POSITIVE PSYCHOSOCIAL PREDICTORS OF HEALTH-PROMOTING BEHAVIORS FOR CARDIOVASCULAR PATIENTS, USING THE STAGES OF CHANGE

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ELISABETH NICKELS

DISSERTATION ADVISOR: DR. JACOB YUICHUNG CHAN

BALL STATE UNIVERSITY

MUNCIE, INDIANA

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Positive Psychosocial Predictors of Health-Promoting Behaviors for Cardiovascular Patients, Using the Stages of Change

Cardiovascular disease (CVD) is the leading cause of death in the world and the United States (U.S.), killing about 610,000 people in the U.S. every year, equal to one in every four deaths (Centers for Disease Control and Prevention [CDC], 2016; World Health Organization [WHO], 2016). In fact, diseases of the heart took 633,842 lives in the U.S. in 2015 (CDC, 2016), and consistently claim more lives than all forms of cancer combined (Mozaffarian et al., 2015). Cardiovascular disease is a broad category that includes a variety of conditions, including heart and blood vessel disease, coronary artery disease, stroke, heart attack, arrhythmia, heart valve disease, heart muscle disease (cardiomyopathy) and heart failure (Mozaffarian et al., 2015; WHO, 2016). These cardiovascular conditions share a common feature, in that they are greatly impacted by behavioral or lifestyle risk factors.

Chronic illnesses such as CVD often have a substantial lifestyle component, meaning they are subject to certain behavioral risk factors and require attention to health behaviors to manage and minimize these risk factors (Bodenheimer, Lorig, Holman, & Grumbach, 2002; Jowsey, Pearce-Brown, Douglas, & Yen, 2011). Minimizing the effects of the disease depends heavily on daily behavior choices. Specifically, an estimated 40% of premature deaths are attributable to preventable behavioral factors such as smoking, unhealthy dietary intake, and sedentary lifestyle (Mokdad, Marks, Stroup, & Gerberding, 2004), all of which have been linked to major chronic illnesses such as CVD (Mozaffarian et al., 2015; Yoon et al., 2014). Thus, the importance of minimizing risk factors and engaging in health-promoting behaviors cannot be overstated for this population.

Despite clear associations with mortality and health risk, large numbers of people with chronic illnesses such as cardiovascular disease continue to engage in unhealthy behaviors (Choi, Chung, & Park, 2013; Paradis, Cossette, Frasure-Smith, Heppell, & Guertin, 2010). Researchers continuously explore strategies for helping patients with chronic illnesses adopt healthy lifestyle recommendations, and yet, implementing effective solutions on a broad scale remains elusive. While much research has focused on the impact of negative psychological states (e.g., depression, anxiety, hostility) on cardiovascular health (Barth, Schneider, & von Känel, 2010; Barth, Schumacher, & Herrmann-Lingen, 2004; DuBois et al., 2015; Kubzansky, Davidson, & Rozanski, 2005; Siegman & Smith, 1994; Versteeg et al., 2009), less attention has been given to the impact of positive psychological constructs. With the goal of enhancing the impact of interventions with this population, this study addresses whether positive psychosocial variables can predict health-promoting behaviors in adults with CVD. Further, examining how these variables may relate to stages of behavior change might help to inform the use of interventions in an increasingly targeted, individualized manner.

Health Behaviors

One of the most common and problematic behaviors for those with chronic illness such as CVD is cigarette smoking. Tobacco smoking is the second-leading risk factor for death in the U.S. and contributed to approximately 7.1 million deaths in 2016 (Benjamin et al., 2019). Further, this risk also applies to inhalation of secondhand smoke (Benjamin et al., 2019; Mozaffarian et al., 2015). Despite an overall decline in smoking prevalence in U.S. adults from 31% in 1980 to 15.5% currently, smoking remains a significant health risk among those with CVD (Benjamin et al., 2019). There is evidence that smoking rates may even be higher in CVD populations than the general population (Kotseva et al., 2009). Further, cigarette smoking is the

most common risk factor present for those with premature heart disease, with onset prior to age 50 (Khot et al., 2003). It is recommended that all persons avoid or cease tobacco smoking and secondhand smoke, and for those with a chronic illness such as CVD, these recommendations are particularly relevant (Mozaffarian et al., 2015). Done at any age, smoking cessation significantly reduces mortality from diseases related to smoking (Benjamin et al., 2019). Smoking cessation has both short-term and long-term benefits, for those already living with CVD and also for lowering CVD risk (Benjamin et al., 2019).

In addition to smoking, another health behavior that is important to monitor is physical activity, specifically for those with chronic illnesses such as CVD (Choi et al., 2013; Czajkowski et al., 2015; Mozaffarian et al., 2015). In 2016, only 23.5% of adults met the Federal 2008 Physical Activity Guidelines for Americans for both aerobic and muscle-strengthening activity (CDC, 2017). Regular physical activity is particularly important for cardiovascular health (Bove, 2016; Huang et al., 2015; Mozaffarian et al., 2015; Paradis et al., 2010). Of note, physical activity is defined as "any bodily movement produced by skeletal muscles that results in energy expenditure," whereas exercise is defined as "planned, structured and repetitive" physical activity, with the specific goal of physical fitness (Caspersen, Powell, & Christenson, 1985, p. 126). Exercise, beyond just physical activity, is considered particularly important for CVD patients (Bove, 2016; Eckel et al., 2014; Mozaffarian et al., 2015). However, any physical activity is preferable to none, and even a small increase in physical activity has been shown to improve cardiovascular health (Carnethon, 2009). A sedentary lifestyle is especially harmful for those with CVD (Czajkowski et al., 2015; Eckel et al., 2014; Mozaffarian et al., 2015).

Another concern closely aligned with lack of exercise for those with CVD is diet. Consuming too many calories, or unhealthy foods regularly, poses a risk to heart health, and

remains a major area of emphasis in managing chronic illnesses such as CVD (Mozaffarian et al., 2015). A significant number of people with and without CVD struggle to maintain a healthy diet and do not burn enough calories to achieve a healthy balance (Benjamin et al., 2019). While current guidelines avoid recommending a specific calorie count, recommendations typically focus on balancing caloric intake with amount of physical activity (Eckel et al., 2014; Mozaffarian et al., 2015). In addition to limiting the number of calories, the type of foods recommended for a heart-healthy diet include regular intake of vegetables, fruits, whole grains, low-fat dairy products, poultry, fish, legumes, non-tropical vegetable oils and nuts; and limiting intake of sweets, sugar-sweetened beverages, red meats, sodium, trans fat and saturated fat (Benjamin et al., 2019; Eckel et al., 2014).

Psychosocial Variables

Researchers have identified associations between the aforementioned health behaviors, certain psychosocial variables, and health outcomes in patients with chronic illness. For example, studies in the U.S. and other countries have linked anxiety and depression with less engagement in healthy behaviors and poorer health outcomes (Boehm & Kubzansky, 2012; Katon et al., 2010; Seligman, 2008; Whalley, Thompson, & Taylor, 2014). Negative psychological states have frequently been associated with poorer cardiovascular health specifically (Barth et al., 2004; Barth et al., 2010; DuBois et al., 2015; Kubzansky et al., 2005; Siegman & Smith, 1994; Versteeg et al., 2009). As such, the goals of behavioral health research often include developing and improving behavioral health interventions for use in health care settings, to help patients change unhealthy habits, as well as to empower individuals to better manage their own health and health behavior (Czajkowski et al., 2015; Whalley et al., 2014). To this end, attention to psychosocial factors associated with health behaviors is increasing in the

literature, along with a targeted, individualized approach to motivating health behavior change.

While much research has focused on the impact of negative psychological states on cardiovascular health, less attention has been given to the impact of positive psychological constructs. This area of research is growing, however. In a non-systematic review of the literature, DuBois et al. (2012) found positive psychosocial constructs (e.g., optimism, gratitude, positive affect) to be associated with cardiac health outcomes, as well as health behaviors, and possibly physiologic changes. Further, in a systematic review of 30 eligible studies, DuBois et al. (2015) found that among studies with 100 or more participants, 65% of all analyses indicated a significant association between positive psychological constructs and subsequent health outcomes. Furthermore, positive psychological variables such as positive affect have been successfully increased through interventions with cardiac patients, resulting in more successful health behavior change (Charlson et al., 2013; Sanjuán et al., 2016).

Specifically, optimism, one of the most widely researched positive constructs related to heart health, has been robustly related to better CVD outcomes in both healthy and patient populations (Boehm & Kubzansky, 2012; DuBois et al., 2015; Labarthe et al., 2016). Optimism is defined in the literature as a favorable outlook, or a general expectation that good things will happen (Boehm & Kubzansky, 2012; Carver, Scheier, & Segerstrom, 2010; Scheier & Carver, 1992). Higher levels of optimism have been associated with decreased mortality risk in patients with CVD, as well as healthier eating habits, increased physical activity, and decreased likelihood of smoking (Boehm et al., 2018; Boehm & Kubzansky, 2012; Ronaldson et al., 2015). Further, a meta-analysis by Boehm et al. (2018) found optimism associated with greater fruit and vegetable consumption, physical activity, and avoidance of smoking. Additionally, research has demonstrated that optimism can be increased via intervention (Malouff & Shutte, 2017; Peters,

Meevissen, & Hanssen, 2013).

Further, positive affect, or the experience of positive mood and emotions such as excitement, enthusiasm, or pride, has been found to be associated with health-promoting behavior, protective biological responses, and better health outcomes (Sin, 2016; Sin, Moskowitz, & Whooley, 2015; Steptoe, Dockray, & Wardle, 2009). Specifically, positive affect has been associated with decreased secondary events and hospital re-admittance in cardiovascular patients, as well as improved sleep, diet, exercise, and adherence to medical regimens (Pressman & Cohen, 2005; Sin, 2016). Moreover, Peterson et al. (2012) found that positive affect increased via a psychological intervention had a positive impact on physical activity in CVD patients. Additionally, both optimism and positive affect have been associated with physical activity and healthy eating in CVD patients (Huffman et al., 2016; Sin et al., 2015). Importantly, evidence suggests that positive affect can be increased with interventions (Boumparis, Karyotaki, Kleiboer, Hofmann, & Cuijpers, 2016).

Additionally, social support has been linked with cardiovascular health behaviors and outcomes. Social support is defined in the literature as both emotional and tangible support from others, such as help, encouragement, and a feeling of being cared about (Barth et al., 2010; Yunus & Sharoni, 2016). Low perceived social support has been associated with increased mortality in those with coronary heart disease (CHD), and increased risk of developing CHD, suggesting that increased social support has protective benefits (Barth et al., 2010). Tay, Tan, Diener, and Gonzalez (2013) found social support to be positively correlated with health promoting behaviors and healthier outcomes in patients with CHD. Various types of social support were significantly positively associated with beneficial self-care behaviors in patients with heart failure (Graven & Grant, 2014; Yunus & Sharoni, 2016). There is preliminary support

regarding the effectiveness of interventions to increase social support, including less traditional forms of support, such as internet and social media-based (Cattan et al., 2005; Hogan, Linden, & Najarian, 2002; Maher et al., 2014; Van Dam et al., 2005).

A fourth psychosocial variable, a sense of purpose in life, has also been found to relate to improved health outcomes in cardiovascular patients (Boehm & Kubzansky, 2012; DuBois et al., 2015; Kim, Sun, Park, Kubzansky, & Peterson, 2013). Purpose in life is defined variously in the literature, and is often described as either equivalent to or including *meaning* in life. Definitions converge on purpose as a sense of directedness; a central theme that guides one's goals for life, and provides meaning for what one does (Boehm & Kubzansky, 2012; DuBois et al., 2015; Kashdan & McKnight, 2009). Kim and colleagues (2013) found that a greater sense of purpose in life was associated with lower risk of heart attack in older adults with heart disease over a two-year period. Cohen, Bavishi, and Rozanski's 2016 meta-analysis revealed that higher sense of purpose in life was associated with reduced risk for all-cause mortality and cardiovascular events. Specifically, a greater sense of purpose in life has been found to correlate with embracing of more beneficial health behaviors such as exercise, diet, and not smoking (Park, 2015). While intervention studies for increasing meaning and purpose in life are limited, preliminary evidence is positive and significant for effectiveness of therapies with meaning and purpose in life as a target (Fava, 1999; Ryff, 2013).

Most research to date has focused on how positive psychological constructs are associated with the absence of unhealthy behaviors or biological dysfunction. Less attention has been given to positive psychological constructs associated with the presence of health-promoting behaviors or biological functioning (Boehm & Kubzansky, 2012; DuBois et al., 2015). Findings have indicated that higher levels of positive psychological constructs are positively associated

with restorative health behaviors and negatively associated with harmful health behaviors (Boehm & Kubzansky, 2012; DuBois et al., 2015). Further, the cardiovascular benefit associated with positive psychological states appears to operate independently from simply an absence of depression or anxiety (Huffman et al., 2011). What is less clear in the research is how the presence of these psychosocial variables correlates with behavior *change* associated with health outcomes. To translate these findings into effective interventions, further research into how positive psychological constructs associate with readiness to change, and maintenance of, specific health behaviors and CVD is needed.

Several patterns in the existing research signal a need for further investigation of these associations. Reviews have largely focused on a single positive construct, such as optimism, or have had limited focus on patients with cardiac disease, and/or have been solely descriptive in nature (DuBois et al., 2015). It is important to examine a wide range of positive states and traits, as studying multiple positive constructs at once could help determine if different positive constructs may have greater or lesser effects on health behaviors and outcomes. Additionally, while studies of the general population help to predict and ideally prevent illness, more studies of those with existing health conditions such as CVD are necessary to inform disease management. Furthermore, it is possible that significant findings from research with clinical populations can then be used to inform more targeted preventive interventions for the general population.

Researchers have called for more attention to both risk factors and protective factors, in preventing and managing CVD (Barth et al., 2004; WHO, 2016). Pathways linking these factors with outcome are still unclear, and psychological interventions have demonstrated mixed evidence of effectiveness (Barth et al, 2004). DuBois et al. (2015) argued that given the importance of identifying protective factors for the high-risk cardiovascular population, the lack

of reviews and analyses of positive psychosocial constructs in heart disease patients represents a crucial gap in the literature. While associations are emerging in the literature, more detailed evidence is needed about how these variables interact with health behavior, to translate these findings into effective practice.

Transtheoretical Model

Researchers of the psychology of health behavior often use models to describe and understand behavior change, and theories of health behavior are becoming increasingly complex (Hagger, 2009). The Transtheoretical Model (TTM) of health behavior change (Prochaska & Velicer, 1997) has been praised for more accurately capturing the complexity and process of behavior change (Choi et al., 2013; Huang et al., 2015). The TTM was originally developed for smoking cessation, and focuses on how an individual progresses through various stages of behavior change (Prochaska & Velicer, 1997). It incorporates the ideas that readiness and motivation fluctuate, relapses happen, and change may not necessarily progress in a clear linear fashion (Prochaska & Velicer, 1997). A four-factor model, the TTM consists of stages of change, processes of change, decisional balance (pros vs. cons), and self-efficacy vs. temptation. The TTM is theorized to represent the natural process of behavior change, and has been applied to many health behaviors (Prochaska & Velicer, 1997).

The TTM includes six stages of change: 1) *Precontemplation*: not yet considering changing behavior, and may not be aware a change is needed; 2) *Contemplation*: recognizes a need to change and begins considering ways to change; 3) *Preparation*: ready to take action and begins making efforts toward behavior change; 4) *Action*: making significant positive changes in behavior; 5) *Maintenance:* able to maintain those changes for at least six months; and 6) *Termination*: confident in and accustomed to the behavior change, without fear of relapse

(Prochaska & Velicer, 1997). These stages are the most-studied aspect of the model, and the other aspects of the model are often not included in studies utilizing the stages of change. Proponents of the TTM argue that behavior change interventions are most effective when tailored to an individual's current stage of change (Bridle et al., 2005). While research presents mixed findings, many studies have demonstrated effectiveness of the TTM when applied to understanding and changing important cardiovascular health behaviors (Armitage, 2009; Bulley et al., 2007; Carvalho de Menezes, 2016; Huang et al., 2015; Paradis et al., 2010).

