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Effects of Partners Together in Health (PaTH) Intervention on Physical Activity and Healthy Eating Behaviors: A Pilot Study

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Abstract

Background—Despite proven efficacy of cardiac rehabilitation (CR) in helping patients initiate physical activity and healthy eating changes, less than 50% of CR participants maintain changes 6 months later.

Objective—The objective of this feasibility study was to test the Partners Together in Health (PaTH) Intervention versus usual care (UC) in improving physical activity and healthy eating behaviors in coronary artery bypass graft (CABG) surgery patients and spouses.

Methods—An experimental, two-group (n = 17 couples/group), repeated measures design was used. CABG patients in both groups participated in Phase II outpatient CR. Spouses in the PaTH group attended CR with the patient and were asked to make the same physical activity and healthy eating changes as patients. Spouses in the control group attended educational classes with patients. It was theorized that “two persons would be better than one” at making changes and sticking with them long-term. Physical activity behavior was measured using the Actiheart accelerometer; the activity biomarker was an exercise tolerance test. Eating behavior was measured using 3-day food records; the biomarker was the lipid profile. Data were collected at baseline (entrance in CR), 3-months (post-CR), and 6-months. Changes over time were examined using Mann-Whitney U statistics and effect sizes.

Results—The PaTH intervention was successful primarily in demonstrating improved trends in healthy eating behavior for patients and spouses. No differences were found between the PaTH and UC patients or spouses at 3 or 6 months in the number of minutes/week of physical activity. By 6 months, patients in both groups were, on average, below the national guidelines for PA recommendations (≥ 150 min/week at > 3 METs).

Conclusions—The couple-focused PaTH intervention demonstrated promise in offsetting the decline in dietary adherence typically seen 6 months after CR.

Coronary heart disease (CHD) remains the leading cause of morbidity and mortality in the United States for both men and women. The most recent statistics from the American Heart Association (AHA) reported there were over 785,000 new heart attacks each year in the U.S., and over 232,000 coronary artery bypass surgeries (CABG).[1] There are several modifiable risk factors for heart disease including smoking, sedentary lifestyle, high fat diet, and hyperlipidemia to name a few.[1–2]

Long-term maintenance of lifestyle changes to reduce cardiovascular risk factors for patients after coronary artery bypass graft (CABG) surgery is essential to fully reap the benefits of the CABG surgery. Despite proven efficacy of cardiac rehabilitation (CR) in helping patients initiate lifestyle changes, less than 50% of CABG patients maintain these changes by 6 months post-CABG.[3–5] In addition, spouses of CABG patients often share the same lifestyle as the patient (i.e., lack of activity, high fat diet, etc.) and may also have an elevated risk profile.[6–7] CR is an excellent opportunity to combine strategies of secondary prevention for patients with strategies of primary prevention for spouses by involving them in the patients' outpatient CR efforts. Unfortunately, most of the existing couple-oriented interventions involve the spouse as a way to improve patient adherence to medical guidelines,[6–7] or to address the role of marital functioning in illness management[8–9] with limited opportunity for health promotion for the spouse.[6–8] Lifestyle interventions that specifically target the marital partners as a unit may be more efficacious than current individually-oriented education strategies. The purpose of this study was to examine the differences between patients and spouses in two groups (PaTH intervention vs. UC groups) in changes overtime in physical activity (PA) behavior and PA biomarker (functional capacity) and in healthy eating behaviors and biomarkers (lipid profile).

Background

Research has focused on achievement of target physical activity/exercise goals within CR programs. Several investigators found significant improvements in functional capacity during CR,[10–13] ranging from 23%[10] to 36%.[11] Although exercise performance increases in CR, there is a downward trend for physical activity/exercise participation during the year following CR.[14–16] One year after a cardiac event, Moore[15] found that only 28% of patients in a lifestyle exercise intervention met the minimum weekly guideline of 150 min/week[17] of ≥ moderate (PA.

Heart healthy dietary changes in patients with CHD have been found to lower blood pressure and reduce the risk of CHD, myocardial infarction, and stroke.[18–22] However, adherence to dietary recommendations is less than desirable among patients with CHD.[23–24] Although the majority of patients followed a heart healthy diet during CR, less than half of the participants were following the diet 1–3 years later.[24] In the OASIS (Organization to Assess Strategies in Acute Ischemic Syndromes) trial, 21% of participants did not adhere to diet or exercise prescriptions, 43% adhered to one or the other, and 36% adhered to both diet and exercise at 3 months post event.[20] In a recent meta-analysis of the effects of diet, exercise, or both diet and exercise on lipids, reductions in serum cholesterol and LDL-C were greater for diet and diet and exercise combined.[25] In contrast, reductions in triglycerides were limited to the effects of exercise.[25] More studies are needed examining intervention strategies that improve dietary and lipid changes after CABG surgery.

Few studies have been done examining the risk factors and/or health behaviors of the healthy spouse of patients with CHD. In a descriptive study, CHD patients' and spouses' lifestyle behaviors were significantly correlated in relation to shared high-fat diet, sedentary lifestyle, overweight, and smoking behavior, placing the spouse at risk for coronary heart disease (CHD).[26] In one of the few intervention studies, Mosca et al.[27] provided risk factor screening and lifestyle counseling (primary prevention) for family members of patients undergoing cardiac revascularization, 65% of whom were spouses (Family Intervention Trial for Heart Health [FIT HEART]). Compared to control group participants, those in the intervention group demonstrated a greater likelihood to exercise ≥ 3 days per week,[27] better adherence to the therapeutic lifestyle change (TLC) diet, and improved HDLs.[28] Contrary to expectations, LDL cholesterol decreased in both groups with no significant difference between groups. In other studies, partners of cardiac patients also demonstrated improved dietary outcomes in response to family-based cardiovascular prevention programs.[29–30] Thus, there is preliminary evidence that a risk reduction program may benefit the healthy spouse although no studies were found using CR for this.

