CR participant moderated the relationship between emotional/informational support and CR adherence. Therefore, a stratified analysis by

Table 7

Multiple Linear Regression of the Relationships of Tangible Social Support and the Quality of the Primary Intimate Relationship with CR Adherence (N = 53)

Variables in the model	Unstandardized		Standardized	<i>t</i>	<i>p</i>
	coefficients		coefficients		
	b	<i>SE</i>	<i>β</i>		
(Constant)	.16	.28		.59	.56
Tangible Social Support	.001	.002	.08	.70	.49
Quality of the Primary Intimate Relationship	-.003	.002	-.17	-1.48	.15
Age	.01	.003	.61	5.38	< .001

Model Summary $F(3, 48) = 11.05, p < .001, R^2_{Adjusted} = .37$

Table 8

Multiple Linear Regression Evaluating the Potential Moderating Effect of Sex of CR Participant on the Relationship between Emotional/Informational Support and CR Adherence (N = 53)

Variables in the model	Unstandardized		Standardized	<i>t</i>	<i>p</i>
	coefficients		coefficients		
	b	<i>SE</i>	β		
(Constant)	-.50	.66		-.76	.45
Emotional/Informational Support	.02	.01	1.03	2.27	.03
Sex of CR Participant	1.22	.55	1.75	2.21	.03
Emotional/Informational Support x Sex of CR Participant	-.02	.01	-2.19	-2.41	.02

Model Summary $F(3, 49) = 2.28, p = .09, R^2_{Adjusted} = .07$

sex of the CR participant (male or female) was pursued to further assess the direction and strength of this influence.

The VIF scores were greater than 10 and the tolerance was less than 0.1, which suggests multicollinearity, but according to McClelland et al. (2017) and Disatnik and Sivan (2016), multicollinearity in MMR is a distraction, not a barrier to identifying moderation effects. Furthermore, McClelland et al. (2017) suggests that methods of resolving multicollinearity should be avoided as it is unnecessary. Multicollinearity in MMR is problematic for attaining a precise effect size; Hayes (2013) cautions against using standardized regression coefficients in interpreting effect magnitude in MMR because they can be misleading and result in inaccurate interpretation.

Pursuant to this significant moderating effect of sex of the CR participant, regression models were run separately for male and female CR participants. The association between emotional/informational support and CR adherence in male participants was non-significant ($\beta = .13$; $p = .43$) (Table 9) but was significant in females ($\beta = -.56$; $p = .05$) (Table 10).

The interaction of sex of the CR participant and tangible support was not significant ($F [3, 49] = 1.96$, $p = .13$, $R^2_{Adjusted} = .05$) (Table 11). Sex of the CR participant did not moderate the relationship between tangible support and CR adherence. The interaction of sex of the CR participant and the quality of the primary intimate relationship, adjusting for the quality of the primary intimate relationship and sex, was not significant ($F [3, 49] = .67$, $p = .58$, $R^2_{Adjusted} = -.02$) (Table 12). Sex of the CR participant did not moderate the relationship between the quality of the primary intimate relationship and CR adherence.

Table 9

Linear Regression Evaluating the Relationship between Emotional/Informational Support and CR Adherence in Male CR Participants (N = 40)

Variables in the model	Unstandardized		Standardized	<i>t</i>	<i>p</i>
	coefficients		coefficients		
	b	<i>SE</i>	<i>β</i>		
(Constant)	.72	.21		3.41	.002
Emotional/Informational Support	.002	.002	.13	.80	.43

Model Summary F (1, 38) = .64, p = .43, R²_{Adjusted} = -.01

Table 10

Linear Regression Evaluating the Relationship between Emotional/Informational Support and CR Adherence in Female CR Participants (N = 13)

Variables in the model	Unstandardized		Standardized	<i>t</i>	<i>p</i>
	coefficients		coefficients		
	b	<i>SE</i>	<i>β</i>		
(Constant)	1.93	.51		3.76	.003
Emotional/Informational Support	-.01	.01	-.56	-2.26	.045

Model Summary F (1, 11) = 5.10, p = .05, R²_{Adjusted} = .25

Table 11*Multiple Linear Regression Evaluating the Potential Moderating Effect of Sex of CR**Participant on the Relationship between Tangible Support and CR Adherence (N = 53)*

Variables in the model	Unstandardized		Standardized	<i>t</i>	<i>p</i>
	coefficients		coefficients		
	b	<i>SE</i>	<i>β</i>		
(Constant)	-.11	.52		-.21	.83
Tangible Support	.01	.01	.90	2.16	.04
Sex of CR Participant	.64	.40	.92	1.59	.12
Tangible Support x Sex of CR Participant	-.01	.004	-1.35	-1.89	.07

Model Summary $F(3, 49) = 1.96, p = .13, R^2_{Adjusted} = .05$

MMR was used to assess the potential modifying effect of sex of the primary intimate on the relationship of each individual dimension of social support and CR adherence. The interaction of sex of the primary intimate and emotional/informational support, adjusting for emotional/informational support and sex of the primary intimate, was not significant ($F [3, 49] = 1.27, p = .30, R^2_{Adjusted} = .02$) (Table 13). Thus, sex of the primary intimate did not moderate the relationship between emotional/informational support and CR adherence. The interaction of sex of the primary intimate and tangible support, was not significant ($F [3, 49] = 1.83, p = .15, R^2_{Adjusted} = .05$) (Table 14). Thus, sex of the primary intimate did not moderate the relationship between tangible support and CR adherence. The interaction of sex of the primary intimate and the quality of the primary intimate relationship, was not significant ($F [3, 49] = 1.75, p = .17, R^2_{Adjusted} = .04$) (Table 15). Sex of the primary intimate did not moderate the relationship between the quality of the primary intimate relationship and CR adherence.

Specific Aim 3: Determine if the type of primary intimate modifies the relationships between different dimensions of social support and CR adherence.