TTM and Smoking

The TTM was originally developed as a model based on the process of smoking cessation (Prochaska & DiClemente, 1982). As such, it is theorized to reflect the actual process of change for those thinking about, attempting to, or actively quitting smoking. Specifically, stage-based interventions for those in earlier stages (i.e. Precontemplation, Contemplation) allow those who may not be "ready" to quit (i.e., Preparation) to be effectively targeted (Velicer, Prochaska, & Redding, 2006). The TTM model has been validated in studies of smoking cessation (Fava et al., 1995; Prochaska & DiClemente, 1982; Velicer et al., 2006). While stage-based intervention studies have yielded mixed evidence compared to non-stage based, researchers have found evidence suggesting that stage-matched smoking cessation interventions are effective, in general and in cardiovascular populations (Armitage, 2009; Paradis et al., 2010; Steptoe, Kerry, Rink, & Hilton, 2001).

TTM and Exercise

Independent trials and systematic reviews using the TTM demonstrate promising but limited evidence in favor of the TTM, for prediction and intervention of physical activity. Several studies using stage-based interventions to improve physical activity in cardiovascular

patients indicate positive results, albeit with limitations (Huang et al., 2015; Steptoe et al., 2001). In addition to trials, systematic reviews and meta-analyses offer similarly cautious endorsements of the TTM for exercise measurement and intervention (Adams & White, 2003; Bulley et al., 2007). Notably, Bulley et al. cautioned that self-reported stages may not reflect objective behavior measures, and Adams and White noted that TTM interventions may not necessarily support long-term changes. Overall however, these findings support the use of stage of change information to more effectively target physical activity interventions for cardiac patients.

TTM and Dietary Behavior

In addition to physical activity, dietary behavior is often studied using the TTM, although less frequently. Evidence from individual trials and reviews reveals modest support for the TTM, with calls for further study (Carvalho de Menezes, 2016; Glanz et al., 1998; Horwath, Nigg, Motl, Wong, & Dishman, 2010; Verheijden et al., 2004). Trials involving patients at risk for cancer and cardiovascular disease revealed short-term improvements in diet using stage-matched interventions for reduced fat consumption and increased fiber, fruit, and vegetable consumption (Glanz et al., 1998; Verheijden et al., 2004). Further, a 2016 systematic review by Carvalho de Menezes revealed that stage-matched interventions were effective for reduction of fat consumption, and increased fruit and vegetable consumption. In sum, the promising evidence for the stages of change as applied to smoking, diet, and exercise merits further investigation of its application to health behavior change, and justifies its continued use in research.

The Present Study

In order to explore the predictive power of positive psychosocial variables related to behavior change, this study includes four positive psychosocial variables: optimism, positive affect, perceived social support and meaning/purpose in life; and how they associate with stages

of behavior change for three important health behaviors for patients with CVD. These variables have each previously been found to be positively associated with health-promoting behaviors cited consistently in the literature as being highly impactful on cardiovascular health: smoking cessation, diet, and physical activity (Bodenheimer et al, 2002; Boehm & Kubzansky, 2012; Choi et al., 2013; Kim et al., 2013; Park, 2015; Sin, 2016; Sin et al., 2015; Steptoe et al., 2009; Tay et al., 2013; Whalley et al., 2014), yet more research is needed to determine how specifically they relate to behavior change, to inform effective interventions.

Knowledge of how these behaviors appear to be correlated with positive psychosocial variables could inform targeted, individualized interventions for improving health outcomes for patients with CVD. While research has explored positive psychosocial variables in relation to health behaviors in patients with CVD, none has examined how these variables relate to specific stage of behavior change. Most health behavior interventions target moving into the Action (fourth) stage, assuming that individuals are ready and prepared to change. However, research has indicated that those in the general population tend to be distributed in earlier stages with respect to "high risk" health behaviors (Fava et al., 1995; Prochaska & Velicer, 1997). Thus, interventions tailored to stage of readiness, and also for those trying to maintain a change, may be more effective for more people. This study examined several hypotheses:

1) Patients who have already experienced some level of cardiovascular event or condition will display a more varied distribution of stages for health behavior change, compared to those from the general population, as described in the literature.
2) Higher reported levels of optimism, positive affect, perceived social support and purpose in life will predict later stages of change for health behaviors needing improvement.

3) Various psychosocial and demographic variables will have different predictive power for the three health behaviors.

Investigation of how psychosocial and demographic variables such as gender interact to predict behavior change may serve to inform targeted and impactful health behavior interventions.

Methods

Participants

Since information on the expected odds ratio, the proportion of observations in the group membership of the dependent variables, and the distribution of each independent variable was not available, an a priori power analysis could not be conducted to determine the minimum sample size needed. Using the rule of thumb suggested by Hosmer, Lemeshow, and Sturdivant (2013), a minimum sample of 15 observations per independent variable in the model was sought.

The final sample consisted of 300 adults age 30 and above with a self-reported history of cardiovascular disease, who completed all survey measures. Table 1 displays frequencies for key demographic variables, and Table 2 displays means and other relevant statistics for continuous demographic variables. Participants were 62% female and 38% male. Age ranged from 30 to 88 years old, with an average age of 57.5 years. The sample identified predominantly as Caucasian (93%), 2.3% as African American, 2% as Hispanic or Latino, 1% as Asian or Pacific Islander, 1% as biracial, and 0.7% as Native American. Participants' education levels varied, with 29% having a bachelor's degree, 19% a graduate degree, 18% some college, 14% associate's degree, 11% high school diploma or equivalent, 7% trade/tech/vocational training, and 2% less than high school. The majority of participants (70%) were married or partnered and living together, 14% divorced, 9% single, never married, 6% widowed, and 2% separated. Household income was somewhat higher than expected, with 30% reporting $100,000 or more,

37% reporting $40,000 – 99,999, 28% 39,999 or less, and 5% not reporting income. The majority, 56%, had never participated in cardiac rehabilitation, while 27% had in the past, 10% were currently participating, and 7% had been referred but did not participate. The majority of participants were either very or extremely familiar with recommendations for heart health regarding smoking (93%), exercise (77%), and diet (72%). Information on participants' medical treatments received is presented in Table 3, and participants' familiarity with health behavior recommendations is presented in Table 4.

Measures

Smoking: Adult Stage of Change (Short Form). The Adult Stage of Change (Short Form) measure for smoking was developed by DiClemente et al. (1991), based on the TTM. It is a three-item measure which identifies current smokers, past smokers, and never-smokers. Items include questions such as "Are you currently a smoker? For smokers only: In the last year, how many times have you quit smoking for at least 24 hours? Are you seriously thinking of quitting smoking? If so, within the next 6 months, or 30 days?" (University of Rhode Island Cancer Prevention Research Center [URICPRC], 2017). Depending on length since quitting or future plans to quit, responses were categorized into stages of change (DiClemente et al., 1991; URICPRC, 2017). For example, a current smoker not thinking of quitting would be categorized in the Precontemplation stage, whereas a non-smoker who quit within the last 6 months would be in the Action stage. Psychometric properties for this measure are not reported in the literature, however the measure exhibits high face validity, as the questions appear to directly measure the construct of smoking behavior. However, this measure is widely used in research on smoking cessation (DiClemente & Prochaska, 1985; Velicer et al., 2006).

Exercise: Stages of Change. The measure used for exercise stage is a brief measure adapted for this study from a scale by Driskell, Dyment, Mauriello, Castle, and Sherman (2008), which is based on the TTM. After a brief description of "regular exercise," operationalized as at least 30 minutes of moderate-intensity aerobic activity at least 4 days per week, for a total of 120 minutes (Shipe, 2012), respondents were asked about their current frequency of exercise, and based on responses, either length of maintaining the frequency, or plans for future exercise. Items include statements such as, "How long have you been doing 30 minutes of moderate-intensity aerobic activity for at least 4 days of the week?" or "Do you plan to start doing 30 minutes of moderate-intensity aerobic activity on at least 4 days of the week?" (Driskell et al., 2008). Responses were categorized into a certain stage of change. For instance, exercising regularly for less than six months is considered the Action stage, while intending to start in the next 30 days is considered the Preparation stage. Information on reliability and validity for the original measure was unavailable, however the measure has been used in prior TTM literature.

Dietary Stages of Change. Dietary stages of change were measured using a brief measure adapted for this study from the scale by Driskell et al. (2008), which is based on the TTM. It begins with a description of a "heart-healthy diet" operationalized as "regular intake of fruits (particularly fresh), vegetables (emphasizing root and green varieties), whole grains (cereals, breads, rice, or pasta), fatty fish (rich in omega–3 fatty acids), low-or-non-fat dairy products, lean poultry, legumes, nuts, olive or canola vegetable oils in lieu of butter, and nuts; and limiting intake of sweets, sugar-sweetened beverages, red meats, sodium, trans fat and saturated fat" (Eckel et al., 2014, p.15). Recommended number of servings for each type of food are listed for participants' reference. Respondents were asked about their current diet, and based on responses, either length of maintaining the diet, or plans for future dietary changes. Items

include statements such as, “How long have you been eating according to the above diet guidelines, for 6 days per week?” or “Do you plan to start eating according to the above diet guidelines, for 6 days per week?” (Driskell et al., 2008). Responses were categorized into a certain stage of change. For instance, eating a “healthy diet” for less than six months is considered the Action stage, while intending to start in the next 30 days is considered the Preparation stage. Information on reliability and validity for the original measure was unavailable.

Life Orientation Test – Revised (LOT-R). The Life Orientation Test – Revised (LOT-R) was developed by Scheier, Carver, and Bridges (1994) as a revised version of the original, 12-item LOT (Scheier & Carver, 1992). The LOT is a widely-used measure of optimism and pessimism in the literature. The LOT-R is a 10-item measure of optimism and pessimism, with each item rated on a five-point Likert scale, from 0, *“Strongly disagree”* to 4, *“Strongly agree”* (Scheier et al., 1994). Items include statements such as “In uncertain times, I usually expect the best,” and “I hardly ever expect things to go my way” (Scheier et al., 1994). Scoring of the measure is continuous, without a specific benchmark for optimist versus pessimist. Cronbach’s alpha was found to be .78, indicating acceptable internal consistency (Scheier et al., 1994), and the measure was found to have construct validity, when compared with measures for neuroticism, anxiety, depression, positive affect, and self-esteem (Scheier & Carver, 1992). In the current study, Cronbach’s alpha was found to be .87, indicating good internal consistency.

Positive and Negative Affect Schedule (PANAS). The Positive and Negative Affect Schedule (PANAS), developed by Watson, Clark and Tellegen (1988), is a well-established measure that consists of two 10-item subscales. One subscale measures negative affect, while the other measures positive affect. The PANAS was developed in response to criticisms of other

measures of affect, which had low reliability and poor validity (Watson et al., 1988). Items consist of emotion words such as "excited," "inspired," and "distressed", and respondents rate the extent to which they have felt the emotions over the past week. Reponses range from 1, "*Very slightly or not at all*," to 5, "*Extremely*." Cronbach's alpha was found to be .88 for positive affect and .85 for negative affect, indicating acceptable internal consistency, and the measure was found to have adequate construct validity for both subscales, when compared with other measures of mood and affect (Watson et al., 1988). The current study used only the positive affect subscale, and Cronbach's alpha was found to be .92, indicating excellent internal consistency.

Multidimensional Scale of Perceived Social Support (MSPSS). The MSPSS (Zimet, Dahlem, Zimet, & Farley, 1988) is a 12-item self-report measure assessing an individual's perceived social support from family, friends, and significant others. Items include statements which are rated in terms of agreement, such as "I can talk about my problems with my family," and "My friends really try to help me" (Zimet et al., 1988). Responses are Likert-style, and range from 1, "*Very strongly disagree,"* to 7, *"Very strongly agree*." The original study found the measure to be psychometrically sound, with coefficient alphas ranging from .85 to .91 (internal reliability), test-retest values from .72 to .85 (stability), and construct validity supported by correlation of responses with depression and anxiety scales (Zimet et al., 1988). An additional study by Zimet, Powell, Farley, Werkman, and Berkoff (1990) found a Cronbach alpha range of .84 to .92 across three different groups. In the current study, Cronbach's alpha was found to be .95, indicating excellent internal consistency.

Meaning in Life Questionnaire (MLQ). The Meaning in Life Questionnaire (MLQ) by Steger, Frazier, Oishi, and Kaler (2006) is a widely-used 10-item measure of the presence of and

search for meaning in life. Research on purpose in life and health outcomes generally includes measures that treat meaning and purpose as largely interchangeable. For example, Ryff's Psychological Well-Being Scales include a widely-used subscale measuring purpose in life, which defines purpose as "having goals in life and a sense of directedness; feeling there is meaning to present and past life; holding beliefs that give life purpose; and having aims and objectives for living" (Ryff, 1989, p. 1072). While widely used in health literature on positive psychosocial constructs, the Ryff Scales include six subscales total, and therefore its length is prohibitive for purposes of the current study. The MLQ offers a more succinct measure of the same constructs, meaning and purpose.

The MLQ consists of two subscales, the MLQ-P (presence of meaning) and MLQ-S (search for meaning), with 5 items for each subscale. It was created in response to criticisms of other meaning and purpose-focused measures, which tend to include items relating to confounding variables such as mood, affect, or endorsement of certain values (Steger et al., 2006). Items include statements which the respondent rates in terms of truthfulness for them (from 1 to 7). These statements include "My life has a clear sense of purpose," and "I am searching for meaning in my life." Internal consistency reliability was found to range from .81 to .86 for MLQ–P, and from .84 to .92 for MLQ-P (Steger et al., 2006). Convergent validity was established via positive correlations with measures of life satisfaction, positive emotions, intrinsic religiosity, extraversion, and agreeableness, and negative correlations with depression, negative emotions, and neuroticism. Discriminant validity was established via low correlations with measures of social desirability, extrinsic religiosity, and values (Steger et al., 2006). In the current study, Cronbach's alpha for MLQ-P was found to be .92, indicating excellent internal consistency, and .88 for MLQ-S, indicating good internal consistency.

Demographic questionnaire. Participants' data collected included age, gender, income, marital/relationship status, ethnicity, education, type of heart condition, length of time with condition, current treatment/procedures, medications, any participation in cardiac rehabilitation, and familiarity with behavior recommendations for heart health.

Procedure

The study utilized a cross-sectional, self-report survey of health behaviors, demographics and psychosocial variables. Participants were recruited through targeted outreach to organizations via the internet, through survey invitations posted on public groups pertaining to cardiovascular disease, organizations such as the American Heart Association, The Heart Foundation, Heart Failure Society of America, and National Coalition for Women with Heart Disease. Local medical facilities including Ball Memorial Hospital Cardiology Department and Cardiac Rehabilitation provided participants, with IRB approval. Ball State's Adult Physical Fitness Program and the employee Working Well Program distributed the survey as well. The participants were recruited via online invitations and distribution of paper surveys. Additionally, a number of support groups with an online presence were contacted regarding recruiting participants. Invitations included a brief explanation, indication of IRB approval, a link to the survey and informed consent. There were 261 online respondents, from various outreach efforts, and 39 paper survey respondents, from Ball Memorial Hospital, included in the final analysis.

Participants were asked to give informed consent before viewing the questionnaires and fully debriefed of the purpose of the study upon completing the survey. All data gathered from participants was anonymous. The measures, with the exception of the demographic questionnaire, were administered in a randomized order. The demographic questionnaire was completed after the other measures. Participants completed surveys either online, using

Qualtrics, or in paper form. Participants had monetary incentive in the form of five $40 gift cards which were distributed randomly via a lottery. Respondents were offered a chance to voluntarily register for this lottery in a separate database, which prevented any identifying information to be connected to individual surveys. In addition, participants were able to select from a list of non-profit organizations dedicated to heart disease, to which the researcher donated $2 per selected organization, for a total of $536. Organizations included the American Heart Association, the Heart Foundation, the Children's Heart Foundation, The National Coalition for Women with Heart Disease, and the Hypertrophic Cardiomyopathy Association.