Family or couple-focused interventions in cardiovascular disease are in their early stages. Dunbar et al.[31] tested a family partnership intervention and found that involving the partner in sessions on family support and patient choice helped improve the heart failure patient's dietary sodium self-management. Stewart et al.,[32] testing a 12 week support group intervention, found that participants reported improved relations with spouse, enhanced coping, increased confidence about lifestyle change, and changed outlook. A recent meta-analysis examined 25 randomized couple-centered interventions in chronically ill patients and their partners, 6 of which were cardiac trials.[8] They found that couple interventions were successful in reducing patients' depressive symptoms, enhancing marital functioning, and reducing pain.[8] In contrast, two studies did not find significant improvements on indicators of family functioning and family resources.[33–34] Mosca et al.[27] described family involvement as a motivational moment that should be used to promote health/reduce cardiovascular risk factors in healthy family members who may share poor lifestyle behaviors or the genetics of the patient with CHD.

Conceptual Basis

The PaTH intervention was guided by theoretical concepts from social cognitive theory[35] and social support theory.[36] Cardiac Rehabilitation is designed to build self-efficacy through four main sources: successful performance of a behavior (losing weight), vicarious experiences (learning by observing role models), persuasion by authority (health care professionals), and physiological feedback (interpret symptoms accurately).[35] Social support, delivered within the PaTH intervention, is theorized to function through three support dimensions: emotional, tangible, and informational support.[36] First, emotional support (expressions of caring, empathy, and acceptance) functions to reduce the appraised threat of the cardiac event and to reassure one another that they are loved and accepted in this new set of circumstances. Tangible aid is important, particularly in early phases of CR, to assist individuals with tasks they temporarily need assistance with (cooking, transportation). By exercising in CR and following the cardiac diet together, the two members of the dyad provide practical assistance for each other for adopting health promoting behaviors. Third, informational support includes advice and suggestions about what to do, how to solve problems, or where to get needed information (from each other, CR staff). If the couple builds new habits together, they can motivate and support one another to engage in these behaviors and continue with them long-term. These lifestyle changes may, in turn, improve the cardiovascular health of both individuals. Although the spouse was included in the above-cited studies, few studies measured their outcomes in response to an intervention and no studies were found that included the spouse in an existing CR program to make the same lifestyle changes as the patient as in this study.

Methods

Design

This pilot study used an experimental, two-group, repeated measures design to examine differences between the PaTH intervention group and the usual care (UC) group in patients' and spouses' physical activity and healthy eating behaviors in response to CR.

Setting and Target Population

A convenience sample from a mid-western academic medical center and a community hospital was used. This study (referred to as the PaTH Intervention study) was a feasibility trial to pilot test the effects of the Partners Together in Health (PaTH) Intervention versus UC in improving physical activity and healthy eating behaviors, quality of life, and risk factors for heart disease. Spousal caregivers in the PaTH Intervention group joined CR with the patient to participate in exercise sessions and educational classes to undertake comprehensive risk reduction for themselves; caregivers in the UC group were invited to attend the educational sessions with the patient.

Eligibility criteria

Eligible patients included: a) age 19 or older (age of majority in Nebraska); b) diagnosis of coronary artery bypass graft surgery (CABGs) and enrollment in outpatient CR; c) married or living with partner for more than 1 year; d) partner was also willing to participate; e) no history of psychiatric illness; and f) classified as low to moderate risk for the occurrence of cardiac events during exercise.[37] Eligible spouses included: a) ≥ 19 years of age; b) no history of psychiatric illness; c) classified as low to moderate risk for the occurrence of cardiac events during exercise, d) married or living with CAB surgery patient for more than 1 year; and e) written permission from the primary health care provider to participate in the study. Exclusion criteria for both patients and spouses were: a) orthopedic problems that would prevent them from walking on a treadmill to maximum effort; b) history of cardiac arrest, sudden death, complex dysrhythmias at rest, or CHF diagnosis; c) resting systolic BP > 200 mmHg or diastolic BP > 100 mmHg; d) debilitating non-cardiac disease such as renal failure or anemia, severe chronic obstructive lung disease, or poorly controlled diabetics (diagnosed with diabetic ketoacidosis within the past 6 months or a current HgA1c > 11); or e) diagnosis of heart failure (HF) with an ejection fraction < 35 and/or clinical evidence of decompensated HF.[37]

Sample

Approximately 158 couples were assessed for eligibility (see Figure 1). We excluded 86 couples because they did not meet inclusion criteria leaving 72 eligible couples. Another 33 declined to participate. Thus, the participation rate was 54% (39 consented/72 eligible participants). Of the 39 couples who were eligible and consented to be in the study, we were unable to schedule four couples for baseline data collection. Therefore, 35 couples were randomly assigned to either the PaTH group (n=18) or the UC group (n=17). One patient in the PaTH group did not tolerate the baseline exercise test due to orthopedic problems and the couple was withdrawn from the study yielding an attrition rate of 12.8% (5/39). Consequently, the final sample consisted of 17 couples in each group. One patient in the UC group dropped out of the CR early (completed 33% of the CR program, 12 of 36 planned exercise sessions) but finished the remainder of the study protocol. No couples in either group were lost to follow-up; however, one patient in the UC group worked out of town so follow-up data were incomplete. Because men comprise the majority (65–70%) of CABS patients,[38] randomization was stratified by clinical sites and patient gender so that a 70% male to 30% female proportion of patients was randomized to the two groups. Couples were randomly assigned, in blocks of 4 or 6, to either PaTH or UC groups, using a statistician generated randomization schedule. This study included 34 CABG surgery patients and their spouses/partners. Because this study was considered a feasibility study with results being used to guide further research, the final sample size was determined by logistical and budgetary constraints.