MMR was used to assess the potential modifying effect of the type of primary intimate relationship on the relationship of each individual dimension of social support with CR adherence. The interaction of the type of primary intimate relationship and emotional/informational support was not significant ($F [3, 49] = .18, p = .91, R^2_{Adjusted} = -.05$) (Table 16). Thus, the type of primary intimate relationship did not moderate the relationship between emotional/informational support and CR adherence. The interaction between the type of primary intimate relationship and tangible support, was not significant ($F [3, 49] = .85, p = .48, R^2_{Adjusted} = -.01$) (Table 17). The type of primary

Table 12

Multiple Linear Regression Evaluating the Potential Moderating Effect of Sex of CR Participant on the Relationship between the Quality of the Primary Intimate Relationship and CR Adherence (N = 53)

Variables in the model	Unstandardized		Standardized		<i>t</i>	<i>p</i>
	coefficients		coefficients			
	b	<i>SE</i>	<i>β</i>			
(Constant)	1.91	.99			1.93	.06
Quality of the Primary Intimate Relationship	-.01	.01	-.46		-.96	.34
Sex of CR Participant	-.74	.83	-1.06		-.89	.38
Quality of the Primary Intimate Relationship x Sex of CR Participant	.01	.01	1.07		.80	.43

Model Summary $F(3, 49) = .67, p = .58, R^2_{Adjusted} = -.02$

Table 13

Multiple Linear Regression Evaluating the Potential Moderating Effect of Sex of the Primary Intimate on the Relationship between Emotional/Informational Support and CR Adherence (N = 53)

Variables in the model	Unstandardized		Standardized		<i>t</i>	<i>p</i>
	coefficients		coefficients			
	b	<i>SE</i>	<i>β</i>			
(Constant)	.75	.66			1.14	.26
Emotional/Informational Support	-.003	.01	-.17		-.38	.71
Sex of Primary Intimate	.06	.41	.09		.16	.88
Emotional/Informational Support x Sex of Primary Intimate	.002	.01	.24		.34	.74

Model Summary $F(3, 49) = 1.27, p = .30, R^2_{Adjusted} = .02$

Table 14

Multiple Linear Regression Evaluating the Potential Moderating Effect of Sex of the Primary Intimate on the Relationship between Tangible Support and CR Adherence (N = 53)

Variables in the model	Unstandardized		Standardized	<i>t</i>	<i>p</i>
	coefficients		coefficients		
	b	<i>SE</i>	<i>β</i>		
(Constant)	-.21	.70		-.30	.77
Tangible Support	.01	.01	.62	1.07	.29
Sex of Primary Intimate	.51	.39	.69	1.32	.19
Tangible Support x Sex of Primary Intimate	-.004	.004	-.69	-.87	.39

Model Summary $F(3, 49) = 1.83, p = .15, R^2_{Adjusted} = .05$

Table 15

Multiple Linear Regression Evaluating the Potential Moderating Effect of Sex of the Primary Intimate on the Relationship between the Quality of the Primary Intimate Relationship and CR Adherence (N = 53)

Variables in the model	Unstandardized		Standardized		<i>t</i>	<i>p</i>
	coefficients		coefficients			
	b	<i>SE</i>	<i>β</i>			
(Constant)	2.93	2.01			1.46	.15
Quality of the Primary Intimate Relationship	-.02	.02	-1.11		-1.21	.23
Sex of Primary Intimate	-1.02	1.04	-1.39		-.99	.33
Quality of the Primary Intimate Relationship x Sex of Primary Intimate	.01	.01	1.70		1.17	.25

Model Summary F (3, 49) = 1.75, p = .17, R²_{Adjusted} = .04

intimate relationship did not moderate the relationship between tangible support and CR adherence. The interaction of the type of primary intimate relationship and the quality of the primary intimate relationship, adjusting for the quality of the primary intimate relationship and the type of primary intimate relationship, was not significant ($F [3, 49] = .82, p = .49, R^2_{Adjusted} = -.01$) (Table 18). The type of primary intimate relationship did not moderate the relationship between the quality of the primary intimate relationship and CR adherence.

Table 16

Multiple Linear Regression Evaluating the Potential Moderating Effect of the Type of Primary Intimate Relationship on the Relationship between Emotional/Informational Support and CR Adherence (N = 53)

Variables in the model	Unstandardized		Standardized	<i>t</i>	<i>p</i>
	coefficients		coefficients		
	b	<i>SE</i>	<i>β</i>		
(Constant)	.48	.66		.73	.47
Emotional/Informational Support	.004	.01	.27	.61	.55
Type of Primary Intimate Relationship	.24	.37	.62	.65	.52
Emotional/Informational Support x Type of Primary Intimate Relationship	-.003	.004	-.69	-.69	.49

Model Summary $F(3, 49) = .18, p = .91, R^2_{Adjusted} = -.05$

Table 17

Multiple Linear Regression Evaluating the Potential Moderating Effect of the Type of Primary Intimate Relationship on the Relationship between Tangible Support and CR Adherence (N = 53)

Variables in the model	Unstandardized		Standardized	<i>t</i>	<i>p</i>
	coefficients		coefficients		
	b	<i>SE</i>	β		
(Constant)	1.16	.46		2.54	.01
Tangible Support	-.003	.01	-.24	-.66	.51
Type of Primary Intimate Relationship	-.27	.24	-.70	-1.15	.26
Tangible Support x Type of Primary Intimate Relationship	.003	.003	.76	1.17	.25

Model Summary $F(3, 49) = .85, p = .48, R^2_{Adjusted} = -.01$

Table 18

Multiple Linear Regression Evaluating the Potential Moderating Effect of the Type of Primary Intimate Relationship on the Relationship between the Quality of the Primary Intimate Relationship and CR Adherence (N = 53)