Data Analysis

A preliminary analysis was conducted to examine correlations between the demographic and psychosocial variables. For example, gender and race differences have been identified in CVD. Heart conditions are significantly more prevalent in men than women, and more prevalent in African Americans than Caucasians (Go et al., 2014). However, women with CVD tend to have significantly more depression, anxiety, and stress than men, along with reduced activity and significantly worse clinical outcomes (Brummett, Morey, Boyle, & Mark, 2009). Further, women are less aggressively treated and receive significantly fewer referrals to cardiac rehabilitation (Allan & Fisher, 2012; Colella et al, 2015). Naturally, diagnoses of CVD are more prevalent in older populations (Mozaffarian et al., 2015). Additionally, psychosocial variables have been found to interact with demographic variables in CVD outcomes. For instance, higher levels of positive affect during recovery from a heart attack were found to significantly reduce the decline in functioning in men but not in women (Brummett et al., 2009). Optimism was found to be higher in older patients with atherosclerosis (plaque buildup in the arteries causing hardening and narrowing) than younger, with no differences found in optimism levels for gender

or race (Roy et al., 2010). Finally, health behaviors can vary according to demographic factors. Smoking, for example, is more prevalent in males than females, and most prevalent in American Indian males and females, Black males and White males (Mozaffarian et al., 2015). This preliminary analysis provided information for conducting the predictive analysis, which utilized logistic regression.

Multinomial logistic regression (MLR) was used to analyze the data, using SPSS Statistics Version 25.0 (IBM Corp., 2017). MLR is used to predict membership in a category, or the probability of membership in a category (Starkweather & Moske, 2011). The prediction of membership in a certain category serves as the dependent variable, derived from multiple independent variables, which can be either dichotomous or continuous. MLR was appropriate because there are five potential categories of the dependent variable (five stages of change), and MLR allows for more than two categories of the dependent variable (Starkweather & Moske, 2011). The current study investigated whether certain psychosocial or demographic variables predict stage of change for certain health behaviors. It was important to assess for multicollinearity among the independent variables, given that there was some expected correlation between positive psychosocial variables. Another benefit of using MLR is that it does not require assumptions of normality, linearity, or homoscedasticity (Starkweather & Moske, 2011). Descriptive and reliability statistics for each measure can be found in Table 5. This analysis illustrated which psychosocial variables correlate the strongest with certain stages of behavior change. This information can then be used to apply to clinical practice, such as interventions targeted toward increasing or encouraging certain positive psychological states to affect health behavior change.

Results

For each health behavior, participants were first categorized into one of five stages of behavior change, based on the TTM. Next, an analysis of correlations between demographic variables and psychosocial predictors was conducted for each health behavior (smoking, diet, exercise). Associations among observed variables were examined using bivariate correlations, and assessed for multicollinearity among the independent variables. Lastly, MLR analyses were conducted for each health behavior. Model fit indices and omnibus test statistics for the MLR models can be found in Tables 6 and 7, respectively.

Smoking Behavior Change

As expected, significant Pearson correlations emerged among many psychosocial variables in the smoking behavior sample (Table 8). Optimism was moderately positively correlated with positive affect, $r = .53$, $p < .01$; social support, $r = .41$, $p < .01$; and meaning-presence, $r = .60$, $p < .01$; and weakly negatively correlated with meaning-search, $r = -.28$, $p < .01$. Positive affect was moderately correlated with social support, $r = .52$, $p < .01$; meaning-presence, $r = .64$, $p < .01$; and weakly correlated with meaning-search, $r = -.22$, $p < .01$. Social support was moderately correlated with meaning-presence, $r = .41$, $p < .01$. Additionally, associations between several demographic variables and psychosocial predictors were significant. Age was weakly but positively correlated with optimism, $r = .19$, $p < .05$, and meaning-presence, $r = .20$, $p < .05$, and negatively with meaning-search, $r = -.27$, $p < .01$. Finally, gender was weakly but positively correlated with meaning-presence, $r = .18$, $p < .05$, suggesting that males reported slightly higher presence of meaning/purpose in life.

Overall, the model for Smoking Behavior Change exhibited adequate fit. The omnibus test for the logistic regression model was found to be statistically significant, X^2 (68, $N = 144$) =

118.82, $p < .001$. The Nagelkerke Pseudo R^2 was computed to be .652, suggesting that 65% of the variability is explained by the predictor variables in the model. The Hosmer and Lemeshow goodness of fit test was not significant, X^2 (504, $N = 144$) = 249.47, n.s., indicating a good fit for the model. Further, the overall predictive accuracy for the model is 77.1%, suggesting that the model is useful.

For the regression analyses, each of the first four stages was used as a reference group and compared with the other stages. For the overall model of smoking cessation behavior, several independent variables were significant in predicting participants' stage of change. Significant psychosocial predictors were social support, meaning-presence, and meaning-search, and significant demographic predictors were age, gender, and education. Parameter estimates for the smoking model are presented in Table 9. Specifically, those who reported higher levels of social support had a significant increase in odds of being in the Contemplation stage of change rather than the Precontemplation stage (OR = 8.10; 95% CI: 1.39 to 47.01). Higher reported social support also increased the odds of being in the Maintenance stage compared to the Precontemplation stage (OR = 6.76; 95% CI: 1.46 to 31.29). Unexpectedly, those with higher meaning-presence (presence of meaning in life) had decreased odds of being in the Preparation stage (OR = .11, 95% CI: .01 to .92) or Maintenance stage (OR = .12, 95% CI: .02 to .81) compared to Precontemplation. Notably, those with higher reported meaning-search (search for meaning in life) had decreased odds of being in the Maintenance stage compared to the Preparation stage (OR = .16; 95% CI: .04 to .61).

In terms of demographic predictors, age had a small but significant role in predicting stage of smoking behavior change for current and former smokers. Specifically, older age was associated with increased odds of being in the Contemplation stage compared to

Precontemplation (OR = 1.23, 95% CI: 1.05 to 1.43), and also for being in the Maintenance stage compared to Precontemplation (OR = 1.22, 95% CI: 1.07 to 1.39). Males had significantly decreased odds of being in the Action stage compared to Contemplation (OR = .01, 95% CI: .00 to .41) or Preparation (OR = .03, 95% CI: .00 to .66). Finally, males had decreased odds of being in the Maintenance stage compared to the Contemplation Stage (OR = .04, 95% CI: .00 to .90). Interestingly, while education level was a significant predictor in the overall model, it did not emerge as significant in any individual parameter estimates (individual bivariate regression analyses conducted between pairs of stages).

Exercise Behavior Change

Significant Pearson correlations emerged among several psychosocial variables in the exercise behavior sample, as expected (Table 11). Optimism was moderately positively correlated with positive affect, $r = .53$, $p < .01$; social support, $r = .43$, $p < .01$; and meaning-presence, $r = .53$, $p < .01$; and weakly negatively correlated with meaning-search, $r = -.28$, $p < .01$. Positive affect was moderately correlated with social support, $r = .50$, $p < .01$; meaning-presence, $r = .60$, $p < .01$; and weakly correlated with meaning-search, $r = -.22$, $p < .01$. Social support was moderately correlated with meaning-presence, $r = .46$, $p < .01$, and weakly correlated with meaning-search, $r = -.14$, $p < .05$. Meaning-presence was weakly negatively correlated with meaning-search, $r = -.17$, $p < .05$. Additionally, associations between several demographic variables and psychosocial predictors were significant. Age was weakly but positively correlated with optimism, $r = .22$, $p < .01$, positive affect, $r = .16$, $p < .01$, and meaning-presence, $r = .17$, $p < .01$, and negatively with meaning-search, $r = -.28$, $p < .01$. Gender was weakly negatively correlated with meaning-search, $r = -.12$, $p < .05$, suggesting that

males reported slightly lower levels of searching for meaning in life. Finally, optimism was weakly but positively correlated with education, $r = .17$, $p < .05$.

Overall, the model for Exercise Behavior Change exhibited adequate fit. The omnibus test for the logistic regression model was found to be statistically significant, X^2 (72, $N = 298$) = 147.93, $p < .001$. The Nagelkerke Pseudo R^2 was computed to be .411, suggesting that approximately 41% of the variability is explained by the predictor variables in the model. The Hosmer and Lemeshow goodness of fit test was not significant, X^2 (1116, $N = 298$) = 1095.88, n.s., indicating a good fit for the model. Further, the overall predictive accuracy for the model is 45.6%, suggesting that the model is moderately useful, but less so than the Smoking model.

For the regression analyses, each of the first four stages was used as a reference group and compared with the other stages. For the overall model of exercise behavior, two independent variables were significant in predicting participants' stage of change. The one significant psychosocial predictor was positive affect, and the one significant demographic predictor was education. Parameter estimates for the exercise model are presented in Table 12. Specifically, compared to the Precontemplation stage, those who reported higher levels of positive affect had a significant increase in odds of being in the Preparation stage (OR = 1.79; 95% CI: 1.02 to 3.14), Action stage (OR = 2.66; 95% CI: 1.23 to 5.77) or Maintenance stage of change (OR = 4.11; 95% CI: 2.28 to 7.43). Higher reported positive affect also increased the odds of being in the Maintenance stage compared to both the Contemplation stage (OR = 2.77; 95% CI: 1.57 to 4.89) and the Preparation stage (OR = 2.30; 95% CI: 1.37 to 3.86).

In terms of demographic predictors, those whose highest level of education was "some college, no degree" had decreased odds of being in the Maintenance stage compared to both the Precontemplation stage (OR = .21; 95% CI: .06 to .80) and the Contemplation stage (OR = .27;

95% CI: .07 to .99). Those whose highest level of education was a bachelor's degree had decreased odds of being in the Maintenance stage compared to the Preparation stage (OR = .37; 95% CI: .14 to .95).

Dietary Behavior Change

Significant Pearson correlations emerged among several psychosocial variables in the dietary behavior analysis, which were similar to those in the other analyses (Table 13). Optimism was moderately positively correlated with positive affect, $r = .53$, $p < .01$; social support, $r = .43$, $p < .01$; and meaning-presence, $r = .53$, $p < .01$; and weakly negatively correlated with meaning-search, $r = -.29$, $p < .01$. Positive affect was moderately correlated with social support, $r = .50$, $p < .01$; meaning-presence, $r = .60$, $p < .01$; and weakly correlated with meaning-search, $r = -.20$, $p < .01$. Social support was moderately correlated with meaning-presence, $r = .46$, $p < .01$, and weakly correlated with meaning-search, $r = -.14$, $p < .05$. Meaning-presence was weakly negatively correlated with meaning-search, $r = -.17$, $p < .01$. Additionally, associations between several demographic variables and psychosocial predictors were significant. Age was weakly but positively correlated with optimism, $r = .23$, $p < .01$, positive affect, $r = .16$, $p < .01$, and meaning-presence, $r = .17$, $p < .01$, and negatively with meaning-search, $r = -.28$, $p < .01$. Gender was weakly negatively correlated with meaning-search, $r = -.12$, $p < .05$, suggesting that males reported slightly lower levels of searching for meaning in life. Finally, optimism was weakly but positively correlated with education, $r = .16$, $p < .01$.

Overall, the model for Dietary Behavior Change exhibited adequate fit. The omnibus test for the logistic regression model was found to be statistically significant, X^2 (72, $N = 300$) = 113.33, $p < .001$. The Nagelkerke Pseudo R^2 was computed to be .333, suggesting that

approximately 33% of the variability is explained by the predictor variables in the model. The Hosmer and Lemeshow goodness of fit test was not significant, X^2 (1124, N = 300) = 1185.78, n.s., indicating a good fit for the model. Further, the overall predictive accuracy for the model is 45.3%, suggesting that the model is moderately useful, but less so than the Smoking model.

For the regression analyses, each of the first four stages was used as a reference group and compared with the other stages. For the overall model of dietary behavior, only one independent variable was significant in predicting participants' stage of change. No psychosocial predictors were significant in the overall model, and the only significant demographic predictor was age. Parameter estimates for the diet model are presented in Table 14. Specifically, an increase in age was associated with decreased odds of being in the Contemplation stage compared to Precontemplation (OR = .93, 95% CI: .89 to .97). Compared to the Contemplation stage, increased age was associated with increased odds of being in the Preparation stage (OR = 1.07, 95% CI: 1.02 to 1.11), Action stage (OR = 1.11, 95% CI: 1.03 to 1.21) or Maintenance stage (OR = 1.07, 95% CI: 1.03 to 1.12).

Discussion

The purpose of this study was to examine the predictive power of four positive psychosocial variables related to stages of behavior change for three important health behaviors for patients with CVD. The first model examined stages of smoking behavior change in a sample of those who either currently smoke or had previously smoked. The second model examined stages of exercise behavior change, and the third model explored dietary behavior stages of change. Tests of model fit indicated that each model exhibited adequate fit, with the Smoking model having the best fit, followed by the Exercise model, and lastly the Diet model. Significant predictors for each overall model will be discussed. While certain predictors

emerged as significant in the parameter estimates but not the overall model, these have limited interpretability. The parameter estimates consist of bivariate logistic regressions between each pair of stages, meaning the results suggest a variable's impact only on predicting *one stage over another*, rather than predicting one stage *over all others*. Hypotheses for the study were as follows:

1) Patients who have already experienced some level of cardiovascular event or condition will display a more varied distribution of stages for health behavior change, compared to those from the general population., as discussed in the literature.
2) Higher reported levels of optimism, positive affect, perceived social support and purpose in life will predict later stages of change for health behaviors needing improvement.
3) Various psychosocial and demographic variables will have different predictive power for the three health behaviors.

The first hypothesis was supported by the findings. While researchers have estimated the general population distribution of those needing health behavior change to be approximately 40% in Precontemplation, 40% in Contemplation, and 20% in Preparation (Fava et al., 1995), a more varied distribution of stages did emerge for each health behavior (Table 15) in the present study. Interestingly, and perhaps encouragingly, the highest percentage of both the Smoking (72%) and Exercise (33%) samples were in the Maintenance stage, and the highest percentage of the Diet sample (34%) was in the Preparation stage. This concentration in later stages of change likely reflects an increased awareness of and attention to health behaviors in the clinical cardiovascular population, whose well-being and longevity are particularly negatively impacted by tobacco use, lack of exercise, and poor diet. For instance, Twardella et al. (2006) found that a diagnosis such as cardiovascular disease was a significant predictor of smoking cessation,

particularly during the first year after diagnosis. Furthermore, these results align with previous findings that those with chronic health conditions have increased readiness to change health behaviors such as smoking, exercise and diet, regardless of demographic characteristics (Boyle, O'Connor, Pronk, & Tan, 1998). In fact, patients with heart disease expressed the most readiness to change compared to other conditions (Boyle et al., 1998). The findings in relation to the second and third hypotheses are more complex and will be discussed in detail for each health behavior.

The moderate, positive correlations revealed among many of the psychosocial variables in each analysis were expected, and aligned with construct validity findings reported for each scale (Scheier & Carver, 1992; Steger et al., 2006; Watson et al., 1988; Zimet et al., 1988). Further, associations between positive psychological constructs have been previously established, including bidirectional positive correlations among positive affect, optimism, purpose, and social support (Pressman & Cohen, 2005; Steptoe et al., 2009). In the current study, meaning-presence and meaning-search were weakly negatively correlated, meaning that higher presence of meaning was associated with lower search for leaning, and vice versa. This finding illustrates the independence of these constructs, and the fact that those reporting greater presence of meaning in life tended to report less of a need to search for meaning, and those reporting higher search for meaning tended to report lower presence of meaning. Further, because the variables of optimism, positive affect, and social support each correlated positively with presence of meaning, it logically follows that each of them also weakly negatively correlated with search for meaning.

Smoking Behavior Model

Notably, the exclusion of those participants who have never smoked resulted in a smaller

sample size for this model. Additionally, the cell sizes were considerably uneven, with the majority of the sample reporting being in the Maintenance stage; having quit more than six months ago. While this is a positive finding in terms of health-promoting behaviors, it resulted in small cell sizes for the first four stages (n = 9, 11, 12 and 9, respectively) of smoking behavior, limiting the generalizability of the results. Thus, the findings for this model should be interpreted with caution. While three psychosocial variables were significant predictors in the overall smoking cessation model, only social support served to support the study's second hypothesis, that higher levels of the variable would predict later stages of change for smoking behavior.