Intervention

Patients in both groups and partners in the PaTH intervention group began outpatient CR within 3–5 days at the community hospital and within 2–3 weeks at the academic medical center after hospital discharge. Both CR programs are nationally certified by the AACVPR (https://www.aacvpr.org/Certification/CertificationCenter/tabid/496/Default.aspx) indicating standardized program elements. Individualized counseling and education were provided by a multidisciplinary team of nurses, dietitians, pharmacists, exercise specialists, and physicians. Individualized exercise plans were implemented that included aerobic, strength, and flexibility exercises, 3 days a week for 6 to 12 weeks (18 to 36 sessions). Although it was preferred to standardize the number of exercises sessions, these were ultimately dependent upon the patients' insurance coverage because of the fiscal constraints of the grant. Group education classes in nutrition, exercise, smoking cessation, knowledge of heart disease and risk factors, stress management, medications, and lifestyle change were offered on a regular cycle.

Patients in both CR groups were provided with individualized counseling, education, and goal setting in relation to life style changes (i.e., exercise regularly, eat low fat diet, lose weight, etc.), and feedback about progress towards goals at regular intervals. Spouses in the PaTH intervention group were also provided with these same CR features. Spouses in the

UC group were invited to participate in the group educational sessions. The CR program at the community hospital had an established program which allowed partners to exercise in the facility. Thus, although these spouses all chose to exercise with their mate in CR, these spouses did not receive individual counseling, monitoring, goal setting, and regular reassessments and feedback.

The specific diet goals that were negotiated with CR participants as part of the TLC diet were: 25–35% of total calories as fat; < 7% as saturated fats; < 200 mg/d of cholesterol; and 10–25 g/day of soluble fiber.[39–40] The goal for lipid management in the secondary prevention of CHD is to reduce the low density lipoprotein cholesterol (LDL-C) to < 70 mg/dL.[40] The goal for lipid management in primary prevention of CHD is to reduce the LDL-C to < 130 mg/dL if no risk factors and to < 100 mg/dL if two or more risk factors.[39–40] The specific physical activity goals that are negotiated with CR participants are based on the AHA's and the American College of Sports Medicine's (ACSM) position stands on exercise which recommend that individuals participate in at least 30 minutes of continuous or accumulated moderate physical activity on most or preferably all days of the week (minimum goal is ≥150 min/week at ≥ 3.0 METs).[17] Moderate-intensity physical activity generally requires sustained rhythmic movements and refers to effort expended while walking briskly, mowing the lawn, dancing, swimming, or bicycling.

Measures

The primary outcome variables that were measured in this study were physical activity/exercise and dietary intake behaviors and biomarkers. These behaviors were chosen because they are the risk reducing behaviors that are relevant to all individuals (patients and spouses) and they were the targeted behaviors that all CR patients and PaTH spouses were requested to change. Patients and spouses in both groups completed all of the measures at the 3 time points: baseline (close to the start of CR), post-CR (3 months), and at 6 months. In all of the measures we calculated change scores to examine improvement over time between baseline and 3 months, and between 3 and 6 month data collection points.

Physical activity behavior

PA was measured, objectively, by the Actiheart monitor (CamNTech Company, United Kingdom; www.camntech.com/products/actiheart/actiheart-overview). The Actiheart was worn on two standard ECG pads on the chest for 7 days at each data collection point. The Actiheart simultaneously records activity and heart rate and uses both parameters to calculate Physical Activity Energy Expenditure (PAEE). By combining both activity and heart rate, the accuracy of the energy expenditure calculation is substantially improved over using just activity or heart rate alone. Energy Expenditure calculations are within 0.02kJ/kg/min of those measured by a Cosmed K4b23 indicating strong accuracy.[41] PAEE estimates were compiled for all participants with at least four valid days of wear time. PAEE estimates were calculated using summed daily minutes of time spent in activities that were ≥ 3.0 METs as 3.0 METs is the starting MET level for moderate intensity PA (MET = metabolic equivalent of task is a physiological measure expressing the energy cost of physical activities).[42] Time spent in PA ≥ 3.0 METs was summed across the days, divided by the number of days for an average daily level of PA, and then multiplied by 7 for an average weekly level of PA.