Variables in the model	Unstandardized		Standardized	<i>t</i>	<i>p</i>
	coefficients		coefficients		
	b	<i>SE</i>	β		
(Constant)	1.91	.68		2.81	.01
Quality of the Primary Intimate Relationship	-.01	.01	-.50	-1.54	.13
Type of Primary Intimate Relationship	-.64	.49	-1.65	-1.32	.19
Quality of the Primary Intimate Relationship x Type of Primary Intimate Relationship	.01	.004	1.80	1.33	.19

Model Summary F (3, 49) = .82, p = .49, R²_{Adjusted} = -.01

CHAPTER V

DISCUSSION

The purposes of this study were to evaluate the relationships of dimensions of social support with CR adherence and to explore the potential modification of these relationships by sex of the CR participant, sex of the primary intimate, and the type of primary intimate relationship. Emotional/informational support, tangible support, and the quality of the primary intimate relationship were postulated to have a positive relationship with CR adherence. Sex of the CR participant was hypothesized to modify the relationships of different dimensions of social support with CR adherence. Particularly, sex of the participant was hypothesized to modify the relationships of different dimensions of social support with CR adherence. Sex of the primary intimate also was explored as a potential modifier of the relationships of different dimensions of social support with CR adherence. The type of primary intimate relationship was examined as a potential modifier of the relationships of dimensions of social support with CR adherence.

The findings revealed that sex of the CR participant modified the relationship between emotional/informational support and CR adherence. While the sample size included too few female participants to obtain any meaningful results from a stratified analysis, these results indicate that sex of the CR participant plays a role in the relationship between emotional/informational support and CR adherence. Conversely, there was no relationship between emotional/informational support and CR adherence,

which suggests that the relationship is contingent upon sex of the CR participant. Similarly, no direct relationships between any of the dimensions of social support and CR adherence were identified in this study. Neither sex of the primary intimate nor the type of the primary intimate relationship modified the relationship between any social support dimension and CR adherence.

Relationships of Emotional/informational Support, Tangible Support, and the Quality of the Primary Intimate Relationship with CR Adherence

While there is very little research on whether emotional/informational support, tangible support, and/or the quality of the primary relationship were associated with CR adherence, prior research indicated there is a strong relationship between various dimensions of social support and CR attendance (Campkin et al., 2017; Marzolini et al., 2016; Molloy et al., 2008; Pogossova et al., 2015; Supervia et al., 2017). Existing literature provided evidence of potential relationships between the aforementioned dimensions of social support and CR adherence; however, these relationships were not observed in the current sample.

Emotional/Informational Support

While this is the first study to evaluate the relationship between emotional/informational support and CR adherence, previous studies supported a potential relationship. Hagan et al. (2007) conducted semi-structured interviews with potential CR participants after their first scheduled CR appointment and reported that encouragement from family members influenced CR attendance. Birtwistle et al. (2020) reported similar findings on the importance of family encouragement in a qualitative study with CR professionals about their perception of the family's role in post-MI

recovery. Both studies differed from the current study in several ways. First, an interview may capture nuances in ways that a survey cannot. Both studies referenced the influence of encouragement from family members to attend CR. The MOS-SSS, used in the current study, is a psychometrically validated tool that had good reliability in this sample. However, it does not include any items directly mentioning encouragement from one's social network. Perhaps it could be that an individual may have sufficient emotional/informational support, but a particular element of it is missing, which affects CR adherence. Furthermore, Hagan et al. (2007) measured CR attendance, which is defined as attending the first CR session, whereas in the current study CR adherence was measured. While the studies are similar, they did not measure the same outcome.

Tangible Support

Contrary to expectations, tangible support was not significantly associated with CR adherence, despite several previous studies showing evidence for a possible relationship. There are several possible explanations for this result. The first reason is because the sample size was small, which provides less power to detect a true association that might exist between the variables. Another reason is that data collection and analysis methods differed from previous studies. In a previous study, tangible support was cited as a barrier to CR adherence (Resurrección et al., 2018). However, these data were obtained via interviews with CR participants and CR professionals, and a qualitative study cannot be compared with a quantitative study.

In all previous studies noted in the literature review, there was a relationship between tangible support and CR participation in some capacity in countries outside the U.S. Population and healthcare system differences may be reasons for the discrepancy in

results of this study. For instance, Marzolini et al. (2008) noted that no fee was required for CR participation in their sample. In the U.S., Medicare patients, for example, must make a co-payment to participate in each session. Though this is a subjectively nominal fee, it can quickly become a burden if the intention is to attend all recommended 36 CR sessions. It is possible that individuals who were eligible for CR did not enroll in the first place due to a lack of sufficient tangible support. It could be that those who did not have enough tangible support did not enroll in CR, i.e., the sample only included participants who had sufficient tangible support. Grace, Gravely-Witte et al. (2009) support this with findings that a lack of tangible support is a barrier to CR enrollment in CR non-attenders. Interestingly, the CR professionals interviewed in the Resurrección et al. (2018) study mentioned financial issues as a barrier to CR completion, but none of the participants noted it as a barrier. Again, it is possible that individuals who experienced that particular barrier did not enroll in CR in the first place.

Quality of the Primary Intimate Relationship

In the current study, the quality of the primary intimate relationship was not significantly associated with CR adherence. The quality of the primary intimate relationship was associated with positive health outcomes in several studies (Hall et al., 1987; Hutti et al., 2015; Yang et al., 2017); thus, it was reasonable to assess if a relationship existed with CR adherence. One possible reason no relationship was observed in the current study is that the ARI has only previously measured the quality of the primary intimate relationship in female samples. Seventy-three percent of the sample in the current study was male. It is important to note that prior studies linking dimensions of social support to CR adherence or CR participation in some capacity used different

measures for the outcome variable. No previous studies were identified in which CR adherence was measured as a continuous variable, as was done in the current study. The outcomes in prior studies include CR program completion versus noncompletion (Marzolini et al., 2008), CR enrollment versus non-enrollment (Grace, Gravely-Witte et al., 2009; Hagan et al., 2007), and CR dropout at any point (Resurrección et al., 2018).