Specifically, higher perceived social support increased odds of either considering quitting (Contemplation) or having stopped for over six months (Maintenance), compared to not considering quitting (Precontemplation). These findings are consistent with existing literature supporting the positive impact of social support on health behaviors in general (Barth et al., 2010; Tay et al., 2013), as well as on smoking cessation specifically (Carlson, Goodey, Bennett, Taenzer, & Koopmans, 2002; Poghosyan, Darwish, Kim, & Cooley, 2016; Ryckman, Bercaw, Ellis, Wolf, & Elgert, 2006). The fact that social support did not predict two of the later stages, Preparation and Action, however, does reflect the mixed evidence in the literature regarding how social support may be related to smoking cessation. For example, Westmaas, Bontemps-Jones, and Bauer (2010) argued that the broad scope of social support as a construct makes conclusive evidence difficult to establish with regard to smoking cessation. They note that social support can be emotional, instrumental, or informational; it can be general support or behavior-specific; within-treatment (e.g., a counselor, support group, peer mentor) or outside of treatment (family, friends, work), or combined (e.g., involving a partner in treatment); and the literature reflects this

heterogeneity (Westmaas et al., 2010). Further, social support can be positive or negative, and social norms can either support or discourage health behaviors (Tay et al., 2013). Examples of negative social support include expressed irritation, frustration, criticism, conflict, misunderstanding, or pressure (Ray, 1992), as well as discouragement of the expression of feelings, invasion of privacy, interference in another's affairs, or failure to provide promised help (Lincoln, 2000). Social norms differ from social support in that norms communicate information about what others think about engaging in a behavior and others' actions with respect to a behavior, whereas social support involves receiving some sort of direct assistance related to engaging in a behavior (Okun et al., 2003). Social support in the present study as measured by the MSPSS consisted of general, positive emotional and instrumental support from family, friends, and significant others. Thus, results from the present study offer further support for the role of social support in smoking behavior change, while illustrating the need for more clearly differentiated research on the mechanisms.

Alternately, higher levels of presence and search for meaning and purpose in life actually decreased the odds of being in some of the later stages of change for smoking behavior. Specifically, higher presence of meaning/purpose decreased odds of preparing to quit (Preparation) or maintaining cessation for over six months (Maintenance), compared to not thinking about quitting (Precontemplation). Higher search for meaning/purpose also decreased the odds of having maintained cessation for six months. Notably, meaning/purpose did not predict odds of thinking about quitting (Contemplation) or having quit for less than six months (Action), so broad conclusions about meaning/purpose and smoking cessation cannot be made.

While the current finding did not support the hypothesis that higher levels of meaning/purpose would predict later stages, existing literature may offer support for the

unexpected findings. Konkolÿ-Thege, Urbán, and Kopp (2013) found that while those with greater meaning and purpose in life were less likely to be smokers, meaning and purpose levels had no significant effect on smoking *cessation*. Further, Steger, Mann, Michels, and Cooper (2009) found that those with higher presence of meaning tended to have less health anxiety, and those with higher search for (but not presence of) meaning tended to have higher health anxiety. Having less health anxiety could explain the decrease in odds of preparing to quit or maintaining cessation for those with higher meaning/purpose. Additionally, higher health anxiety (or any anxiety) may make cessation difficult to maintain, potentially explaining the decreased odds of maintenance for those higher in search for meaning. However, given that meaning and purpose in life have been associated with improved health behaviors and outcomes in cardiovascular patients, including smoking cessation (Boehm & Kubzansky, 2012; DuBois et al., 2015; Kim et al., 2013; Park, 2015), the present findings warrant further investigation into meaning, purpose, and smoking behavior.

Surprisingly, neither positive affect nor optimism were significant in predicting stages of change for smoking. Several factors, beyond the potential overlap in constructs, may have contributed to this. While positive affect has been associated with health behaviors including smoking cessation, samples often consist of participants who were already motivated to quit, potentially skewing the data. Further, an intervention study by Bränström, Penilla, Pérez-Stable, and Muñoz (2010) found increased positive affect to associate with smoking cessation only in those who began with low levels of positive affect. The mean level of positive affect in the present study (M = 30.27; SD = 8.47) was slightly lower compared to a general population sample (M = 33.30; SD = 7.20; Watson et al., 1988), but perhaps not low enough to display the impact of positive affect on smoking behavior. Furthermore, the *affect heuristic*, or use of

emotions to inform decision-making, may impact the risk-assessment process for smokers (Slovic, Peters, Finucane, & MacGregor, 2005). For example, positive feelings that become associated with the act of smoking, based on social interactions, physiological responses, or enjoyable activities may decrease one's assessment of its risk, thereby decreasing the motivation to stop smoking.

Like positive affect, optimism may have a similarly complex relationship to smoking cessation. While optimism has been associated with decreased prevalence of smoking in general and clinical populations (Boehm & Kubzansky, 2012; DuBois et al., 2012; Sin, 2016), evidence is inconclusive regarding its association with smoking cessation specifically. For instance, Progovac et al. (2017) found optimism was not associated with smoking cessation in a large sample (N = 10,242) of postmenopausal female baseline smokers, with 1, 3, and 6-year follow-up. Further, DuBois et al. (2012) suggested that *optimism bias,* an unrealistic expectation about the ease of attaining positive outcomes, may create idealistic expectations regarding the ease of quitting or one's ability to quit. Similarly, Dillard, McCaul, and Klein (2006) noted that optimism bias is prevalent in smokers, and often reduces the perceived health risks of smoking. These findings offer potential explanations for optimism's lack of predictive power in the smoking behavior model.

The demographic factors predicting stage of smoking behavior change included age and gender. Older age predicted greater odds of thinking about or maintaining cessation over not thinking about it, but did not predict preparing to quit or having quit for less than six months. This is consistent with the literature, which suggests mixed evidence in terms of age, smoking cessation, and types of intervention (Twardella et al., 2006; Zbikowski, Magnusson, Pockey, Tindle, & Weaver, 2012). Smoking cessation can either become more or less important as

people age, depending on a number of factors including health status, health beliefs, health knowledge, and level of support, among others. While smoking rates decrease with age and cessation interventions have generally been successful with older populations, particularly those motivated by negative health events; more intensive, targeted, and combined (therapy and medication) interventions tend to be most effective (Zbikowski et al., 2012). Additionally, males in the present study had decreased odds of having quit smoking, compared to thinking about and preparing to quit. This is consistent with general smoking literature which indicates that smoking prevalence is higher in males across adult age groups (Twardella et al., 2006). While conclusions about the specific predictive role of education level in this sample cannot be made, higher education level has previously been found to predict both lower smoking rates and higher smoking cessation rates (Konkolÿ-Thege et al., 2013; Twardella et al., 2006).

While social support emerged as the only positive psychosocial variable to predict later stages of smoking behavior change in the overall model, it is possible that higher levels of positive psychological variables associate with never smoking to begin with (DuBois et al., 2012). Interestingly, mean scores in the present study for never-smokers vs. current and previous smokers revealed slightly higher average scores (by one to four points) for each of the positive psychosocial variables other than meaning-search, for never-smokers compared to former and current smokers (Table 10). In alignment with the current findings, social support had the greatest difference, with an average of four points higher for never-smokers, further supporting the impact of social support on smoking behavior.

Exercise Behavior Model

For exercise behavior, the one psychosocial predictor to support the hypothesis that higher levels of the variable would predict later stages of change was positive affect. Higher

levels increased the odds of preparing to change, changing, and maintaining behavior change, compared to not considering changing. This is consistent with existing literature, which has shown positive affect to be associated with increased physical activity in those with cardiovascular disease (Huffman et al., 2016; Peterson et al., 2012; Sin et al., 2015). Specifically, higher positive affect was found to correlate with higher baseline and follow-up levels of physical activity in cross-sectional studies of cardiovascular patients (Huffman et al., 2016), increases in positive affect correlated with increases in physical activity (Sin et al., 2015), and interventions to increase positive affect resulted in increased physical activity (Peterson et al., 2012). While the correlations are likely bidirectional, as physical activity often results in increased positive affect, evidence does suggest that positive affect is also associated with physiological biomarkers such as lower cortisol levels, blood pressure, and decreased inflammation, suggesting positive influence (Sin, 2016; Steptoe et al., 2009). Additionally, positive affect is believed to serve as a buffer against stress reactions, potentially allowing for more positive health behaviors (Pressman & Cohen, 2005), as well as serving to increase cognitive flexibility and openness to various behaviors in response to challenges (Fredrickson, Mancuso, Branigan, & Tugade, 2000).

While not significant in the overall predictive model, the search for meaning was significant in predicting decreased odds of being in the Maintenance stage of exercise compared to the Preparation stage, similar to the smoking model. This could potentially be a reflection of searching for meaning indicating lower presence of meaning. Presence of meaning or purpose in life has been associated with positive health behaviors in the general population (Park, 2015) and in cardiac patients, and is considered an important area for inclusion in cardiac rehabilitation (Holahan, Holahan, & Suzuki, 2008). One explanation for the lack of predictive power of

meaning/purpose in the present study could be that average scores in the current sample for presence of meaning (M = 22.6; SD = 5.06) and search for meaning (M = 22.07; SD = 7.04) were slightly lower than in a norm sample of college students (M = 23.8; SD = 5.9 and M = 23.4; SD = 6.3, respectively; Steger et al., 2006).

Similarly, social support, which did not significantly predict stage of exercise change, was somewhat lower in the current sample (M = 64.27; SD = 16.85) than in a large sample of patients with heart failure (M = 67; SD = 17; Shumaker, Frazier, Moser, & Chung, 2017). As previously noted, social support has been difficult to define and quantify in the literature, and despite a general consensus that its impact on health behaviors seems positive, the specific mechanisms of its impact remain elusive (Graven & Grant, 2014; Van Dam et al., 2005; Yunus & Sharoni, 2016). Several factors may have contributed to the absence of social support as a predictor of exercise stage of change. While researchers have found higher levels of social support to predict later stages of exercise change for general and cardiovascular populations, the construct of self-efficacy often emerges as an important mediator in the relationship (Fraser & Rodgers, 2012; Gibbison & Johnson, 2012; Quirk, Parfitt, Ferrar, Davison, & Dollman, 2018). Social support is positively associated with self-efficacy, which is then correlated with increased exercise behavior (Fraser & Rodgers, 2012; Gibbison & Johnson, 2012; Quirk et al., 2018). Without investigating this mechanism, and because self-efficacy was not measured in the present study, the independent role of social support may be difficult to determine. Further, exercise-specific support may be a stronger predictor of behavior change than general social support (Van Dam et al., 2005).

In addition to social support failing to predict exercise stage, optimism was also not a significant predictor. This was surprising, given the robust literature regarding optimism and

positive health behaviors in the general population, older adults, and cardiovascular patients (Boehm & Kubzansky, 2012; Giltay, Geleijnse, Zitman, & Kromhout, 2007; Huffman et al., 2016; Steptoe, Wright, Kunz-Ebrecht, & Iliffe, 2006). However, the average optimism score for the present sample was somewhat higher than a norm sample of patients awaiting coronary bypass surgery (M = 20.33, SD = 5.96 and M = 15.16, SD = 4.05, respectively; Scheier et al., 1994), therefore it is possible that variances in optimism were less significant in the current study. Further, optimism has been found to correlate with other constructs such as positive affect and coping style, thereby potentially masking the effects of optimism alone (Scheier et al., 1994). In the present study, it is possible that positive affect as the only significant predictor of exercise may have masked effects of other correlated variables such as optimism. Finally, similar to the smoking model, unrealistic optimism could potentially interfere with behavior change with respect to exercise, by inflating one's self-perceived health or amount of exercise, downplaying the risk of not exercising, or overestimating one's ability to make behavior changes (Scheier & Carver, 1992).

While education level was a significant predictor of stages of exercise change in the overall model, conclusions about the specific relationship based on individual parameter estimates are difficult to make. The consensus in the existing literature is that higher education levels generally correspond with increased positive health behaviors such as exercise (Garber, Allsworth, Marcus, Hesser, & Lapane, 2008; Harper & Lynch, 2007; Mesters, Wahl, & van Keulen, 2014; Zimmerman, Woolf, & Haley, 2015). Specifically, Mesters et al. (2014) found in a cross-sectional study of older adults that higher education levels correlated with higher physical activity levels, while Garber et al. (2008) found that higher education levels increased the odds of being in a later stage of exercise change (Preparation or later). A U.S. national

survey revealed physical activity to represent the greatest disparity in health behaviors by education level, with lower education levels associated with significantly less physical activity (Harper & Lynch, 2007). Finally, Zimmerman et al. (2015) noted that while higher education levels correspond with higher physical activity levels, higher education is also associated with lower stress levels, increased socioeconomic status and access to resources, increasing the likelihood of self-care activities such as exercise.

Dietary Behavior Model

Surprisingly, none of the psychosocial variables were significant predictors of dietary stage of change in the overall model. The only variable that was a significant predictor of diet stage was age. Specifically, older age was associated with slightly decreased odds of being in Contemplation over Precontemplation, but slightly increased odds of being in Preparation, Action, or Maintenance over Contemplation. This suggests that as age increased, so did the odds of either not planning to change, actively planning, changing, or maintaining change, rather than merely thinking about changing diet behavior. This is consistent with previous findings of adults with chronic diseases, in which older age corresponded with increased odds of being in the Maintenance stage, followed by Precontemplation, Preparation, and Action, with respect to increasing fruits and vegetables and decreasing dietary fat (Boyle et al., 1998). In that study, the Maintenance group had the oldest mean age, followed by Precontemplation, Preparation, and Action, and the Contemplation stage had the youngest mean age (Boyle et al., 1998). Dietary behavior is a complex area of study, with multiple guidelines, means of measurement, and potential for recall bias, and the literature reflects this (Giltay et al., 2007; Hingle et al., 2014; Pieroth, Radler, Guenther, Brewster, & Marcus, 2017). Conclusive evidence regarding patterns

of diet behavior and age is elusive. The relationship between age and diet behavior may be better explained by changes in health status that accompany aging (Shatenstein, 2008).

While the lack of significant psychosocial predictors of diet stage was unexpected, several factors may have contributed to this. The Diet model had the lowest percentage of participants reporting either Action or Maintenance stage compared to Smoking and Exercise (28%, versus 78% and 40%, respectively), likely reflecting the difficulty, complexity, and ambiguity of diet behavior change. Previous researchers have found optimism to be correlated with healthful diet changes (Boehm & Kubzansky, 2012; DuBois et al., 2015). Hingle et al. (2014) found high levels of baseline optimism to predict significant positive changes in adhering to a heart-healthy diet at one-year follow-up in a large sample of post-menopausal women. The parameter estimates in the present study revealed that higher levels of optimism increased the odds of being in either the Precontemplation stage or the Preparation stage versus the Contemplation stage, suggesting that optimism may have differential effects on diet behavior. As discussed regarding smoking and exercise, while generally associated with positive health behaviors, optimism can also be unrealistic and create a bias which limits insight about needed behavior change (Dillard et al., 2006; DuBois et al., 2012). Further, the higher mean level of optimism in the current sample may have masked any significant predictive power.

Similarly, while social support is generally considered to be helpful for improving diet behavior (Graven & Grant, 2014; Tay et al., 2013), it is a complex construct and may have differential effects which prevented it from being a significant predictor in the overall diet model. Gender differences have emerged in the literature on social support and diet behavior (Conklin et al., 2014; Pieroth et al., 2017). Specifically, Pieroth et al. (2017) found a positive relationship between social support and diet quality in middle-aged to older males, but not in

females. Further, Conklin et al. (2014) found that diet quality in older males was more negatively impacted by lower social support than for females. In the current study, higher levels of social support did increase the odds of preparing to change diet behavior compared to not thinking about changing, which is consistent with the hypothesized relationship. The lower average level of social support reported in the present sample (compared to a similar group) may also have prevented it from emerging as a significant overall predictor of diet stage.

While meaning and purpose in life were not a significant overall predictor of diet stage, there is limited evidence that meaning and purpose are associated with improved diet behavior. For example, Conner, Brookie, Richardson, and Polak (2015) found a greater sense of meaning and purpose in life to correlate with higher consumption of fruits and vegetables in young adults. However, evidence for older adults is lacking, and researchers have cited the difficulty of studying dietary habits as well as isolating meaning/purpose from other similar variables (Roepke, Jayawickreme, & Riffle, 2014; Wiesmann & Hannich, 2011). Interestingly, while not significant in the overall model, higher search for meaning scores increased the odds of being in the Action stage of diet change, compared to Contemplation. This, combined with the findings that higher search for meaning decreased odds of being in the Maintenance stage vs. Preparation for smoking and exercise, is consistent with literature suggesting that the search for meaning correlates more strongly with preparing to change or actively changing behavior than maintaining it (Piko & Brassai, 2016).

Finally, the third hypothesis of the current study, that various psychosocial and demographic variables would have different predictive power for the three health behaviors, was supported by the findings. No single variable, whether psychosocial or demographic, emerged as a significant predictor consistently across all health behavior models. Additionally, some

variables, such as meaning/purpose, related to health behaviors in unexpected ways. Notably, the present findings serve to illuminate the complexity of the psychosocial variables, and the differential (and bidirectional) interactions they can potentially have with health behavior.