The biomarker of physical activity/exercise was functional capacity assessed from an exercise tolerance test (ETT). The ETT was not a diagnostic test but rather a test of participants' functional capacity from which to ensure they were safe to exercise and measure change and improvement over time.[43] A conservative ramp protocol was used where speed and grade increased gradually by every 30 seconds.[44] Participants began by sitting quietly at rest for 5 minutes to allow for monitoring and recording of baseline heart rate (HR), blood pressure (BP) and cardiac rhythm. During the test, participants were monitored continuously with a 12-lead electrocardiogram (ECG). Auscultatory BP readings and the Borg 6–20 scale for Rating of Perceived Exertion (RPE) were obtained every two minutes during the test. The length of the ETT was limited to 10 minutes to ensure that individuals reached their maximum effort (termination criteria below) rather than quit early because of fatigue. Thus, the starting MET level for each participant differed and accounted for their current levels of physical activity and physical functioning. The tests were supervised by a Cardiology Fellow at the medical center and by an advanced practice nurse (APRN) at the community hospital who were blinded to the participant's group status. The PI was also present at each ETT and was blinded to group assignment to ensure consistent testing between the two clinical sites. Termination criteria for the test were: 1) subject request, 2) symptoms (fatigue, shortness of breath, angina, claudication, or other signs and symptoms of exercise intolerance), 3) the development of abnormal ECG changes suggestive of ischemia or significant arrhythmia, and 4) a drop in systolic BP (≥ 20 mmHg) or an abnormal rise in diastolic BP (≥ 20 mmHg over baseline). After peak effort was reached, participants walked on the treadmill at a slow pace for 5 minutes prior to sitting on a chair for the remainder of recovery. During recovery, HR, BP and cardiac rhythm were monitored for 10–15 minutes. The maximum MET level achieved on the ETT was the variable used in the analysis.

Dietary intake behavior

The 3-day Food Record was used to assess food intake and changes in eating behavior over time.[45] This technique is a well-accepted measure of dietary intake.[46–47] The participant recorded all food and beverages consumed on 3 typical days including two weekdays and one weekend day. The participants were asked to describe in as much detail as possible their food intake, recording ingredients, name brands, and portion sizes. Portion sizes were estimated based on standard household measures and the use of a packet of food pictures depicting portion sizes provided to each participant. The participants were instructed in the method of completing the 3-day Food Record by a member of the research team. Dietary intake data were then entered and analyzed using Nutrition Data System for Research (NDS-R) software[48] by a dietitian who was blinded to group assignment. NDS-R software provides a complete nutrient profile for all foods in the database. The NDS-R has a comprehensive quality control system to ensure accuracy and internal consistency of the database.[49] Using this software, the following variables were generated for analysis based on a three-day average intake: 1) cholesterol intake in mgs/day, 2) % of fat calories in diet, 3) % of saturated fat calories in the diet, and 4) fiber in g/day.

A lipid profile was also measured as a biomarker of eating behavior to examine the effects of modifications in dietary behaviors. Baseline lipid profiles were drawn before the start of CR in spouses. The preferred time to draw lipids in patients is before surgery as lipid values are not accurate until 6-weeks post-CABG surgery. Thus, we used preoperative lipids as the baseline values for patients whose preoperative lipids were available (80%). In the remaining patients, lipids were drawn 6 weeks after surgery when it had returned to pre-surgery values. This did not differ across groups. Both patients and spouses also had them drawn at 3 and 6 months post-CABG surgery to examine changes in the lipid profile. The profile includes measurements of total cholesterol, high density lipoprotein-cholesterol (HDL-C), low density lipoprotein-cholesterol (LDL-C), and triglycerides. Participants were instructed to fast for 12 hours and avoid alcohol consumption for 24 hours prior to having their blood drawn. The method, used by all laboratories met the Laboratory Standardization Panel recommendation of bias ≤ 3 %.

Procedures

Participants were mailed the study questionnaires 7–10 days ahead of their in-person visit for their ETT and instructed to complete them prior to the ETT. At the time of the face-to-face visit and ETT, the questionnaires were reviewed by project staff for any missing data. The 3-day food records also were reviewed closely for completeness.

Data analysis

Analysis of physical activity and eating behavior outcomes was done to test whether significant differences were found between the PaTH group and UC group at the end of CR (3 months) and at follow-up (6 months). Two change scores were calculated: change between baseline and 3 months was calculated by subtracting baseline from 3 month scores and change between 3 and 6 months was calculated by subtracting 3 month from 6 month scores. The 3 and 6 month change scores were compared between the intervention and control groups using a Mann-Whitney test. The level of significance for all comparisons was set at $p < 0.05$ (two-tailed tests). However, because this was a feasibility study and we were interested in calculating effect sizes (ES) from the data, the following values were used for interpreting effect size using the Mann-Whitney test: small = 0.10; medium = 0.30; large = 0.50, equivalent to Cohen's f values of .10, .25, and .40, respectively.[50] Analysis was conducted on an intent-to-treat basis. Patients were analyzed according to their randomized assignment. There was a very small amount of missing data; thus, analyses were performed on the variables with complete data only.

Results

Table 1 contains the demographic and illness characteristics of the sample by group. On average, the majority of the couples were married, Caucasian, employed, had a high school education, and an annual household income between $30–70,000. In relation to CR, patients in both groups demonstrated very good adherence to both the exercise (≥ 90%) and educational sessions (> 75%). Spouses in the PaTH group also demonstrated very good adherence to the exercise sessions (89%). Adherence to the educational sessions was lower for PaTH (79%) and UC (68%) spouses compared to patients. The majority of UC spouses at the community hospital site also participated in the exercise sessions (94%) although they did not receive the individual counseling, monitoring, goal setting, and regular re-assessments and feedback. In relation to illness characteristics, patients had similar numbers of bypass grafts, ejection fraction, and the majority of patients were on lipid medications. In contrast, less than half of the spouses in both groups were on lipid medication. There were no differences between patient groups or between spouse groups in demographic and CR characteristics.