The Role of Sex of the CR Participant in the Relationships Between Different Dimensions of Social Support and CR Adherence

Previous research identified sex differences in the effect of social support on CR adherence. However, the current study delved into different dimensions of social support and the modifying effect of sex on the relationship between social support and CR adherence. The most important finding was that sex of the CR participant affected the relationship between emotional/informational support and CR adherence. This finding further supports the idea that there are differences in associations between social support and health behavior/outcomes, depending on the sex of an individual (Hill et al., 2016; Kristofferzon et al., 2003; Li et al., 2014; Wong et al., 2014).

There was a negative relationship between emotional/informational support and CR adherence in female CR participants but not in males. While this result partially supports Hypothesis 2a, that social supports are positively related with CR adherence in males but not females. Moreover, emotional/informational support was not associated with CR adherence in males.

The original Hypothesis 2a focused on males and not females because the existing literature identifies that upon receiving social support, men experience a greater benefit in the form of health behavior (Cutrona, 1996; Stronge et al., 2019). Conversely,

women's health behavior is less affected by the amount of social support they receive, as reported in previous research (Kiecolt-Glaser & Newton, 2001; Stronge et al., 2019).

The main finding of this study implies that women may not require as much emotional/informational support to adhere to CR compared to men. This finding may be interpreted to support a novel paradigm that despite having lower emotional/informational support, women achieved better CR adherence rates. Although the findings of this study are focused on CR adherence, it is imperative to explore this hypothesis in other aspects of healthcare settings and disease areas. The findings from our study conform with the postulation that less is more for females, particularly regarding them taking ownership of their personal health. Although the findings of this study are paradigm shifting the concept of women demonstrating higher responsibility for personal health is a previously observed phenomenon. Analyses of clinical encounter and billing data from previous studies clearly highlights that women have higher rates of health care utilization as compared to men (Bertakis et al., 2000; Wang et al., 2013). Women have approximately 33% higher primary care visits than men and approximately 16% higher charges than men for healthcare services (Bertakis et al., 2000). These clearly indicate a pattern of higher healthcare utilization by women and in general a higher propensity to adhere to clinical recommendations. Thus, we propose a novel paradigm that "less is more for CR adherence in female patients," meaning lower emotional/informational support may translate into higher CR adherence in this population. The findings of this study highlight that female participants may not need as much emotional/informational support as male participants. These findings do not indicate any type of substitution or reduction of emotional/informational support among female patients. All dimensions of

social support are critical to obtain optimum health outcomes, and efforts should be made to provide these supports to the maximum available capacity.

An additional hypothesis from the findings of our study is that emotional quotient and intelligence among women may play a significant role in their ability to complete prescribed medical regimens (Kirkland et al., 2013). Women have higher emotional quotients than men (Joseph & Newman, 2010), and higher emotional intelligence is associated with better health and health behavior adherence (Aliyari et al., 2022; Cardenas-Cloud et al., 2021; Sarrionandia & Mikolajczak, 2019).

Emotional quotient may translate into – better use of resources, ability to better plan healthcare visits, ability to manage financial displacements surrounding healthcare visits, ability to prioritize health over other commitments, ability to follow recommendations of healthcare experts, etc. It is possible that women in this sample were able to overcome the obstacle of lower emotional/informational support by way of emotional intelligence, which assisted in their ability to better adhere to CR.

Moreover, the current findings may be supported by the support gap hypothesis, which purports that wives receive a smaller amount of support and less helpful support than husbands do in heterosexual marriages (Belle, 1982). Women have adapted to relying less on emotional/informational support as it is less available to them since married women tend to outlive their husbands. It is well-documented that women are more self-sufficient than men with regards to maintaining/improving personal health. For example, women are more likely to seek health information than men (Ek, 2013) and have better medication adherence (Bouquemont et al., 2019).

Contrary to expectations, sex did not affect the relationships of tangible support and the quality of the primary intimate relationship with CR adherence. It is possible that relationships among these dimensions of social support do not differ between men and women. However, caution must be applied to generalize these results because the current sample was limited by a smaller number of female participants.

The Role of Sex of the Primary Intimate in the Relationships Between Different Dimensions of Social Support and CR Adherence

Sex of the primary intimate did not modify the relationship between dimensions of social support and CR adherence. The nonsignificant results were unexpected considering that previous research indicates that social support is perceived as more effective when provided by a woman than a man (Franks et al., 2006; Rendall et al., 2011; Taylor, 2007; Williamson & O'Hara, 2017). There are several possible explanations for these unanticipated results. Previous studies measured social support as a global variable, whereas different dimensions of social support were measured in the current study. Sex of the primary intimate may not matter when social support is broken down into the dimensions of emotional/informational support, tangible support, and the quality of the primary intimate relationship. It could also be because over three-quarters of the primary intimates were female; perhaps a larger sample of male primary intimates would have yielded a different result. Finally, it is possible that sex of the primary intimate does not affect the dimensions of social support in cardiac rehab participants. Again, caution must be taken before generalizing these results on a population level because the participants identified fewer male than female primary intimates.

The Role of Type of Primary Intimate Relationship in the Relationships Between Different Dimensions of Social Support and CR Adherence

Support can be received from many types of relationships, e.g., spouses and friends (Silverstein et al., 1996; Stephens et al., 2013; Taylor, 2007; Thomas et al., 2019). This study uniquely explored whether the type of primary intimate relationship affected the relationships between different dimensions of social support and CR adherence. Surprisingly, no differences in these relationships were found in this sample. One major limitation of this analysis is that groups had to be collapsed to provide enough participants in each subgroup. For instance, “spouse” and “significant other” were combined into one group. This was necessary to perform an adequately powered analysis. Even though these groupings were created using logical reasoning, it is possible that the subgroups within the collapsed groups were too heterogeneous to result in a meaningful representation. Furthermore, the nonsignificant results may not have been representative of each subgroup. It is possible that adequate numbers of participants in each subgroup may have yielded significant results.