Strengths and Limitations

The present study has several notable strengths. First, the investigation of positive psychological constructs represents an important and relevant contribution to the CVD literature, which has traditionally focused on negative psychological states. Second, the inclusion of multiple psychosocial variables and health behaviors in one study helps illuminate differences in correlations that studies focused on one correlation cannot. Additionally, similar methodology has been used in prior research on health behaviors, with different variables and the general population. The participants in this study comprised a clinical sample, which yields results that are directly applicable to practice. The sample size was large enough to provide sufficient statistical power to the analysis. The use of MLR allowed for predictive models including five categories of the outcome variable, and did not require assumptions of normality, linearity, or homoscedasticity. Use of the TTM provided a framework of health behavior change that incorporates varying stages of readiness and motivation, allowing findings to be more effectively translated into practice. Furthermore, this study used psychometrically sound measures, increasing the validity of the findings. Another strength of the current study is the potential to improve interventions and outcomes for a high-risk population.

While the study has several strengths, it also has a number of limitations. Limitations of this study include the heterogeneity of heart condition type. While the sample represented a wide variety of heart conditions, including but not limited to congestive heart failure, atrial fibrillation, myocardial infarction, cardiac arrest, arrhythmia, coronary artery disease,

hypertrophic cardiomyopathy, and peripheral artery disease, different diagnoses and levels of severity may correlate with different recommendations and levels of motivation regarding the specific health behavior changes included in the study. The need to clearly operationally define and measure behaviors such as exercise and diet may have resulted in a narrow classification that did not apply broadly to each individual participant's diagnosis and recommendations. Further, there may be differences in health behavior for those with acquired versus congenital heart conditions, which were not addressed in this study. However, adults and young people with congenital heart disease have been found to struggle with maintaining heart-healthy behaviors similarly to those with acquired heart conditions (Harris et al., 2018).

The study is also limited by the fact that it is self-report, with no medical record review to provide objective data. Being that participants have been diagnosed with a heart condition, they may feel pressure to report more positive health behavior than is actually taking place. While researchers have found perception of health risks to be strongly correlated with health behaviors (Brewer et al., 2007), the perception of health risks associated with cancer and cardiovascular disease are often underestimated in the general population (Newell, Girgis, Sanson-Fisher, & Savolainen, 1999). In a cardiovascular population, specific intervention regarding the role of health behaviors has been found to improve health outcomes, including health behaviors, particularly when delivered immediately post-event (Broadbent, Ellis, Thomas, Gamble, & Petrie, 2009). While cardiac rehabilitation provides structure and education on cardiac risk factors and behaviors, the majority of the current sample had not participated in cardiac rehabilitation, which is reflective of the larger cardiovascular population (Benjamin et al., 2019). Further, the impact of cardiac rehab on health behaviors was not addressed in this study.

Additionally, generalizability may be limited, given that the sample was disproportionately female, Caucasian, partnered, educated, and higher income.

The cross-sectional design rather than longitudinal design presents a clear limitation as well. Conclusions regarding causality cannot be made based on these findings, as they are merely correlational, and the direction of association between psychosocial variables and stages of change could be bidirectional. Indeed, the positive psychosocial variables in the study were mildly to moderately correlated with each other, and differentiating co-occurrence from overlap in construct, as well as mediating and moderating effects, would improve the interpretability of the results. There is also the possibility that the psychological variables fluctuate, rather than being stable states in individuals. Boehm and Kubzansky (2012) noted that constructs such as optimism and purpose in life tend to be fairly stable in contrast with constructs such as positive affect, which may be more variable. Because this study only captures one time point, these nuances of the psychological constructs were not addressed. There is also the possibility of third variable effects not accounted for. Furthermore, health behavior change is complex and involves a multitude of factors, all of which could not be addressed within the scope of this study.

Finally, it should be noted that while each model in the study was significant and a good overall fit, the predictive accuracy of the Exercise and Diet models was only moderate, at 46% and 45% respectively, limiting their usefulness. The predictive accuracy of the Smoking model was higher, at 77%, making it the most useful of the predictive models in the study.

Implications

While the results of this study should be interpreted with caution given the limitations, the findings have several implications for theory, research, and practice. Firstly, the varied distribution of participants in different stages of behavior change provides support for the TTM

as a model for conceptualizing health behavior change. Acknowledgement that health behavior change is complex and potentially non-linear, involving numerous processes and levels of readiness, is a strength of the TTM (Choi et al., 2013; Huang et al., 2015; Prochaska & Velicer, 1997), which was reflected in this sample. As this study focused on the stages of the TTM, and not the other three components of the model (processes of change, decisional balance, and self-efficacy vs. temptation), inclusion of all components of the model would provide a more detailed, comprehensive understanding of behavior change in this population. While the utility of the TTM has been questioned in the literature due to mixed evidence (Armitage, 2009; Bridle et al., 2005), support for effectiveness of the TTM and other stage-matched interventions applied to cardiovascular health behaviors is plentiful (Armitage, 2009; Carvalho de Menezes, 2016; Huang et al., 2015; Paradis et al., 2010). However, it is certainly possible that other stage-based models may equally or better explain health behavior change.

In addition to implications for theory, the present findings have several implications for future research. Given the relationships among positive psychosocial variables, it is likely that other positive psychosocial variables may be contributing to health behavior, such as coping, resilience, and self-efficacy. While these have been included in studies on cardiovascular health (Boehm & Kubzansky, 2012; Sin, 2016, Quirk et al., 2018), further investigation is needed to determine differential impacts of these as well as the variables included in the present study. Additionally, further exploration of the specific components of positive psychosocial variables, as well as the mechanisms through which they impact behavior, is needed. For example, various types, levels, duration, and components of optimism, positive affect, social support, and meaning/purpose may have differential impacts on behavior (Bränström et al., 2010; Dillard et al., 2006; DuBois et al., 2015; Graven & Grant, 2014; Konkolÿ-Thege et al., 2013; Slovic et al.,

2005; Steger et al., 2009; Yunus & Sharoni, 2016). Further, future research would benefit from longitudinal studies as well as direct observation and objective report of variables.

The current findings also have several implications for practice. This analysis demonstrated that higher levels of perceived social support predict later stages of smoking behavior change, and higher levels of positive affect predict later stages of exercise behavior change for cardiovascular patients. Additionally, optimism and meaning/purpose had some, though less clear and significant, association with health behavior change. While the relationships between the psychological variables and health behaviors may be bidirectional, increasing the experience of those positive psychological states may promote greater engagement in heart-healthy behaviors, for those already diagnosed and for prevention purposes in the general population (Boehm et al., 2018; Boehm & Kubzansky, 2012; DuBois et al., 2012; Huffman et al., 2016; Sin, 2016; Steptoe et al., 2009). Importantly, evidence exists that each of these variables can be increased via intervention.

This information, combined with the existing literature, can be used to develop and refine interventions targeted toward increasing or encouraging those positive psychological states in order to motivate health behavior change. Additionally, these findings contribute to existing evidence supporting the use of stage-matched health behavior interventions (Bulley et al., 2007; Carvalho de Menezes, 2016; Huang et al., 2015; Paradis et al., 2010). While a diagnosis of any kind of heart condition may serve to increase motivation toward positive health behaviors, it is clear that this population continues to struggle with improving and maintaining heart-healthy behaviors (Benjamin et al., 2019; Choi et al., 2013). Interventions that incorporate the related psychological variables and are targeted to an individual's particular stage of readiness to change may be more effective than generic interventions that assume readiness.

Conclusion

Cardiovascular disease is the leading cause of death in the world and the U.S. (CDC, 2016; WHO, 2016). Managing and minimizing the effects of the disease depends heavily on daily behavior choices, such as smoking, physical activity, and diet. Nevertheless, many people with cardiovascular disease continue to engage in unhealthy behaviors, putting them at risk for additional cardiac events and premature death (Choi et al., 2013; Paradis et al., 2010). Thus, change processes and psychosocial factors associated with health behaviors are becoming increasingly important factors in research. The purpose of this study was to address whether positive psychosocial variables can predict health-promoting behaviors in adults with CVD, with the goal of enhancing the impact of interventions with this population. Further, it was hoped that examining how these variables relate to stages of behavior change might help to inform the development and use of interventions in a more targeted, individualized manner.

Results indicated that the TTM was an effective model for representing health behavior change in this population, and that the three health behavior models each had adequate fit and moderate to strong predictive accuracy. Perceived social support and positive affect were the strongest psychosocial predictors in the study, of smoking cessation and exercise, respectively. Age and gender also had significant predictive power, as well as education level, although its impact was less clear. Surprisingly, optimism, perhaps the most widely cited positive psychosocial variable believed to impact health behavior, was not a significant predictor in this study. However, optimism, presence of meaning and purpose, and search for meaning and purpose each also made minor contributions to the prediction of behavior stage of change.

The current findings are intended to increase awareness of the psychosocial factors associated with health behavior change for those with cardiovascular disease, for both medical

and mental health care providers. Given the importance of identifying protective factors for this high-risk population, the study of positive psychosocial constructs serves to fill a gap in the current literature, which is focused largely on the impact of negative psychological states. It is hoped that these findings contribute to an evidence base that serves to inform more effective interventions to improve health behaviors, health outcomes, and overall quality of life for those living with CVD.

Table 1

Descriptive Statistics for Demographic Variables

Demographic Attribute	***n***	**%**
Gender		
Female	186	62
Male	114	38
Race/Ethnicity		
White/Caucasian	279	93
Hispanic or Latino	6	2
Black or African American	7	2.3
Native American or American Indian	2	0.7
Asian/Pacific Islander	3	1.0
Other (Biracial)	3	1.0
Education Level		
Master's degree or higher	56	18.7
Bachelor's degree	88	29.3
Associate's degree	42	14
Trade/Technical/Vocational training	20	6.7
Some college credit, no degree	55	18.3
High school graduate, or equivalent	34	11.3
Less than high school	5	1.7
Relationship Status		
Single, never married	26	8.7
Partnered, living together	21	7
Married or domestic partnership	189	63
Widowed	17	5.7
Divorced	41	13.7
Separated	6	2
Household Income (yearly)		
100,000 or more	91	30.3
75,000 to 99,999	40	13.3
40,000 to 74,999	71	23.7
10,000 to 39,999	65	21.7
Less than 10,000	18	6
Not reported	15	5
Cardiac Rehabilitation Participation		
Currently participating	29	9.7
Participated in the past	80	26.7
Never, but have been referred	22	7.3
Never, have never been referred	168	56

Table 2

Descriptive Statistics for Continuous Demographic Variables

Demographic Attribute	**Mean**	**Range**	**Standard Deviation**	**Skewness**	**Kurtosis**
Age	57.47	30 - 88	12.03	.05	-0.37
Years since diagnosis	10.42	0 - 63	12.86	1.84	3.18

Table 3

Participant Self-Reported Medical Treatments

Treatments	Frequency	%
--	27	9.0
1	4	1.3
1,2	15	5.0
1,2,3	6	2.0
1,2,3,5	1	.3
1,2,3,5,6,7,8	1	.3
1,2,3,8,9	1	.3
1,2,8,9	2	.7
1,2,9	1	.3
1,3	2	.7
2	20	6.7
2,8	1	.3
2,3	3	1.0
2,3,4,5,8	1	.3
2,3,5	1	.3
2,3,5,8	1	.3
2,3,8	1	.3
2,5	1	.3
2,8	7	2.3
2,9	1	.3
3	7	2.3
3,8	1	.3
3,5	2	.7
3,5,8	1	.3
3,9	1	.3
5	7	2.3
5,8	4	1.3
5,8,9	6	2.0
5,9	13	4.3
6,9	1	.3
7	1	.3
8	32	10.7
8,9	24	8.0
9	103	34.3
Total	300	100.0

Note. 1 = Angioplasty / Percutaneous Coronary Intervention; 2 = Stent placement; 3 = Bypass Surgery / Coronary Artery Bypass Graft; 4 = Transmyocardial laser revascularization; 5 = Heart valve repair or replacement; 6 = Aneurysm repair; 7 = Heart transplant; 8 = Pacemaker or implantable cardioverter defibrillator; 9 = Other (Ablation, Cardioversion, LVAD, Medication, Septal myectomy, etc.)

Table 4

Participant Familiarity with Health Behavior Recommendations

Behavior	Extremely *n* (%)	Very *n* (%)	Somewhat *n* (%)	Slightly *n* (%)	Not at All *n* (%)
Smoking	238 (79.3)	42 (14)	9 (3)	2 (0.7)	8 (2.7)
Exercise	115 (38.3)	116 (38.7)	50 (16.7)	11 (3.7)	8 (2.7)
Diet	110 (36.7)	106 (35.3)	58 (19.3)	15 (5)	11 (3.7)

Table 5

Descriptive and Reliability Statistics for Observed Model Variables

Instrument	Cronbach's Alpha	N of items	Range	Mean	Standard Deviation	Skewness	Kurtosis
LOT-R	.87	6*	0 - 24	20.33	5.96	-0.29	-0.58
PANAS	.92	10**	10 - 50	30.27	8.48	-0.18	-0.52
MSPSS	.95	12	12 - 84	64.27	16.85	-0.98	0.41
MLQ-P	.92	5	5 - 35	24.89	7.21	-0.65	0.56
MLQ-S	.88	5	5 - 35	22.07	7.04	-0.53	-0.20

Note. LOT-R = Life Orientation Test – Revised (Optimism); PANAS = Positive and Negative Affect Schedule (Positive Affect); MSPSS = Multidimensional Scale of Perceived Social Support (Social Support); MLQ-P = Meaning in Life Questionnaire – Presence (Meaning Presence); MLQ-S = Meaning in Life Questionnaire – Search (Meaning Search)
*Four filler items are not included in analysis
**Only Positive Affect subscale included in analysis

Table 6

Summary of Model Fit Indices

Fit Index	**Smoking**	**Exercise**	**Diet**
x^2	118.82	147.93	113.33
df	68	72	72
p	.000	.000	.001
Nagelkerke Pseudo R^2	.652	.411	.333
Pearson x^2	249.47	1095.88	1185.78
Pearson df	504	1116	1124
Pearson *p*	1.00	.661	.098
Predictive Accuracy	77.1%	45.6%	45.3%

Table 7

Omnibus Test Statistics for Multivariate Logistic Regression Models

	SMOKING MODEL				EXERCISE MODEL				DIET MODEL			
	Model Fitting Criteria	**Likelihood Ratio Tests**			**Model Fitting Criteria**	**Likelihood Ratio Tests**			**Model Fitting Criteria**	**Likelihood Ratio Tests**		
Effect	**-2 Log Likelihood**	**Chi-Square**	**df**	**Sig.**	**-2 Log Likelihood**	**Chi-Square**	**df**	**Sig.**	**-2 Log Likelihood**	**Chi-Square**	**df**	**Sig.**
Intercept	166.24[a]	.000	0	.	752.87[a]	.000	0	.	750.90[a]	.000	0	.
Optimism	168.29	2.05	4	.727	755.44	2.57	4	.632	759.53	8.64	4	.071
Positive Affect	171.65	5.41	4	.248	782.20	29.33	4	.000	757.18	6.29	4	.179
Social Support	176.81	10.57	4	.032	757.19	4.32	4	.364	756.41	5.51	4	.239
Meaning - Presence	176.69	10.45	4	.034	757.44	4.57	4	.334	751.08	.19	4	.996
Meaning - Search	181.60	15.35	4	.004	758.99	6.12	4	.190	757.39	6.50	4	.165
Age	184.60	18.36	4	.001	756.07	3.20	4	.525	766.68	15.78	4	.003
Gender	181.02	14.78	4	.005	761.11	8.24	4	.083	758.48	7.58	4	.108
Race or Ethnicity	186.34	20.10	16	.216	773.33	20.46	20	.430	770.15	19.26	20	.505
Education	207.86	41.62	24	.014	794.64	41.77	24	.014	777.71	26.82	24	.313

Table 8

Bivariate Correlations between Observed Variables – Smoking Model

	LOT-R	PANAS	MSPSS	MLQ-P	MLQ-S	Age	Gender	Race or Ethnicity
PANAS	.525**							
MSPSS	.410**	.515**						
MLQ-P	.595**	.644**	.412**					
MLQ-S	-.281**	-.217**	-.140	-.115				
Age	.185*	.107	-.130	.197*	-.267**			
Gender	.076	.101	.036	.176*	-.073	.312**		
Race/Eth	.069	-.163	-.005	-.019	.034	-.170*	-.033	
Education	.110	.033	-.041	.093	-.022	.033	-.083	.060

Note. LOT-R = Life Orientation Test – Revised (Optimism); PANAS = Positive and Negative Affect Schedule (Positive Affect); MSPSS = Multidimensional Scale of Perceived Social Support (Social Support); MLQ-P = Meaning in Life Questionnaire – Presence (Presence of Meaning), MLQ-S = Meaning in Life Questionnaire-Search (Search for Meaning). Gender is coded as 1 = Female, 2 = Male.