The results can be found in Tables 2 (patients) and 3 (spouses). Patients in both groups increased their PA levels between the start and end of CR (favored UC group, ES = 0.14). In contrast, between the end of CR (3 months) and 6 months, PA levels declined in both groups. The median levels of PA at 6 months were below the recommended guidelines of moderate-intensity PA (≥ 150 min/wk). Functional capacity increased in both groups between baseline and 3 months (favored UC group, 0.11) and 3 and 6 months (favored PaTH group, ES = 0.29). Similarly, between the start and end of CR, eating behavior improved more for patients in the UC group than the PaTH group (less dietary cholesterol, % saturated fat calories and more fiber intake); but by 6 months this trend reversed and now the PaTH group exhibited better eating behaviors in relation to fewer % saturated fat calories.

In relation to the patients' lipid results, the UC care group experienced more decline in serum cholesterol and LDL-C between baseline and 3 months (ES = 0.12 and 0.16, respectively). Between 3 and 6 months, serum cholesterol increased in both groups but the PaTH group experienced a smaller increase than the UC group (ES = 0.15). HDL did not change between baseline and 3 months in either group but significantly increased in the UC group between 3 and 6 months (p = 0.01; ES = 0.47). Triglycerides were stable over time in both groups.

Spouses in both groups demonstrated similar increases in PA behavior between baseline and 3 months as patients and declines between 3 and 6 months. At both 3 and 6 months, the median levels of PA for spouses in both groups were above the recommended guidelines per week of moderate-intensity PA (≥ 150 min/wk). Eating behavior improved more for spouses in the UC group between baseline and 3 months (dietary cholesterol and fiber intake) (small ES) and improved more for spouses in the PaTH group between 3 and 6 months (% fat and saturated calories and cholesterol) (small-medium ES). Lipid results mirrored the trends in eating behavior showing improvement in the UC group between baseline and 3 months and improvement in the PaTH group between 3 and 6 months. The one exception was that the UC group improved HDL (ES = 0.25) between 3 and 6 months.

Across all 10 indicators, 7 indicators favored the UC group and 3 were equal between patient groups at the end of CR. However, at 6 months, there was an opposite trend where two indicators favored the PaTH group, 4 were equal between groups, and only 4 favored the UC group. In spouses, 5 indicators favored the UC group, 2 favored the PaTH group, and 3 were equal between groups at the end of CR. In contrast, at the 6 month follow-up, 6 indicators favored the PaTH group, 3 were equal between groups, and only 1 favored the UC group.

Discussion

The PaTH intervention was successful primarily in demonstrating improved trends in healthy eating behavior for patients and spouses. The improved eating behavior of the couples was likely facilitated by the unique couple-focused intervention in that couples were asked to work together to build new eating habits. The other main finding of the PaTH intervention was that patients and spouses continued to report improvements between 3 and 6 months which is typically when adherence starts declining in CR programs.[21] Thus, the PaTH intervention was successful in offsetting decreasing adherence. Another unique aspect of this study is that few prior studies measured outcomes in spouses.[8] In their meta-analysis, Matire et al.[8] found that only 2 of the 7 couple-oriented studies involving CHD patient-partner dyads reported partners' outcomes, thus limiting our understanding of how CABG surgery impacts both members of the patient-spouse dyad. However, the findings from this pilot study warrant testing in a larger sample size to determine whether the couple focused intervention is more effective for additional physical activity and risk factor outcomes than current individually-oriented education strategies.

The PaTH intervention was not successful in bringing about lasting outcomes in physical activity behavior in patients and spouses. Although PA levels increased in patients and spouses in both groups during CR, they decreased after CR. It is likely that the lack of differences between the UC and PaTH groups was because of the clinical site that allowed partners to exercise with patients. This was also primary recruitment site so it was likely that partner participation at this site attenuated the effects of the PaTH intervention. In a recent study, Ferrier et al.[51] found that the behavioral intervention strategies that were successful in increasing patients' physical activity after CR were self-monitoring, specific goal setting, identifying barriers, and plans for relapse prevention. These strategies, in addition to a true control group, need to be built into a future study testing the PaTH intervention in a larger sample.

At 6 months, patients in both groups were engaged in < 150 min/wk of moderate intensity PA, the level sufficient to lower risk of coronary heart disease.[17] These findings are supported by previous studies. Moore et al.[15] also found that many participants in a lifestyle modification program, designed to maintain PA levels after CR, were exercising below the recommended levels. In the current study, spouses met the recommended guideline (≥ 150 min/wk) of moderate intensity PA and were almost twice as active as patients at all 3 time points.

The PaTH intervention was successful primarily in demonstrating improved trends in dietary intake for patients and spouses. These results were supported by findings from two prior studies in which dietary outcomes were better for the family-based intervention group compared to the control group.[27,30] In this study, the spouse was the primary person preparing the family meals in both groups. Spouses in the PaTH group may have worked harder to follow the TLC diet than spouses in the UC group because the PaTH participants had been asked to work together as a couple to follow the dietary guidelines and thus, were more committed to cooking and adhering to the TLC diet.