The findings do provide a novel description of various primary intimate relationships of CR participants. This study differs from previous research on types of primary intimate relationships and health behaviors/outcomes in the sense that this study was open-ended about the different types of relationships, whereas previous studies focused on a particular relationship rather than comparing more than one.

Limitations

Several limitations may have influenced the results obtained in this study. First, the sample was primarily white, male, high income, highly educated, married, and health

insurance holders. Many of these characteristics are associated with greater CR enrollment (Dankner et al., 2015; Garfein et al., 2022; Li et al., 2018; Mead et al., 2016; Parashar et al., 2012) and adherence (Shanmugasegaram et al., 2013). Having a primarily white and high-income sample does not support generalizability of the findings to a larger population of persons who enroll in CR.

Moreover, educated white females with financial resources are advantaged in the community and are more likely to fulfill commitments (including CR sessions) than any other demographic sub-group, including white males regardless of their education or income. Since the most important finding of this study involves women, a majority of whom were white, educated, and high income, it is imperative to highlight this unintentional limitation, which may be related to the fact that data were collected at only two CR sites and may not reflect the adherence rates of all CR programs within this geographical region. Sustained efforts were undertaken during the study design and recruitment phases to promote enrollment of patients with varied demographic and other backgrounds by recruiting from two distinct sites that were most different from one another. These two sites were in completely different localities and served a wide variety of patients.

One possibility concerning why some of the moderation analyses did not reach statistical significance results is that moderation analysis typically has low statistical power and due to the low power, the analysis may errantly show that there is no interaction effect when there actually is one (Aguinis et al., 2001). Furthermore, Aguinis and Gottfredson (2010) state that a complicating aspect of the low statistical power of moderation analysis is when the moderator is a categorical variable; power improves as

the subgroup ratio nears .5. The off-balance ratio in the current study potentially contributed to the non-significant results.

The small sample size limited the amount of primary intimate relationships that we could analyze. This is unfortunate, as previous researchers have found that support is exchanged in varying amounts and effectiveness depending on the type of relationship between two people (Bodenmann et al., 2015; Evandrou et al., 2018; Fingerman et al., 2020; Rendall et al., 2011). Two groups that may have contrasting social support dynamics are heterosexual relationships and homosexual relationships, as the latter is associated with higher levels of satisfaction with the amount of support an individual receives from their partner when compared with the former (Ellis & Davis, 2017; Xu & Burleson).

Another possible limitation is that many previous CR studies have occurred outside of the U.S. (e.g., Canada) (de Melo Ghisi et al., 2024; Mesa-Vieira et al., 2021; Williamson et al., 2020). It must be considered that other countries have different population characteristics and healthcare systems. For example, Canadian researchers have contributed a tremendous amount to CR research. But their data represents a nationalized healthcare system that differs from the U.S., namely no deductibles or copayments for covered services, such as cardiac rehabilitation. Such barriers to healthcare can be pivotal aspects of outpatient clinical follow-up such as CR.

Measuring CR adherence as a continuous variable made analysis difficult with the sample size. However, both the independent variable (dimensions of social support) and the dependent variable (CR adherence) were continuous variables, which allowed for a

seamless execution of regression analysis, and a standardized coefficient that was readily interpretable.

Implications

This study is the first step to assess the relationships between dimensions of social support and CR adherence. As CR adherence is low nationally and internationally, this study was initiated to better understand why many individuals initially enroll in a CR program but do not complete all prescribed sessions. The results of this study suggest that the relationship between emotional/informational support and CR adherence varies depending on sex of the CR participant. This study introduced the idea that despite receiving less emotional/informational support than males, female participants achieved greater CR adherence. These findings underscore the importance of considering sex differences in the effects of social support on CR adherence. In the context of CR, clinicians should consider that men and women may be influenced by emotional/informational support differently. However, further research is needed to understand this relationship better. Further research should be conducted in larger samples with males and females more equally represented.

Findings of this study may expand clinicians' understanding of social support in CR participants. They may inform clinical practice so that healthcare professionals can have better insights into the dynamics of a patient's social relationships and the effects thereof onto their health behaviors. Specifically, CR professionals should consider that men and women have different thresholds for emotional/informational support in adhering to their CR prescription. Further work needs to be done to determine the role that sex of the CR participant plays in the relationship between emotional/informational

support and CR adherence. The results of should be validated with a larger sample size including equitable numbers of men and women.

The nonsignificant results of this study contribute to the body of literature regarding social support and CR adherence. This was a rigorously designed study that found several non-significant results. While the nonsignificant results were unexpected, they are informative to future research on this topic. A replication of this study should aim for a larger sample size to ensure an adequate number of female CR participant representation.

This study introduced a novel description of different types of primary intimate relationships of CR participants. This information can be used as a guide for future research about the role that the primary intimate plays in CR adherence, whether involving social support or not. Furthermore, future researchers may decide to use exclusive categories for this item to limit the number of different types of primary intimates to eliminate the task of categorizing after data collection and possibly needing further clarification from the CR participant. If the current study is replicated, it would be beneficial to ensure that an adequate number of each type of primary intimate relationship was obtained, based on the responses listed in this study, to ensure that analysis results would be reliable. Furthermore, future research could focus on only one type of primary intimate per study to better understand each relationship type. Many of the previous studies that support Aim 3 of the current study focused primarily on one type of primary intimate relationship (Evandrou et al., 2018; Silverstein et al., 1996; Stephens et al., 2013; Thomas et al., 2019).