**Correlation is significant at the .01 level (2-tailed)

*Correlation is significant at the .05 level (2-tailed)

Table 9

Stages of Smoking Behavior Change – Parameter Estimates

Precontemplation (*n*=9, 6.3%)	**Contemplation** (*n*=11, 7.6%)	**Preparation** (*n*=12, 8.3%)	**Action** (*n*=9, 6.3%)	**Maintenance** (*n*=103, 71.5%)
REFERENCE	Soc. Support* (2.09, .02, 8.10) Age** (.20, .008, 1.23) Gender * (3.81, .04, 45.04) Race/Ethnicity*** (-18, .000, $1.53e^{-8}$)	Meaning-P* (-2.19, .04, .11)		Soc. Support* (1.91, .01, 6.76) Meaning-P* (-2.11, .03, .12) Age** (.20, .004, 1.22)
	REFERENCE		Gender* (-4.41, .01, .01)	Gender* (-3.15, .04, .04)
		REFERENCE	Gender* (-3.40, .03, .03)	Meaning-S** (-1.84, .007, .16)
			REFERENCE	

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$ (β, *p*, odds ratio)

Table 10

Means Comparison of Psychosocial Variables for Smoking Behavior

	Optimism Mean (*SD*)	**Positive Affect Mean (*SD*)**	**Social Support Mean (*SD*)**	**Meaning – Presence Mean (*SD*)**	**Meaning – Search Mean (*SD*)**
Never-Smokers *n* = 156	21.43 (5.71)	30.91 (8.08)	66.27 (16.06)	22.91 (4.50)	21.73 (7.09)
Current or Former Smokers *n* = 144	19.15 (6.02)	29.57 (8.86)	62.11 (17.46)	22.26 (5.60)	22.42 (6.99)
Difference	2.28	1.34	4.16	0.65	0.69

Note. Optimism = Life Orientation Test – Revised (LOT-R); Positive Affect = Positive and Negative Affect Schedule (PANAS); Social Support = Multidimensional Scale of Perceived Social Support (MSPSS); Meaning Presence = Meaning in Life Questionnaire – Presence (MLQ-P), Meaning-Search = Meaning in Life Questionnaire-Search (MLQ-S).

Table 11

Bivariate Correlations between Observed Variables – Exercise Model

	LOT-R	PANAS	MSPSS	MLQ-P	MLQ-S	Age	Gender	Race or Ethnicity
PANAS	.531**							
MSPSS	.426**	.496**						
MLQ-P	.529**	.597**	.461**					
MLQ-S	-.284**	-.200**	-.137*	-.170**				
Age	.220**	.155**	-.077	.166**	-.279**			
Gender	.044	.089	.007	.072	-.117*	.191**		
Race/Eth	.103	-.095	-.006	.055	-.016	-.117*	-.101	
Education	.168**	.055	.057	.083	-.050	.032	-.007	.036

Note. LOT-R = Life Orientation Test – Revised (Optimism); PANAS = Positive and Negative Affect Schedule (Positive Affect); MSPSS = Multidimensional Scale of Perceived Social Support (Social Support); MLQ-P = Meaning in Life Questionnaire – Presence (Presence of Meaning), MLQ-S = Meaning in Life Questionnaire-Search (Search for Meaning), Gender is coded as 1 = Female, 2 = Male.

**Correlation is significant at the .01 level (2-tailed)

*Correlation is significant at the .05 level (2-tailed)

Table 12

Stages of Exercise Behavior Change – Parameter Estimates

Precontemplation (*n*=52, 17.4%)	**Contemplation** (*n*=54, 18.1%)	**Preparation** (*n*=73, 24.5%)	**Action** (*n*=21, 7%)	**Maintenance** (*n*=98, 32.9%)
REFERENCE		Positive Affect* (.58, .04, 1.79)	Positive Affect* (.98, .01, 2.66)	Positive Affect*** (1.41, .000, 4.11) Education (some col)* (-1.55, .02, .21)
	REFERENCE			Positive Affect*** (1.02, .000, 2.77) Gender* (-1.01, .02, .36) Education (some col)* (-1.32, .048, .27)
		REFERENCE		Positive Affect** (.83, .002, 2.30) Meaning (S)* (-.46, .02, .63) Gender* (-.76, .04, .47) Education (BA)* (-.99, .04, .37)
			REFERENCE	

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$ (β, *p*, odds ratio)

Table 13

Bivariate Correlations between Observed Variables – Diet Model

	LOT-R	PANAS	MSPSS	MLQ-P	MLQ-S	Age	Gender	Race or Ethnicity
PANAS	.534**							
MSPSS	.429**	.498**						
MLQ-P	.532**	.599**	.464**					
MLQ-S	-.287**	-.203**	-.140*	-.173**				
Age	.226**	.159**	-.072	.170**	-.282**			
Gender	.048	.093	.013	.078	-.119*	.193**		
Race/Eth	.101	-.096	-.007	.053	-.015	-.117*	-.103	
Education	.159**	.049	.049	.074	-.046	.028	-.020	.039

Note. LOT-R = Life Orientation Test – Revised (Optimism); PANAS = Positive and Negative Affect Schedule (Positive Affect); MSPSS = Multidimensional Scale of Perceived Social Support (Social Support); MLQ-P = Meaning in Life Questionnaire – Presence (Presence of Meaning), MLQ-S = Meaning in Life Questionnaire-Search (Search for Meaning), Gender is coded as 1 = Female, 2 = Male.

**Correlation is significant at the .01 level (2-tailed)

*Correlation is significant at the .05 level (2-tailed)

Table 14

Stages of Dietary Behavior Change – Parameter Estimates

Precontemplation (*n*=74, 24.7%)	**Contemplation** (*n*=40, 13.3%)	**Preparation** (*n*=101, 33.7%)	**Action** (*n*=10, 3.3%)	**Maintenance** (*n*=75, 25%)
REFERENCE	Optimism* (-.67, .02, .51) Age** (-.07, .001, .93)	Soc. Support* (.45, .03, 1.56)		Positive Affect* (.55, .03, 1.73)
	REFERENCE	Optimism* (.60, .03, 1.82) Age** (.06, .002, 1.07)	Meaning (S)* (1.03, .04, 2.80) Age** (.11, .006, 1.11)	Age** (.07, .002, 1.07) Education (hs/ged)* (-1.78, .03, .17)
		REFERENCE		Positive Affect* (.48, .046, 1.62) Gender* (-.83, .02, .44)
			REFERENCE	

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$ (β, *p*, odds ratio)

Table 15

Stage Distributions for Health Behaviors

Behavior	Pre-contemplation %	Contemplation %	Preparation %	Action %	Maintenance %
Smoking *n* = 144	6.3	7.6	8.3	6.3	71.5
Exercise *n* = 298	17.4	18.1	24.5	7	32.9
Diet *n* = 300	24.7	13.3	33.7	3.3	25

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Appendix A

Demographic Questionnaire

1. What is your age? _____ years

2. What is your gender?
    a. Female
    b. Male
    c. Transgender (please circle: Female or Male)
    d. Other _____

3. What race or ethnicity do you identify with?
    a. White
    b. Hispanic or Latino
    c. Black or African American
    d. Native American or American Indian
    e. Asian / Pacific Islander
    f. Other _____

4. Please describe your highest level of education:
    a. Less than high school
    b. High school graduate, diploma or the equivalent (for example: GED)
    c. Some college credit, no degree
    d. Trade/technical/vocational training
    e. Associate degree
    f. Bachelor's degree
    g. Master's degree or higher

5. What is your current relationship status?
    a. Single, never married
    b. Partnered, living together, but not married
    c. Married or domestic partnership
    d. Widowed
    e. Divorced
    f. Separated

6. What is your current household income?
    a. Less than $10,000
    b. $10,000 to $39,999
    c. $40,000 to $74,999
    d. $75,000 to $99,999
    e. $100,000 or more

7. Please describe the type of heart condition(s) you have (coronary heart disease, heart failure, etc.)

_____

_____

8. How long have you had your heart condition(s)? (years since diagnosis or first coronary event)

_____

9. Please circle any medical treatment/procedure you have received for your heart condition.

a. Angioplasty / Percutaneous Coronary Intervention (PCI)
b. Stent placement
c. Bypass Surgery / Coronary Artery Bypass Graft (CABG)
d. Transmyocardial laser revascularization (TMR) - surgery used to treat angina
e. Heart valve repair or replacement
f. Heart transplant
g. Aneurysm repair
h. Pacemaker or implantable cardioverter defibrillator (ICD)

If not listed, please describe treatment or procedure received:

_____

_____

10. Please list any medications you are currently taking for your heart condition.

_____

_____

11. Are you currently participating in a cardiac rehabilitation program, or have you in the past?

a. Yes – currently participating
b. No – but I have in the past
c. No – never participated, but I have been referred to cardiac rehab
d. No – never participated, have never been referred to cardiac rehab

12. How familiar are you with diet recommendations for heart health?

a. Not at all
b. A little bit
c. Somewhat
d. Quite a bit
e. Extremely

13. How familiar are you with physical activity recommendations for heart health?

a. Not at all
b. A little bit
c. Somewhat
d. Quite a bit
e. Extremely

14. How familiar are you with recommendations for heart health regarding cigarette smoking?

a. Not at all
b. A little bit
c. Somewhat
d. Quite a bit
e. Extremely

15. Thank you for your time and effort in completing this survey. In order to thank you for your time, we would like to donate $2 to the heart disease organization of your choice. Please select a charity below (links to websites available as well):

a. American Heart Association
b. The Heart Foundation
c. The Children's Heart Foundation
d. The National Coalition for Women with Heart Disease
e. The Hypertrophic Cardiomyopathy Association

Appendix B

Smoking: Adult Stage of Change (Short Form)

1) Are you currently a smoker?

A. Yes, I currently smoke
B. No, I quit within the last 6 months (ACTION STAGE)
C. No, I quit more than 6 months ago (MAINTENANCE STAGE)
D. No, I have never smoked (NONSMOKER)

(For Current Smokers Only)

2) In the last year, how many times have you quit smoking for at least 24 hours?

(For Current Smokers Only)

3) Are you seriously thinking of quitting smoking?

A. Yes, within the next 30 days (PREPARATION STAGE if they have one 24-hour quit attempt in the past year – refer to previous question… if no quit attempt then CONTEMPLATION STAGE)
B. Yes, within the next 6 months (CONTEMPLATION STAGE)
C. No, not thinking of quitting (PRECONTEMPLATION STAGE)

Appendix C

Exercise Stage of Change

For cardiovascular health, adults are recommended to engage in at least 30 minutes of moderate-intensity aerobic activity at least 4 days per week, for a total of 120 minutes (Shipe, 2012).

Examples of aerobic activity include, but are not limited to:

Dancing	Biking	Stair climbing
Swimming	Walking	Elliptical
Water aerobics	Running	Treadmill

In a typical week, how many days do you do 30 minutes or more of moderate-intensity aerobic activity? (please circle one)

0 1 2 3 4 5 or more

If your answer is anything less than 4 days (e.g., 0 to 3), please answer the following:

You said you are not doing 30 minutes or more of moderate-intensity aerobic activity on at least 4 days of the week. Do you plan to start doing 30 minutes or more of moderate-intensity aerobic activity on at least 4 days of the week?

1) No, I do not plan to start in the next 6 months. (PRECONTEMPLATION)

2) Yes, I plan to start in the next 6 months. (CONTEMPLATION)

3) Yes, I plan to start in the next 30 days. (PREPARATION)

If your answer to the first question is 4 or more days, please answer the following:

You said you are doing 30 minutes or more of moderate-intensity aerobic activity on at least 4 days of the week. How long have you been doing this?

1) Less than 6 months (ACTION)

2) More than 6 months (MAINTENANCE)

Appendix D

Dietary Stage of Change

For cardiovascular health, adults are recommended to follow the diet guidelines below, regarding foods and daily servings. In addition, it is recommended to limit intake of sweets, sugar-sweetened beverages, red meats, sodium, trans fat and saturated fat (Eckel et al., 2014).

Food	Daily Servings (based on a 2000 calorie diet)
Whole grains and grain products (bread etc.)	6–8
Vegetables (esp. root and green varieties)	4–5
Fruits (particularly fresh)	4–5
Low-fat or fat free dairy foods	2–3
Lean meats, poultry, and fish	2 or fewer
Fats and oils (olive or canola)	2–3
Nuts, seeds, and beans	4–5 per week
Sweets	5 per week

In a typical week, how many days does your food intake meet the above diet guidelines? (please circle one)

0 1 2 3 4 5 6 7

If your answer is anything less than 6 days (i.e., 0 to 5), please answer the following:

You said you are not eating according to the above guidelines on at least 6 days of the week. Do you plan to start eating according to the above guidelines, at least 6 days of the week?

1) No, I do not plan to start in the next 6 months. (PRECONTEMPLATION)

2) Yes, I plan to start in the next 6 months. (CONTEMPLATION)

3) Yes, I plan to start in the next 30 days. (PREPARATION)

If your answer to the first question is 6 or 7 days, please answer the following:

You said you are eating according to the above guidelines on at least 6 days of the week. How long have you been doing this?

1) Less than 6 months (ACTION)

2) More than 6 months (MAINTENANCE)

Appendix E

Life Orientation Test – Revised (LOT-R)

Please be as honest and accurate as you can throughout. Try not to let your response to one statement influence your responses to other statements. There are no "correct" or "incorrect" answers. Answer according to your own feelings, rather than how you think "most people" would answer.

I disagree a lot	I disagree a little	I neither agree nor disagree	I agree a little	I agree a lot
0	1	2	3	4

1. In uncertain times, I usually expect the best.

0 1 2 3 4

2. It's easy for me to relax.

0 1 2 3 4

3. If something can go wrong for me, it will.

0 1 2 3 4

4. I'm always optimistic about my future.

0 1 2 3 4

5. I enjoy my friends a lot.

0 1 2 3 4

6. It's important for me to keep busy.

0 1 2 3 4

7. I hardly ever expect things to go my way.

0 1 2 3 4

8. I don't get upset too easily.

0 1 2 3 4

9. I rarely count on good things happening to me.

0 1 2 3 4

10. Overall, I expect more good things to happen to me than bad.

0 1 2 3 4

Scoring:
Items 3, 7, and 9 are reverse scored (or scored separately as a pessimism measure).
Items 2, 5, 6, and 8 are fillers and should not be scored.
Scoring is kept continuous – there is no benchmark for being an optimist/pessimist.

Appendix F

The Positive and Negative Affect Schedule (PANAS)

This scale consists of a number of words that describe different feelings and emotions. Read each item and then list the number from the scale below next to each word. Indicate the extent you have felt this way over the past week, including today.

Very Slightly or Not at All	A Little	Moderately	Quite a Bit	Extremely
1	2	3	4	5

_____1. Interested	_____ 11. Irritable
_____ 2. Distressed	_____ 12. Alert
_____ 3. Excited	_____ 13. Ashamed
_____ 4. Upset	_____ 14. Inspired
_____ 5. Strong	_____ 15. Nervous
_____ 6. Guilty	_____ 16. Determined
_____ 7. Scared	_____ 17. Attentive
_____ 8. Hostile	_____ 18. Jittery
_____ 9. Enthusiastic	_____ 19. Active
_____ 10. Proud	_____ 20. Afraid

Scoring Instructions:

Positive Affect Score: Add the scores on items 1, 3, 5, 9, 10, 12, 14, 16, 17, and 19.

Scores can range from 10 – 50, with higher scores representing higher levels of positive affect.

Mean Scores: Momentary 29.7 (SD 7.9); Weekly 33.3 (SD 7.2)

Appendix G

Multidimensional Scale of Perceived Social Support **(**MSPSS)

We are interested in how you feel about the following statements. Read each statement carefully. Indicate how you feel about each statement, by circling the corresponding number.