Based on the results of this study, the couple-oriented focus of the intervention needs to be enhanced in a future study. Although CR programs invite the spouse or family to attend the educational classes, they typically have an individual focus. That is, content is directed at the patient with the expectation that the spouse will help the patient adhere to the health care recommendations. In addition, the couple may not have the best ways of interacting or may not understand how to support one another. Thus, couples need to be taught how to work together to make these lifestyle changes. In a future study, the PaTH intervention needs to be more robust to include sessions about how best to support one another when making lifestyle changes, what changes can be expected in family relationships in response to a life-threatening illness and how these affect illness management, and skills training in clarifying expectations for PA/exercise and healthy eating changes.

Limitations

There were several limitations in this study. Because this was a feasibility study, the study was underpowered to detect statistically significant differences and the results must be interpreted with caution. Although trends were in the right direction and favored the PaTH intervention group particularly at 6 months, a larger sample size and a longer follow up period are needed to more definitively test the effects of the PaTH intervention vs. UC in improving physical activity and healthy eating behaviors and their respective biomarkers for patients and spouses after CABG surgery. Another limitation was that the UC group differed for spouses between the two clinical sites. Spouses in the UC group at the community hospital were able to exercise with patients although they did not receive individualized risk factor counseling, exercise prescription updates, or monitoring. This variation on the planned UC intervention may have impacted outcomes and it is likely that we would have seen even greater effects of the PaTH intervention for spouses with a true control group. In a larger study, spouses who elect to enroll in the partnership program will not be allowed to participate in the study. There was also limited racial/ethnic diversity in sample; however, the sample was representative of the racial diversity in the metropolitan area where the study was conducted. In addition, selection bias may have been operating in that it was a convenience sample and we may have attracted couples to the study who were interested in working together as a couple. Thus, those couples where marital satisfaction was lower may not have chosen to participate in the study.

In summary, the PaTH intervention demonstrated promising results for facilitating positive physical activity and healthy eating behaviors in patients and spouses after CABG surgery as a couple-focused intervention. A larger sample and a longer follow up period is needed to definitively test the impact of the PaTH intervention on patients and spouses in a future study. In a larger study, it is hypothesized that the PaTH Intervention, where two people work together to make lifestyle changes and support one another, will yield better adherence to PA and dietary guidelines and promote cardiovascular health for both patient and partner than will individually focused (patient only) interventions that are currently in use.

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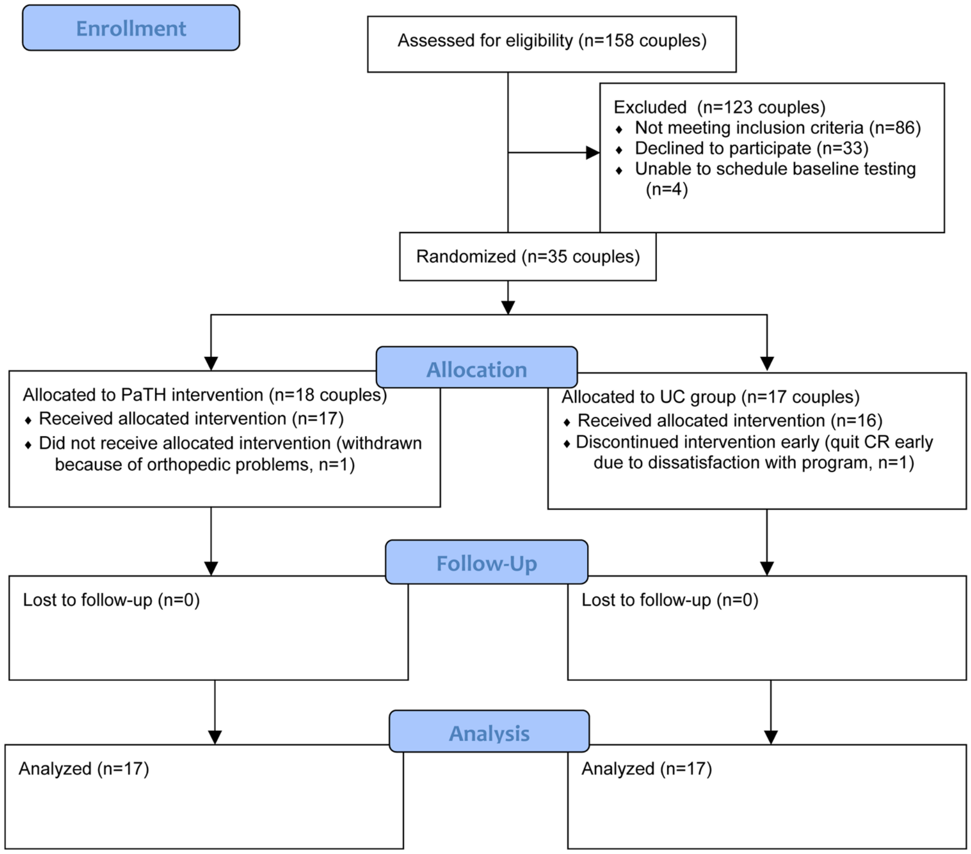