Future research should be designed to explore the dynamics of primary intimate relationships within the LGBTQ+ population. More research, particularly on this population, needs to be done in the context of CR adherence. Individuals in this population have cited feelings of not being heard in a healthcare setting (Medina-Martinez et al., 2021). A qualitative study should be conducted with members of this population who have recently enrolled in CR. A qualitative design allows for the gathering of information on which variables to focus on in a study in a larger sample (Tenny et al., 2022). This would broaden the understanding of the effectiveness of different dimensions of social support in other demographics.

Conclusions

This study aimed to evaluate the relationships of dimensions of social support with CR adherence and to explore the potential modification of these relationships by sex of the CR participant, sex of the primary intimate, and the type of primary intimate relationship. Sex of the CR participant modified the relationship between emotional/informational support and CR adherence in female CR participants, but these results should be considered with caution. Though other aims were non-significant, the results inform future research on this topic. The limitations of this study highlight the difficulty of analyzing data on CR adherence. Further data collection to increase the sample size of female CR participants and different types of primary intimate relationships is needed to determine precisely how social support dimensions affect CR adherence.

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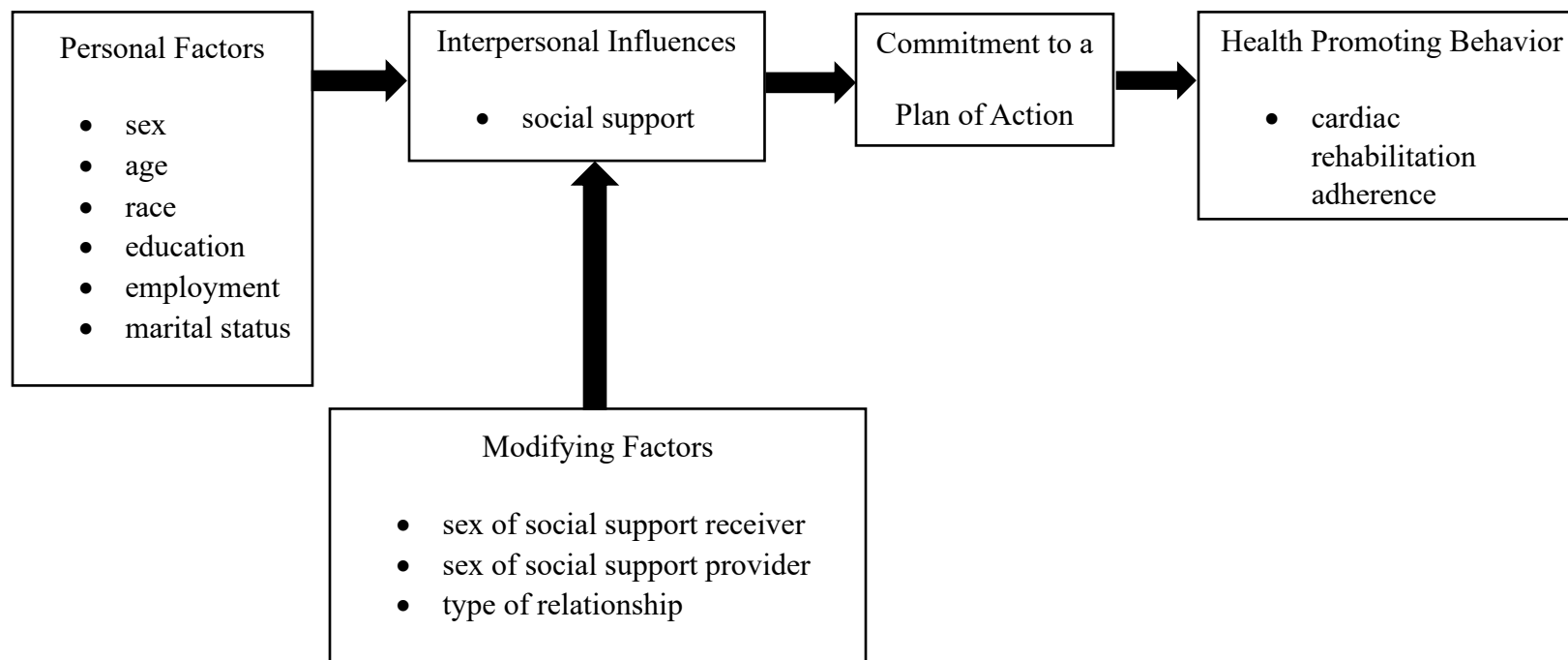
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APPENDIX A

Adapted Version of Health Promotion Model for CR Population



Note: This model was adapted from Pender's Health Promotion Model (1996) for a CR Population (Pender, 1996).

APPENDIX B

Socio-demographic Questionnaire

Date: _____

ID: _____

Phone number: _____

What is your age?: _____ years

Please check the box that applies to you:

Sex: Male Female

Gender: Male Female

Race: Hispanic White/non-hispanic Black/non-hispanic Asian

Other/Multiracial (please list) _____

Marital status: Married Living with partner Divorced Separated

Widowed Never married

Education: Some high school High school graduate Some college
 College degree Graduate degree

Employment: Full-time Part-time Unemployed Disabled
 Retired

Health insurance: Medicare Medicaid Private health plan
 No health insurance Other (Please list)_____

Monthly household income: \$0 – 399 \$400 – 799 \$800 – 1249
 \$1250-1649 \$1650 – 2099 \$2100 – 2899 \$2900 - \$3749
 \$3750 - \$4599 \$4600 - \$5399 \$5400 - \$6249 \$6250 - \$8399
 \$8400 and over Don't know or prefer not to disclose

APPENDIX C

Charlson Comorbidity Index (Charlson et al., 1987)

What is your age? Please circle one of the following options:

less than 50 years

50-59 years

60-69 years

70-79 years

80 years or more

Have you been diagnosed with any of the following conditions? Circle yes or no.