Very Strongly Disagree	Strongly Disagree	Mildly Disagree	Neutral	Mildly Agree	Strongly Agree	Very Strongly Agree
1	2	3	4	5	6	7

1. There is a special person who is around when I am in need.	1	2	3	4	5	6	7
2. There is a special person with whom I can share my joys and sorrows.	1	2	3	4	5	6	7
3. My family really tries to help me.	1	2	3	4	5	6	7
4. I get the emotional help and support I need from my family.	1	2	3	4	5	6	7
5. I have a special person who is a real source of comfort to me.	1	2	3	4	5	6	7
6. My friends really try to help me.	1	2	3	4	5	6	7
7. I can count on my friends when things go wrong.	1	2	3	4	5	6	7
8. I can talk about my problems with my family.	1	2	3	4	5	6	7
9. I have friends with whom I can share my joys and sorrows.	1	2	3	4	5	6	7
10. There is a special person in my life who cares about my feelings.	1	2	3	4	5	6	7
11. My family is willing to help me make decisions.	1	2	3	4	5	6	7
12. I can talk about my problems with my friends.	1	2	3	4	5	6	7

The items tended to divide into factor groups relating to the source of the social support, namely family (Fam), friends (Fri) or significant other (SO).

Appendix H

The Meaning in Life Questionnaire (MLQ)

Please take a moment to think about what makes your life feel important to you. Please respond to the following statements as truthfully and accurately as you can, and also please remember that these are very subjective questions and that there are no right or wrong answers. Please rate each item according to the scale below:

Absolutely Untrue	Mostly Untrue	Somewhat Untrue	Can't Say True or False	Somewhat True	Mostly True	Absolutely True
1	2	3	4	5	6	7

1. _____ I understand my life's meaning.

2. _____ I am looking for something that makes my life feel meaningful.

3. _____ I am always looking to find my life's purpose.

4. _____ My life has a clear sense of purpose.

5. _____ I have a good sense of what makes my life meaningful.

6. _____ I have discovered a satisfying life purpose.

7. _____ I am always searching for something that makes my life feel significant.

8. _____ I am seeking a purpose or mission for my life.

9. _____ My life has no clear purpose.

10. _____ I am searching for meaning in my life.

MLQ syntax to create Presence and Search subscales:
Presence 1, 4, 5, 6, & 9-reverse-coded
Search 2, 3, 7, 8, & 10

Appendix I

Literature Review

Introduction

Cardiovascular disease (CVD) is a serious public health problem. It is the leading cause of death in the world and the United States (U.S.), killing about 610,000 people in the U.S. every year, equal to one in every four deaths (Centers for Disease Control and Prevention [CDC], 2016; World Health Organization [WHO], 2016). In fact, diseases of the heart took 633,842 lives in the U.S. in 2015 (CDC, 2016), and consistently claim more lives than all forms of cancer combined (Mozaffarian et al., 2015). While coronary heart disease is the most common type, cardiovascular disease is a broad category that includes a variety of conditions, including heart and blood vessel disease, coronary artery disease, stroke, heart attack, arrhythmia, heart valve disease, heart muscle disease (cardiomyopathy) and heart failure (Mozaffarian et al., 2015; WHO, 2016). Whether congenital or acquired, these cardiovascular conditions share a common feature, in that they are greatly impacted by behavioral or lifestyle risk factors.

Chronic illnesses such as CVD often have a substantial lifestyle component, meaning they are subject to certain behavioral risk factors and require attention to health behaviors to manage and minimize these risk factors (Bodenheimer, Lorig, Holman, & Grumbach, 2002; Jowsey, Pearce-Brown, Douglas, & Yen, 2014). Minimizing the effects of the disease, whether congenital or developed, depends heavily on daily behavior choices. Specifically, an estimated 40% of premature deaths are attributable to preventable behavioral factors such as smoking, unhealthy dietary intake, and sedentary lifestyle (Mokdad, Marks, Stroup, & Gerberding, 2004), all of which have been linked to major chronic illnesses such as CVD (Mozaffarian et al., 2015; Yoon et al., 2014). Thus, the importance of minimizing risk factors and engaging in health-

promoting behaviors such as smoking cessation, increased physical activity and healthy eating cannot be overstated for this population.

Despite clear associations with mortality and health risk, large numbers of people with chronic illnesses such as cardiovascular disease continue to engage in unhealthy behaviors (Choi, Chung, & Park, 2013; Paradis et al., 2010). Researchers continuously explore strategies for helping patients with chronic illnesses adopt healthy lifestyle recommendations, and yet, implementing effective solutions on a broad scale remains elusive. As healthcare costs continue to rise, successful self-management of chronic illnesses such as CVD becomes increasingly critical. Toward this end, change processes and psychosocial factors associated with health behaviors are receiving increased attention in the literature. While much research has focused on the impact of negative psychological states (e.g., depression, anxiety, hostility) on cardiovascular health (Barth, Schneider, & von Känel, 2010; Barth, Schumacher, & Herrmann-Lingen, 2004; DuBois et al., 2015; Kubzansky, Davidson, & Rozanski, 2005; Siegman & Smith, 1994; Versteeg et al., 2009), less attention has been given to the impact of positive psychological constructs. With the goal of enhancing the impact of interventions with this population, this study addresses whether positive psychosocial variables can predict health-promoting behaviors in adults with CVD. Further, examining how these variables may relate to stages of behavior change might help to inform the use of interventions in a more targeted, individualized manner.

Health Behaviors

Smoking

One of the most common and problematic behaviors for those with chronic illness such as CVD is cigarette smoking. Tobacco smoking is one of the top three leading risk factors for disease worldwide (Mozaffarian et al., 2015), the second-leading risk factor for death in the U.S.,

and contributed to approximately 7.1 million deaths in 2016 (Benjamin et al., 2019). Further, this risk applies not only to personal use of tobacco, but also inhalation of secondhand smoke (Benjamin et al., 2019; Mozaffarian et al., 2015). Despite an overall decline in smoking prevalence in U.S. adults from 31% in 1980 to 15.5% currently, smoking remains a significant health risk among those with CVD (Benjamin et al., 2019). Smoking is more prevalent in males, with 17.5% of males and 13.5% of females being current smokers in the U.S (Benjamin et al., 2019). Significant disparities in smoking prevalence exist, with certain populations having notably higher rates. These include American Indian/Alaska Natives, lesbian, gay, bisexual, and transgender populations, active-duty military, and individuals with low socioeconomic status, mental illness, disability, or HIV (Benjamin et al., 2019).

Smoking is a significant risk factor for both developing and managing CVD. There is evidence that smoking rates may even be higher in CVD populations than the general population (Kotseva et al., 2009). Leifheit-Limson et al. (2013) found that in a large sample of heart attack patients, approximately 55% of those under age 55 were current smokers, and approximately 26% of those over 55 were current smokers. Further, cigarette smoking is the most common risk factor present for those with premature heart disease, with onset prior to age 50 (Khot et al., 2003). It is recommended that all persons avoid or cease tobacco smoking and secondhand smoke, and for those with a chronic illness such as CVD, these recommendations are particularly relevant (Mozaffarian et al., 2015). Done at any age, smoking cessation significantly reduces mortality from diseases related to smoking (Benjamin et al., 2019). Further, the more time that passes after quitting, the greater decline in mortality risk (Benjamin et al., 2019). Smoking cessation has both short-term and long-term benefits, for those already living with CVD and also for lowering CVD risk (Benjamin et al., 2019).

Exercise

In addition to smoking, another health behavior that is challenging but important to monitor is physical activity, within the general population, and specifically those with chronic illnesses such as CVD (Choi et al., 2013; Czajkowski et al., 2015; Mozaffarian et al., 2015). In fact, about one in every three U.S. adults reports participating in no leisure time physical activity (Mozaffarian et al., 2015). In 2016, only 23.5% of adults aged 18 and over met the Federal 2008 Physical Activity Guidelines for Americans for both aerobic and muscle-strengthening activity (CDC, 2017). Regular physical activity is particularly important for cardiovascular health and is consistently emphasized in cardiac rehabilitation programs and for anyone with or at risk for CVD (Bove, 2016; Huang et al., 2015; Mozaffarian et al., 2015; Paradis et al., 2010). For cardiovascular health, adults are recommended to engage in at least 30 minutes of moderate-intensity aerobic activity at least 4 days per week for a total of 120 minutes (Shipe, 2012). Certainly, amount and intensity of activity recommended for CVD patients specifically varies per individual circumstances.

Of note, physical activity and exercise are defined differently in the health literature. Physical activity is defined as "any bodily movement produced by skeletal muscles that results in energy expenditure," whereas exercise is defined as "planned, structured and repetitive" physical activity, with the specific goal of physical fitness (Caspersen, Powell, & Christenson, 1985, p. 126). Exercise, beyond just physical activity, is considered particularly important for CVD patients (Bove, 2016; Eckel et al., 2014; Mozaffarian et al., 2015). However, any physical activity is preferable to none, and even a small increase in physical activity has been shown to improve cardiovascular health (Carnethon, 2009). In sum, a sedentary lifestyle is especially harmful for those with CVD (Czajkowski et al., 2015; Eckel et al., 2014; Mozaffarian et al.,

2015). Physical activity and exercise reduce premature deaths and improve risk factors for CVD, including high blood pressure and high cholesterol (Benjamin et al., 2019). Further, increased physical activity and exercise reduce the odds of developing other diseases related to CVD, such as type 2 diabetes, and sudden heart attacks (Benjamin et al., 2019).

Diet

Another concern closely aligned with lack of exercise for those with CVD is diet. Consuming too many calories, or unhealthy foods regularly, poses a risk to heart health, and remains a major area of emphasis in managing chronic illnesses such as CVD (Mozaffarian et al., 2015). Although the rate of deaths attributed to poor diet has decreased since 2005, it is estimated that in 2015, 22.4% of male deaths and 20.7% of female deaths globally could be attributed to poor dietary habits (Benjamin et al., 2019). Alarmingly, overall caloric intake of individuals in the U.S. has increased over several decades, largely due to increased carbohydrate intake, including starches, refined grains, and sugars (Benjamin et al., 2019). From 1971 to 2004, women consumed an average of 22 percent more calories over time, and men consumed an average of 10 percent more (Mozaffarian et al., 2015). A combination of poor diet and lack of exercise contributes to the current prevalence of adult overweight and obesity of 69.4%, in the U.S., with 37.9% of males and 41.1% of females classified as obese (Benjamin et al., 2019).

A significant number of people with and without CVD struggle to maintain a healthy diet and do not burn enough calories to achieve a healthy balance. For example, in 2013-2014, less than 1% of U.S. adults met four out of five primary diet goals for heart health, including specific consumption levels of fruit and vegetables, fish, whole grains, and limiting sodium and sugar-sweetened beverages (Benjamin et al., 2019). As with other health behaviors, significant disparities exist for dietary behavior, with poorer diet scores observed in African American and

Hispanic populations, and those with lower socioeconomic status (Benjamin, et al., 2019). While current guidelines avoid recommending a specific calorie count, recommendations typically focus on balancing caloric intake with amount of physical activity (Eckel et al., 2014; Mozaffarian et al., 2015). In addition to limiting the number of calories, the type of foods recommended for a heart-healthy diet include regular intake of vegetables, fruits, whole grains, low-fat dairy products, poultry, fish, legumes, non-tropical vegetable oils and nuts; and limiting intake of sweets, sugar-sweetened beverages, red meats, sodium, trans fat and saturated fat (Benjamin et al., 2019; Eckel et al., 2014).

Psychosocial Variables

Researchers have identified associations between the aforementioned health behaviors, certain psychosocial variables, and health outcomes in patients with chronic illness. For example, studies in the U.S. and other countries have linked anxiety and depression with less engagement in healthy behaviors and poorer health outcomes (Boehm & Kubzansky, 2012; Katon et al., 2010; Seligman, 2008; Whalley et al., 2014). Negative psychological states have frequently been associated with poorer cardiovascular health specifically (Barth et al., 2004; Barth et al., 2010; DuBois et al., 2015; Kubzansky et al., 2005; Siegman & Smith, 1994; Versteeg et al., 2009). A number of studies have revealed psychosocial factors such as depression, anxiety and low perceived social support to be related to morbidity and mortality in those with cardiovascular diseases (Everson-Rose & Lewis, 2005; Kim et al., 2013; Tay et al., 2013; Whalley et al., 2014). As such, the goals of behavioral health research often include developing and improving behavioral health interventions for use in health care settings, to help patients change unhealthy habits, as well as to empower individuals to better manage their own health and health behavior (Czajkowski et al., 2015; Whalley et al., 2014). To this end, attention

to psychosocial factors associated with health behaviors is increasing in the literature, along with a more targeted, individualized approach to motivating health behavior change.

While much research has focused on the impact of negative psychological states on cardiovascular health, less attention has been given to the impact of positive psychological constructs. This area of research is growing, however. In a non-systematic review of the literature, DuBois et al. (2012) found positive psychosocial constructs (e.g., optimism, gratitude, positive affect) to be associated with cardiac health outcomes, as well as health behaviors, and possibly physiologic changes. Further, in a systematic review of 77 analyses from 30 eligible studies (N = 14,624), DuBois et al. (2015) found that among studies with 100 or more participants, 65% of all analyses indicated a significant association between positive psychological constructs and subsequent health outcomes. Furthermore, positive psychological variables such as positive affect have been successfully increased through interventions with cardiac patients, resulting in more successful health behavior change (Charlson et al., 2013; Sanjuán et al., 2016).

Optimism

Optimism, one of the most widely researched positive constructs related to heart health, has been robustly related to better CVD outcomes in both healthy and patient populations (Boehm & Kubzansky, 2012; DuBois et al., 2015; Labarthe et al., 2016). Optimism is defined in the literature as a favorable outlook, or a general expectation that good things will happen (Boehm & Kubzansky, 2012; Carver et al., 2010; Scheier & Carver, 1992). Higher levels of optimism have been associated with decreased mortality risk in patients with CVD, as well as healthier eating habits, increased physical activity, and decreased likelihood of smoking (Boehm et al., 2018; Boehm & Kubzansky, 2012; Ronaldson et al., 2015). Higher levels of pre-surgery

optimism were correlated with faster recovery following bypass surgery, as well as reduced hospital readmittance at 6-month follow-up (Boehm & Kubzansky, 2012). Further, a meta-analysis of 38 studies by Boehm et al. (2018) found optimism associated with greater fruit and vegetable consumption, more physical activity, and avoidance of smoking, although effect sizes were small. Additionally, several studies in elderly CVD populations have shown optimism to predict longevity and better self-care, including physical activity (Giltay et al., 2006; Giltay et al., 2007).

Moreover, research has demonstrated that optimism can be increased via psychological intervention (Malouff & Shutte, 2017; Peters, Meevissen, & Hanssen, 2013). For example, in a meta-analysis of 29 studies, interventions were generally effective in increasing optimism, with a small to moderate effect size (Malouff & Shutte, 2017). It should be noted however that the effects of interventions varied by type of intervention, delivery method of intervention, and length, and studies had significant heterogeneity in effect sizes (Malouff & Shutte, 2017). Further, an eight-week in-person group intervention served to increase optimism in patients with coronary artery disease, with moderate to large effect sizes at completion and eight weeks later (Mohammadi et al., 2018). Given the evidence on optimism and health behaviors and outcomes, it stands to reason that increasing optimism may have a positive effect on health behaviors.

Positive Affect

Positive affect, or the experience of positive mood and emotions such as excitement, enthusiasm, or pride, has been found to be associated with health-promoting behavior, protective biological responses, and better health outcomes (Sin, 2016; Sin et al., 2015; Steptoe et al., 2009). Specifically, positive affect has been associated with decreased secondary events and hospital re-admittance in cardiovascular patients, as well as improved sleep, diet, exercise, and

adherence to medical regimens (Pressman & Cohen, 2005; Sin, 2016). Fredrickson et al. (2000) found that positive affect helped to counter cardiovascular reactivity to negative affect. Moreover, Peterson et al. (2012) found that positive affect increased via a psychological intervention had a positive impact on physical activity in CVD patients. Further, the effects of positive affect on health behaviors are thought to operate independently from negative affect, and do not merely represent the absence of negative affect (Chaves, & Park, 2016; Huffman et al., 2011).