Figure 1.
Study Flow Diagram

Table 1

Demographic and Illness Characteristics of Patients and Spouses at Baseline

Variable	Patients		Spouses	
	PaTH group N=17 Mdn (Range)	**UC group N=17 Mdn (Range)**	**PaTH group N=17 Mdn (Range)**	**UC group N=17 Mdn (Range)**
Age (years)	64 (33–77)	66 (40–77)	62 (33–76)	63 (29–76)
Education (years)	14 (12–17)	16 (9–17)	14 (11–17)	16 (8–17)
CR Adherence				
Exercise sessions	98% (80–100)	90% (33–100)	89% (50–100%)	--
Educational sessions	77% (50–100%)	79% (39–100%)	79% (39–100%)	68% (0–100%)
# of bypass grafts	4.0 (1–5)	3.0 (2–5)	--	--
Ejection fraction	60 (37.5–65)	57.5 (38–67.5)	--	--
	N (%)	N (%)	N (%)	N (%)
Gender				
Males	15 (88%)	13 (77%)	2 (12%)	3 (18%)
Females	2 (12%)	4 (23%)	15 (88%)	14 (82%)
Married	17 (100%)	15 (88%)		
Employment status				
Working	14 (82%)	10 (59%)	10 (59%)	10 (59%)
Retired/not working	3 (18%)	7 (41%)	7 (41%)	7 (41%)
Race (Caucasian)	15 (88%)	17 (100%)	16 (94%)	16 (94%)
Household income				
< $30,000 annually	2 (12%)	1 (6%)		
$30–70,000 annually	8 (47%)	10 (59%)	--	--
> $70,000 annually	7 (41%)	6 (35%)		
On lipid medications[a]	16 (94%)	16 (94%)	8 (47%)	7 (41%)

CR = Cardiac Rehabilitation

UC = Usual Care

[a]During the 6 month study, 1 patient in each group changed the lipid lowering medications they were taking. One spouse in the UC group and 2 spouses in the PaTH group had their lipid medication discontinued; 2 spouses in the PaTH group started on lipid medications.

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Table 2

Patients: Mann Whitney U Tests Comparing Differences by Groups in Changes over Time in Physical Activity (PA) and Eating Behaviors

Outcome variable	Median (min, max) Baseline	Median change (Min, Max) 3 mo - B	Median change (Min, Max) 6 mo – 3 mo	Δ 3mo-B Z statistic[a]	*p* value (effect size)	Δ 6mo-3mo Z statistic[a]	*p* value (effect size)
PA behavior (min/wk ≥ 3 METs)							
UC	28.0 (0, 402.5)	+105.0 (−280.0, 1044.8)	−11.4 (−770.0, 504.0)	0.81	0.42	0.26	0.79
PaTH	31.5 (0, 250.3)	+57.8 (−31.5, 201.3)	−24.5 (−218.8, 855.8)		(0.14)[b]		(0.05)[d]
PA biomarker (Exercise tolerance test: Max METs)							
UC	7.0 (2.4, 11.2)	+2.7 (−1.0, 5.8)	+0.5 (−0.8, 2.3)	0.61	0.54	1.63	0.10
PaTH	7.0 (4.5, 10.7)	+2.3 (0, 5.3)	+0.45 (−1.4, 0.9)		(0.11)[b]		(0.29)[b]
Eating behavior							
% fat calories in diet (goal < 25–35% of total calories)							
UC	31.6 (22.5, 49.6)	+1.5 (−19.8, 6.9)	−0.7 (−10.3, 19.1)	0.40	0.69	0.28	0.78
PaTH	33.3 (20.6, 39.5)	−1.8 (−8.4, 9.7)	+0.6 (−11.8, 8.3)		(0.07)[d]		(0.05)[d]
Dietary cholesterol (< 200 mg/day)							
UC	217.1 (105, 453)	−40.4 (−218.7, 86.6)	+26.5 (−89.1, 262.0)	2.28	0.03*	0.85	0.40
PaTH	152.1 (85, 411.9)	+11.5 (−174.9, 332.0)	+31.9 (−298.0, 143.0)		(0.40)[b]		(0.15)[b]
% saturated fat calories in diet (≤ 7% of total calories)							
UC	9.6 (6.9, 19.5)	−0.6 (−10.6, 3.9)	+0.7 (−2.4, 8.3)	1.30	0.19	0.81	0.42
PaTH	9.9 (5.5, 14.2)	+0.4 (−4.2, 6.1)	−0.3 (−10.4, 5.5)		(0.23)[b]		(0.14)[c]
Fiber (20–30 g/day)							
UC	14.8 (10.7, 41.4)	+4.1 (−21.1, 19.3)	+2.0 (−18.2, 8.8)	1.68	0.09	0.13	0.90
PaTH	20.1 (7.2, 31.8)	+0.7 (−10.9, 14.5)	−1.3 (−13.9, 18.6)		(0.30)[b]		(0.02)[d]
Eating behavior biomarkers (lipid profile)							
Serum cholesterol (< 200 mg/dL)							
UC	168.5 (105, 272)	−32.5 (−113, 40)	+5 (−29, 43)	0.68	0.49	0.88	0.38
PaTH	154 (105, 291)	−12.0 (−136, 70)	+3 (−51, 60)		(0.12)[b]		(0.15)[c]
Triglycerides (<150 mg/dL)							
UC	122.5 (58, 253)	−22.5 (−157, 38)	+6.0 (−48, 112)	0.47	0.67	0.45	0.65

Outcome variable	Median (min, max) Baseline	Median change (Min, Max) 3 mo - B	Median change (Min, Max) 6 mo – 3 mo	Δ 3mo-B Z statistic[a]	*p* value (effect size)	Δ 6mo-3mo Z statistic[a]	*p* value (effect size)
PaTH	134 (59, 334)	−27.0 (−154, 83)	+16.0 (−42, 244)		(0.08)[d]		(0.08)[d]
HDL (> 40 mg/dL for men; > 50 mg/dL for women)							
UC	42.5 (25, 99)	−0.5 (−9, 16)	+4.5 (−4, 14)	0.43	0.67	2.73	0.01*
PaTH	36 (28, 57)	+1.0 (−12, 18)	−4.0 (−11, 39)		(0.08)[d]		(0.47)[b]
LDL (< 70 mg/dL)							
UC	98 (31, 193)	−34.5 (−102, 42)	−2.5 (−33, 28)	0.90	0.37	0.79	0.43
PaTH	97 (53, 207)	−13.0 (−110, 61)	+2.0 (−48, 25)		(0.16)[b]		(0.14)[b]