Myocardial infarction (MI) (heart attack) Yes No

Congestive heart failure (CHF) Yes No

Peripheral vascular disease (PVD) Yes No

Cerebrovascular accident (CVA) (stroke) or Yes No

Transient ischemic attack (TIA)

Dementia Yes No

Chronic obstructive pulmonary disease (COPD) Yes No

Connective tissue disease Yes No

Peptic ulcer disease Yes No

Liver disease Yes No

Diabetes mellitus	Yes	No	
Hemiplegia	Yes	No	
Moderate to severe chronic kidney disease (CKD)	Yes	No	
Solid tumor	Yes	No	
If yes, is the tumor localized or metastatic?	localized		metastatic
Leukemia	Yes	No	
Lymphoma	Yes	No	
Acquired immunodeficiency syndrome (AIDS)	Yes	No	

APPENDIX D

Medical Outcomes Study - Social Support Survey (Sherbourne & Stewart, 1991)

People sometimes look to others for companionship, assistance, or other types of support.

How often is each of the following kinds of support available to you if you need it?

Circle one number from each line.

Emotional/Informational support	None of the time	A little of the time	Some of the time	Most of the time	All of the time
Someone you can count on to listen to you when you need to talk	1	2	3	4	5
Someone to give you information to help you understand a situation	1	2	3	4	5
Someone to give you good advice about a crisis	1	2	3	4	5
Someone to confide in or talk to about yourself or your problems	1	2	3	4	5
Someone whose advice you really want	1	2	3	4	5
Someone to share your most private worries and fears with	1	2	3	4	5
Someone to turn to for suggestions about how to deal with a personal problem	1	2	3	4	5
Someone who understands your problems	1	2	3	4	5

Tangible support	None of	A little of	Some of	Most of	All of
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	the time	the time	the time	the time	the time
Someone to help you if you were confined to bed	1	2	3	4	5
Someone to take you to the doctor if you needed it.	1	2	3	4	5
Someone to prepare your meals if you were unable to do it yourself	1	2	3	4	5
Someone to help with daily chores if you were sick	1	2	3	4	5

Affectionate support

	None of the time	A little of the time	Some of the time	Most of the time	All of the time
Someone who shows you love and affection	1	2	3	4	5
Someone to love and make you feel wanted	1	2	3	4	5
Someone who hugs you	1	2	3	4	5

Positive social interaction

	None of the time	A little of the time	Some of the time	Most of the time	All of the time
Someone to have a good time with	1	2	3	4	5
Someone to get together with for relaxation	1	2	3	4	5
Someone to do something enjoyable with	1	2	3	4	5

Additional item

	None of the time	A little of the time	Some of the time	Most of the time	All of the time
Someone to do things with to help you get your mind off things	1	2	3	4	5

APPENDIX E

Autonomy and Relatedness Inventory (Hall, 1983)

Who is the most important person in your life..., the person to whom you feel closest?

This could be anyone: your spouse, a parent, a significant other, any relative or friend, or a helping professional such as a social worker or minister.

Please tell me the relationship of that person to you:

Is this person a man or a woman? _____

Next, please indicate how well each of the following statements describes this person.

The choices are:

1=Not at all like him/her

2=Very little like him/her

3=Somewhat like him/her

4=Much like him/her

5=Very much like him/her

1. Talks over his/her problems with me.

1 2 3 4 5

2. Is always trying to change me.	1	2	3	4	5
3. Respects my opinions.	1	2	3	4	5
4. Acts as though I am in the way.	1	2	3	4	5
<hr/>					
5. Is there when I need him/her.	1	2	3	4	5
6. Won't take no for an answer when he/she wants something.	1	2	3	4	5
7. Tries to understand how I see things.	1	2	3	4	5
8. Gives me as much freedom as I want.	1	2	3	4	5
<hr/>					
9. Is always thinking of things that would please me.	1	2	3	4	5
10. Argues back no matter what I say.	1	2	3	4	5
11. Encourages me to follow my own interests	1	2	3	4	5
12. Makes fun of me.	1	2	3	4	5
<hr/>					
13. Is very willing to help when I need it.	1	2	3	4	5
14. Wants to have the last word on how we spend our time.	1	2	3	4	5
15. Thinks I am worth listening to.	1	2	3	4	5
16. Lets me make up my own mind.	1	2	3	4	5
<hr/>					
17. Has a good time with me.	1	2	3	4	5
18. Wants to control everything I do.	1	2	3	4	5
19. Is happy to go along with my decisions.	1	2	3	4	5

20. Says I'm a big problem.	1	2	3	4	5
<hr/>					
21. Does what he/she can to make things easier for me.	1	2	3	4	5
22. Expects me to do everything his/her way.	1	2	3	4	5
23. Makes me feel I can tell him/her anything.	1	2	3	4	5
24. Thinks it's okay if I disagree with him/her.	1	2	3	4	5
<hr/>					
25. Asks me to share things he/she enjoys.	1	2	3	4	5
26. Finds fault with me.	1	2	3	4	5
27. Considers my point of view.	1	2	3	4	5
28. Doesn't think about me very much.	1	2	3	4	5
<hr/>					
29. Tries to comfort me when things go wrong.	1	2	3	4	5
30. Acts as if he/she doesn't know me when he/she's angry.	1	2	3	4	5
31. Wants me to tell him/her about things that are bothering me.	1	2	3	4	5
32. Lets me do anything I want to do.	1	2	3	4	5
<hr/>					

APPENDIX F

Missed CR Sessions Form

Participants who did not complete all assigned CR sessions will be called by telephone. The following script will be used to better understand why the participant was unable to attend all CR sessions:

“Hello, this is Melissa from the UofL Cardiac Rehab study. We are trying to better understand the reasons why people are unable to attend cardiac rehab sessions. Can you tell me what you think prevented you from attending all of the cardiac rehab sessions?”