The pathways through which positive affect influences health behaviors are not entirely clear, but it has been theorized as a buffer against stress, helping individuals avoid engaging in unhealthy behaviors (Chaves, & Park, 2016). Additionally, both optimism and positive affect have been associated with physical activity and healthy eating in CVD patients, with a bidirectional positive relationship (Huffman et al., 2016; Sin et al., 2015). Thus, positive affect both influences behavior and is influenced by behavior. Importantly, evidence suggests that positive affect can be increased with interventions. For example, a small systematic review and meta-analysis of 10 studies of interventions targeting affect revealed significant increases in positive affect, with small to moderate effect sizes (Boumparis, Karyotaki, Kleiboer, Hofmann, & Cuijpers, 2016). Types of interventions used were heterogeneous and the length of their impact was not always clear, however this offers promising evidence for increasing positive affect via intervention (Boumparis et al., 2016). While the association is often reciprocal, the impact of positive affect on health-promoting behaviors is promising.

Social Support

Additionally, social support has been linked with cardiovascular health behaviors and outcomes. Social support is defined in the literature as both emotional and tangible support from

others, such as help, encouragement, and a feeling of being cared about (Barth et al., 2010; Yunus & Sharoni, 2016). In their systematic review and meta-analysis of studies on social support and coronary heart disease (CHD), Barth et al. (2010) noted two broad categories of social support. These are *functional* support, which is focused on types, including emotional, instrumental, financial, and informational support; and *structural* support, which is focused on sources, including the number of social connections or sources providing support. Low perceived social support has been associated with increased mortality in those with CHD, and increased risk of developing CHD, suggesting that increased social support has protective benefits (Barth et al., 2010). Further, Tay et al. (2013) conducted a review and found social support, particularly family support, to be positively correlated with health promoting behaviors and healthier outcomes in patients with coronary heart disease. Various types of social support, including emotional, informational, and tangible, were significantly positively associated with beneficial self-care behaviors in patients with heart failure (Graven & Grant, 2014; Yunus & Sharoni, 2016).

While evidence is limited regarding the effectiveness of interventions to increase social support, there is preliminary support (Cattan et al., 2005; Hogan et al., 2002). For example, Hogan et al. (2002) reviewed 100 studies and found that the majority of them reported at least some positive impact of interventions on social support, however heterogeneity of methods and quality warrant cautionary interpretation. Notably, they found that interventions that emphasized both giving and receiving support had even more positive results than those focused only on receiving support (Hogan et al., 2002). Further, in a systematic review, Cattan et al. (2005) found that group interventions including educational and social activity helped ease isolation and loneliness in older people, more effectively than one-to-one interventions. Van Dam et al.

(2005) concluded in a systematic review of controlled trials that social support interventions had a positive impact on self-care and health outcomes in patients with type 2 diabetes. Additionally, social support can take various forms, including friends, family, caregivers, support groups, and even online support. Less traditional forms of support, such as internet, social media and telephone-based peer support, are growing and have shown promise in achieving positive outcomes (Maher et al., 2014; Van Dam et al., 2005). While research continues in this area, the evidence suggests that better social support leads to better health (Barth et al., 2010; Tay et al., 2013; Van Dam et al., 2005).

Purpose in Life

A fourth psychosocial variable, a sense of purpose in life, has also been found to relate to improved health outcomes in both the general population (Park, 2015; Seligman, 2008) and cardiovascular patients (Boehm & Kubzansky, 2012; DuBois et al., 2015; Kim et al., 2013). Purpose in life is defined variously in the literature, and is often described as either equivalent to or including *meaning* in life. Definitions converge on purpose as a sense of directedness; a central theme that guides one's goals for life, and provides meaning for what one does (Boehm & Kubzansky, 2012; DuBois et al., 2015; Kashdan & McKnight, 2009). Further, measures of purpose often include items about meaning, and vice versa. Kim and colleagues (2013) found that a greater sense of purpose in life was associated with lower risk of heart attack in older adults with heart disease over a two-year period. Cohen et al.'s 2016 meta-analysis revealed that higher sense of purpose in life was associated with reduced risk for all-cause mortality and cardiovascular events. Specifically, a greater sense of purpose in life has been found to correlate with embracing of more beneficial health behaviors such as exercise, diet, and not smoking (Park, 2015).

While intervention studies for increasing meaning and purpose in life are limited, preliminary evidence is positive and significant for effectiveness of therapies with meaning and purpose in life included as a target, such as Well-Being Therapy (Fava, 1999; Ryff, 2013). For example, a pilot trial of an 8-week group intervention using concepts from Well-Being Therapy aimed at multiple dimensions of psychological well-being in older adults significantly increased sense of purpose in life (Friedman et al., 2017). Westerhof, Bohlmeijer, van Beljouw, and Pot (2010) noted the importance of increasing meaning for older persons, as meaning and purpose typically decrease with age. Their randomized controlled trial involving a life review intervention for older adults significantly increased sense of meaning, and decreased depressive symptoms (Westerhof et al., 2010). Further, a randomized controlled trial by Breitbart et al. (2010) found an eight-week group intervention effective in increasing sense of meaning and purpose in life for patients with advanced cancer. In sum, this evidence suggests that increasing sense of meaning and purpose is possible and could potentially improve health behaviors.

Most research to date has focused on how positive psychological constructs are associated with the absence of unhealthy behaviors or biological dysfunction. Less attention has been given to positive psychological constructs associated with the presence of health-promoting behaviors or biological functioning (Boehm & Kubzansky, 2012; DuBois et al., 2015). Findings have indicated that higher levels of positive psychological constructs are positively associated with restorative health behaviors and negatively associated with harmful health behaviors (Boehm & Kubzansky, 2012; DuBois et al., 2015). Further, the cardiovascular benefit associated with positive psychological states appears to operate independently from simply an absence of depression or anxiety (Huffman et al., 2011). What is less clear in the research is how the presence of these psychosocial variables correlates with behavior *change* associated with health

outcomes. To translate these findings into effective interventions, further research into how positive psychological constructs associate with readiness to change, and maintenance of, specific health behaviors and CVD is needed.

Several patterns in the existing research signal a need for further investigation of these associations. Reviews have largely focused on a single positive construct, such as optimism, or have had limited focus on patients with cardiac disease, and/or have been solely descriptive in nature (DuBois et al., 2015). It is important to examine a wide range of positive states and traits, as studying multiple positive constructs at once could help determine if different positive constructs may have greater or lesser effects on health behaviors and outcomes. Additionally, while studies of the general population help to predict and ideally prevent illness, more studies of those with existing health conditions such as CVD are necessary to inform disease management. Furthermore, it is possible that significant findings from research with clinical populations can then be used to inform more targeted preventive interventions for the general population.

Researchers have called for more attention to both risk factors and protective factors, in preventing and managing CVD (Barth et al., 2004; WHO, 2016). Pathways linking these factors with outcome are still unclear, and psychological interventions have demonstrated mixed evidence of effectiveness (Barth et al, 2004). While psychotherapeutic treatment has shown improvements in cardiac patient psychological symptoms, it has not demonstrated significant impact on clinical outcomes such as mortality (Barth et al., 2004). DuBois et al. (2015) argued that given the importance of identifying protective factors for the high-risk cardiovascular population, the lack of reviews and analyses of positive psychosocial constructs in heart disease patients represents a crucial gap in the literature. While associations are emerging in the literature, more detailed evidence is needed about how these variables interact with health

behavior, to translate these findings into effective practice.

Transtheoretical Model

Researchers of the psychology of health behavior often use models to describe and understand behavior change. Some argue that the process of behavior change is more nuanced than it is often treated in the literature, and theories of health behavior are becoming increasingly complex (Hagger, 2009). For instance, it may require a more complex model than a simplistic dichotomy of either engaging in a behavior or not engaging in it (Choi et al., 2013). The Transtheoretical Model (TTM) of health behavior change (Prochaska & Velicer, 1997) has been praised for more accurately capturing the complexity and process of behavior change (Choi et al., 2013; Huang et al., 2015). The TTM was originally developed for smoking cessation, and focuses on how an individual progresses through various stages of behavior change (Prochaska & Velicer, 1997). It incorporates the ideas that readiness and motivation fluctuate, relapses happen, and change may not necessarily progress in a clear linear fashion (Prochaska & Velicer, 1997). A four-factor model, the TTM consists of stages of change, processes of change, decisional balance (pros vs. cons), and self-efficacy vs. temptation. The TTM is theorized to represent the natural process of behavior change, and has been applied to many health behaviors (Prochaska & Velicer, 1997).

The TTM includes six stages of change: 1) *Precontemplation*: not yet considering changing behavior, and may not be aware a change is needed; 2) *Contemplation*: recognizes a need to change and begins considering ways to change; 3) *Preparation*: ready to take action and begins making efforts toward behavior change; 4) *Action*: making significant positive changes in behavior; 5) *Maintenance:* able to maintain those changes for at least six months; and 6) *Termination*: confident in and accustomed to the behavior change, without fear of relapse

(Prochaska & Velicer, 1997). These stages are the most-studied aspect of the model, and the other aspects of the model are often not included in studies utilizing the stages of change.

Additionally, Prochaska and Velicer (1997) proposed ten *processes* of change, or strategies used within each stage, to progress forward. These include consciousness raising, self and environmental re-evaluation, counterconditioning, stimulus control, and helping relationships (Prochaska & Velicer, 1997). Different processes become salient at different stages of change. The processes, while important, receive less attention in research, perhaps due to the complexity they add to the model in contrast to the structure of the stages. Proponents of the TTM argue that behavior interventions are most effective when tailored to an individual's current stage of change (Bridle et al., 2005). However, researchers also have questioned the utility of stage-based interventions in overall treatment effectiveness (Armitage, 2009; Bridle et al., 2005). While research presents mixed findings, many studies have demonstrated effectiveness of the TTM when applied to understanding and changing important cardiovascular health behaviors, including smoking, physical activity and diet (Armitage, 2009; Bulley et al., 2007; Carvalho de Menezes, 2016; Huang et al., 2015; Paradis et al., 2010).

TTM and Smoking

The TTM was originally developed as a model based on the process of smoking cessation (Prochaska & DiClemente, 1982). As such, it is theorized to reflect the actual process of change for those thinking about, attempting to, or actively quitting smoking. The TTM has been identified as a particularly effective model for smoking cessation intervention in the general population, who may not be as motivated to quit as those with chronic health conditions (Velicer et al., 2006). Specifically, stage-based interventions for those in earlier stages (i.e. Precontemplation, Contemplation) allow those who may not be "ready" to quit (i.e., Preparation)

to be effectively targeted (Velicer et al., 2006). The TTM model has been validated in studies of smoking cessation (Fava et al., 1995; Prochaska & DiClemente, 1982; Velicer et al., 2006). While stage-based intervention studies have yielded mixed evidence compared to non-stage based, researchers have found evidence suggesting that stage-matched smoking cessation interventions are effective, in general and in cardiovascular populations (Armitage, 2009; Paradis et al., 2010; Steptoe et al., 2001).

TTM and Exercise

Independent trials using the TTM demonstrate promising but limited evidence in favor of the TTM, for prediction and intervention. Several studies using stage-based interventions to improve cardiovascular health behaviors indicate positive results, albeit with limitations. For example, Huang et al. (2015) found that stage-based cardiac rehabilitation interventions following open-heart surgery were effective in moving Taiwanese patients to later stages of exercise change at the 6-month mark. Steptoe et al. (2001) found that for patients in the U.K. with at least one cardiovascular risk factor, the likelihood of reaching a target (i.e., later) stage of change for physical activity at 12-month follow-up was greater in a stage-based behavioral counseling group than in the information-only group. In addition to trials, systematic reviews and meta-analyses offer similarly cautious endorsements of the TTM for exercise measurement and intervention (Adams & White, 2003; Bulley et al., 2007). Notably, Bulley et al. cautioned that self-reported stages may not reflect objective behavior measures, and Adams and White noted that TTM interventions may not necessarily support long-term changes. Overall, these findings support the use of stage of change information to more effectively target physical activity interventions for cardiac patients.

TTM and Dietary Behavior

In addition to physical activity, dietary behavior is often studied using the TTM, although less frequently. Evidence from individual trials and reviews reveals similar findings to those on physical activity, including modest support for use of the TTM, with numerous concerns and calls for further study (Carvalho de Menezes, 2016; Glanz et al., 1998; Horwath et al., 2010; Verheijden et al., 2004). Trials involving patients at risk for cancer (Glanz et al., 1998) and cardiovascular disease (Verheijden et al., 2004) revealed short-term improvements in diet using stage-matched interventions. Compared to control groups, more patients in stage-based counseling groups moved to later stages in dietary change, including reduced fat consumption and increased fiber, fruit and vegetable consumption (Glanz et al., 1998; Verheijden et al., 2004). Further, a 2016 systematic review by Carvalho de Menezes of randomized clinical trials (RCT) revealed that stage-matched interventions were effective for reduction of fat consumption, and increased fruit and vegetable consumption. While limitations included attrition, complexity of dietary behavior, and self-report measures, strengths of the studies included use of RCTs, large sample sizes, and prospective design (Carvalho de Menezes, 2016). In sum, despite limitations of studies using the TTM, the promising evidence presented for the stages of change as applied to smoking, diet, and exercise merits further investigation of its application to health behavior change, and justifies its continued use in research.

The Present Study

In order to explore the predictive power of positive psychosocial variables related to behavior change, this study includes four positive psychosocial variables and how they associate with stages of behavior change for three important health behaviors for patients with CVD. The psychosocial predictor variables in the study include optimism, positive affect, perceived social

support and meaning/purpose in life. These variables have each previously been found to be positively associated with health-promoting behaviors (Bodenheimer et al, 2002; Boehm & Kubzansky, 2012; Choi et al., 2013; Kim et al., 2013; Park, 2015; Sin, 2016; Sin et al., 2015; Steptoe et al., 2009), yet more research is needed to determine how specifically they relate to behavior change, to inform effective interventions.

The four psychosocial variables are each examined in relation to three health behaviors in the present study. Three health behaviors cited consistently in the literature as being highly impactful on cardiovascular health are cigarette smoking, diet, and physical activity (Boehm & Kubzansky, 2012; Choi et al., 2013; Tay et al., 2013; Whalley et al., 2014). Knowledge of how these behaviors appear to be correlated with positive psychosocial variables could inform targeted, individualized interventions for improving health outcomes for patients with CVD. While research has explored positive psychosocial variables in relation to health behaviors in patients with CVD, none has examined how these variables relate to stage of behavior change. Most health behavior interventions target moving into the Action (fourth) stage, assuming that individuals are ready and prepared to change. However, research has indicated that those in the general population tend to be distributed in the earlier stages with respect to "high risk" health behaviors (Fava et al., 1995; Prochaska & Velicer, 1997). Thus, interventions tailored to stage of readiness, and also for those trying to maintain a change, may be more effective for more people.

The present study has several implications for theory, research, and practice. It is hoped that the findings will offer further evidence for the efficacy of the TTM as a model of health behavior change, and by extension, stage-matched behavioral health interventions. Further, evidence in support of the TTM will ideally lead to further exploration of the other factors of the four-factor model, beyond just the stages of change. Significant results will hopefully lead to

continued research of positive psychological constructs in relation to health behaviors and outcomes, including specific mechanisms that connect them. Future research will also ideally examine each psychosocial construct in greater detail, to determine types, levels, and duration needed to positively impact health behavior. In practice, positive variables found to associate with positive health behaviors can then be targeted via intervention, and increased, with the goal of influencing behavior. It is hoped that findings from the present study will contribute to a greater understanding of human health behavior, and will inform effective interventions for people with and without cardiovascular disease.

This study examines several hypotheses. Behavior change researchers have suggested that populations with behavioral health risk factors are generally distributed in the first three stages of change: 40% in Precontemplation, 40% in Contemplation, and 20% in Preparation (Fava et al., 1995). Hypotheses for the study were as follows:

1) Patients who have already experienced some level of cardiovascular event or condition will display a more varied distribution of stages for health behavior change, compared to those from the general population, as described in the literature.
2) Higher reported levels of optimism, positive affect, perceived social support and purpose in life will predict later stages of change for health behaviors needing improvement.
3) Various psychosocial and demographic variables will have different predictive power for the three health behaviors.

Investigation of how psychosocial and demographic variables such as age and gender interact to predict behavior change may serve to inform targeted and impactful health behavior interventions.

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