Participant response:

APPENDIX G

Participant Screening Form

Inclusion Criteria:

- English-speaking
- Can read/write in English
- 18 years of age or older
- Attending initial CR session

Exclusion Criteria:

- medically unstable for CR participation as determined by CR clinician
- cognitive impairment (score of < 3 on Mini-Cog)

CURRICULUM VITAE

Melissa Amraotkar, BSN, RN, PhD Candidate

University of Louisville School of Nursing

melissa.amraotkar@outlook.com

EDUCATION

- 2015-present Doctor of Philosophy in Nursing, BSN-to-PhD Program
School of Nursing, University of Louisville, Louisville, Kentucky
- 2011 Bachelor of Science in Nursing
School of Nursing, Spalding University, Louisville, Kentucky
- 2006 Bachelor of Arts in History of Art and Studio Art
College of Arts and Science, Indiana University, Bloomington, Indiana

LICENSES AND CERTIFICATIONS

Kentucky Registered Nurse, license # 1129105

ACLS, current

CPR-BLS, current

PROFESSIONAL EMPLOYMENT

- 2020-present Clinical Research Coverage Analyst
Norton Research Institute, Norton Healthcare, Louisville, Kentucky
- 2015-2020 Graduate Research Assistant/Graduate Teaching Assistant
School of Nursing, University of Louisville, Louisville, Kentucky
- 2015-2020 Registered Nurse
Non-Invasive Cardiology, Norton Healthcare, Louisville, Kentucky

2011-2015 Critical Care Staff Nurse
Cardiac Telemetry Unit/Progressive Care Unit, Floyd Memorial
Hospital, New Albany, Indiana

PEER-REVIEWED PUBLICATIONS

Desai, R., Amraotkar, A. R., Amraotkar, M. G., Thakkar, S., Fong, H. K., Varma, Y., Damarlapally, N., Doshi, R. P., & Gangani, K. (2019). Outcomes and predictors of mortality in hospitalized frail patients undergoing percutaneous coronary intervention. *Cureus, 11*(8), e5399. doi:10.7759/cureus.5399

PRESENTATIONS

Amraotkar, M. (2024, February). *Billing compliance: What does it mean for our institution?* Presented at Spring 2024 Onboarding at Norton Research Institute, Norton Healthcare, Louisville, KY.

Amraotkar, M. (2019, April). *A systematic review of cardiac rehabilitation participation: Barriers and facilitators*. Poster presentation at the American Heart Association - Quality of Care and Outcomes Research 2019 Scientific Sessions, Arlington, VA.

Amraotkar, M. (2019, March). *A systematic review of cardiac rehabilitation participation: Barriers and facilitators*. Poster presentation at the Graduate Student Regional Research Conference, Louisville, KY.

Amraotkar, M. (2019, February). *Why I chose a PhD in Nursing*. Podium presentation at School of Nursing Spring 2019 Research Assembly, Louisville, KY.

Amraotkar, M., Midden, A., Crawford, T., Combs, R., McCarthy, V. (2018, October). *Promoting self-care among older female Alzheimer's caregivers: The PATH Program*. Poster presented at Research!Louisville, Louisville, KY.

Amraotkar, M., Midden, A., Crawford, T., Combs, R., McCarthy, V. (2018, April). *Promoting self-care among older female Alzheimer's caregivers: The PATH Program*. Poster session presented at the Annual Research Conference of the Midwest Nursing Research Society, Cleveland, OH.

Amraotkar, M., Midden, A., Crawford, T., Combs, R., McCarthy, V. (2018, March). *Promoting self-care among older female Alzheimer's caregivers: The PATH Program*. Poster session presented at the Graduate Student Regional Research Conference, Louisville, KY.

TEACHING

Spring 2019 Graduate Teaching Assistant: NURS 507 "Transition to Practice" -
MEPN students

Spring 2019	Graduate Teaching Assistant: NURS 657 “Health Promotion and Disease Prevention in Culturally Diverse and Vulnerable Populations” - MEPN, DNP, and PhD students
Summer 2019, Fall 2019	Graduate Teaching Assistant: NURS 652 “Advanced Statistics” - DNP and PhD students
Fall 2015, Spring 2016	Graduate Teaching Assistant: NURS 371 “Adult Health” - BSN students
Fall 2015, Spring 2016	Graduate Teaching Assistant: NURS 472 “Transition to Practice” - BSN students

PROFESSIONAL DEVELOPMENT

Spring 2019	Participant, Graduate Teaching Academy II
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AWARDS / HONORS

2021, 2022, 2023, 2024	Silver Award, Norton Research Institute, Norton Healthcare, Louisville, KY
2019	Ruth Craddock Travel Grant, School of Nursing, University of Louisville. American Heart Association, Quality of Care and Outcomes Research Annual Conference, Arlington, VA
2018	Ruth Craddock Travel Grant, School of Nursing, University of Louisville. Midwest Nursing Research Society Annual Conference, Cleveland, OH
2018	Graduate Student Travel Grant, Graduate Student Council, University of Louisville. American Association of Cardiovascular and Pulmonary Rehabilitation Annual Conference, Louisville, KY
2018	Graduate Student Travel Grant, Graduate Student Council, University of Louisville. American Heart Association, Arteriosclerosis Thrombosis and Vascular Biology Annual Conference, Minneapolis, MN
2017	Student Fellowship, IdeaFestival, Kentucky Center for the Arts, Louisville, KY
2015	Graduate Student Travel Grant, Graduate Student Council, University of Louisville. American Heart Association Annual Conference, Orlando, FL

2014, 2013,
2012 Recipient, C.A.R.E. Award, Floyd Memorial Hospital, New Albany,
IN

2010 Nursing Student Scholarship, School of Nursing, Spalding University,
Louisville, KY

2006 Founder's Day Award for High Scholastic Achievement, Indiana
University, Bloomington, IN

GRANT AWARD

2019 Graduate Student Research Grant (\$500), Graduate Student Council,
University of Louisville, Louisville, KY