* $p<0.05$

Note. UC = UC group; METs = Metabolic equivalents

[a] Group difference scores were compared using the Mann-Whitney test; effect sizes are interpreted as: small = 0.10; medium = 0.30; large = 0.50;

[b] Results favor UC group (UC);

[c] Results favor PaTH intervention group;

[d] If effect size was < .10, changes over time were considered equal between groups; HDL = high density lipoprotein; LDL = low density lipoprotein

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Table 3

Spouses: Mann Whitney U Tests Comparing Differences by Groups in Changes over Time in Physical Activity and Eating Behaviors

Outcome variable	Median (Min, Max) Baseline (B)	Median change (Min, Max) 3 mo - B	Median change (Min, Max) 6 mo – 3 mo	Δ 3mo - B Z statistic[a]	*p* value (effect size)	Δ 6mo-3mo Z statistic[a]	*p* value (effect size)
PA behavior (min/wk ≥ 3 METs)							
UC	162 (15.8, 645.8)	+63.9 (−184, 450)	−76.1 (−413, 933)	0.08	0.94	0.24	0.81
PaTH	294 (31.5, 565.3)	+29.8 (−315, 653)	−36.8 (−640.5, 318.5)		(0.01)[d]		(0.04)[d]
PA biomarker (Exercise tolerance test: Max METs)							
UC	7.8 (4.8, 11.6)	+0.9 (0, 2.5)	0 (−0.5, 0.9)	0.36	0.72	0.19	0.85
PaTH	8.7 (5.1, 12.8)	+0.9 (−0.4, 2.9)	0 (−2.4, 1.0)		(0.06)[d]		(0.03)[d]
Eating behavior							
% fat calories in diet (goal < 25–35% of total calories)							
UC	28.9 (22.1, 57.6)	+2.0 (−36.4, 21.6)	+6.2 (−18.4, 13.6)	0.96	0.34	1.79	0.08
PaTH	35.7 (16.8, 48.0)	−0.2 (−15.8, 13.7)	+0.4 (−17.7, 8.2)		(0.17)[c]		(0.31)[c]
Dietary cholesterol (< 200 mg/day)							
UC	203.4 (96, 493)	−31.2 (−244, 244.3)	+73.7 (−344.5, 539)	0.58	0.56	1.30	0.20
PaTH	175.5 (34, 457)	−25.1 (−174, 123)	+32 (−84, 225.2)		(0.10)[b]		(0.23)[c]
% saturated fat calories in diet (≤ 7% of total calories)							
UC	9.9 (5.7, 16.0)	+0.3 (−8 to 11.4)	+1.5 (−9.7 to 5.1)	0.43	0.67	0.73	0.47
PaTH	9.7 (6.5, 15.9)	+1.0 (−8.9 to 3.3)	−1.0 (−3.5 to 3.0)		(0.08)[d]		(0.13)[c]
Total fiber (20–30 g/day)							
UC	13.8 (6.4, 22.1)	+1.1 (−4.0, 12.7)	−1.2 (−7.8, 10.6)	1.22	0.23	0.92	0.36
PaTH	17.2 (7.4, 26.9)	−1.0 (−9.4, 9.8)	+0.7 (−8.9, 13.2)		(0.22)[b]		(0.16)[c]
Eating behavior biomarkers (lipid profile)							
Serum cholesterol (< 200 mg/dL)							
UC	175.5 (105, 232)	−5.0 (−35, 103)	+9.5 (−8, 55)	1.05	0.30	0.97	0.34
PaTH	177 (111, 252)	+1.0 (−125, 93)	+2.0 (−56, 45)		(0.18)[b]		(0.17)[c]
Triglycerides (<150 mg/dL)							
UC	110 (29, 363)	−4.0 (−64, 99)	−1.5 (−94, 128)	0.77	0.44	0.38	0.71

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Outcome variable	Median (Min, Max) Baseline (B)	Median change (Min, Max) 3 mo - B	Median change (Min, Max) 6 mo – 3 mo	Δ 3mo - B Z statistic[a]	*p* value (effect size)	Δ 6mo-3mo Z statistic[a]	*p* value (effect size)
PaTH	94 (49, 171)	0.0 (−78, 50)	−4.0 (−58, 87)		(0.13)[b]		(0.07)[d]
HDL (> 40 mg/dL for men; > 50 mg/dL for women)							
UC	54 (26, 82)	−2.0 (−17, 10)	+3.5 (−8.0, 19)	1.05	0.30	1.41	0.17
PaTH	49 (26, 87)	+2.0 (−10, 13)	0.0 (−13.0, 32)		(0.18)[c]		(0.25)[b]
LDL (< 100 mg/dL)							
UC	104 (21, 148)	−7.5 (−32, 101)	+5.0 (−20, 57)	0.65	0.52	0.79	0.43
PaTH	100 (65, 184)	−1.0 (−119, 81)	+3.0 (−58, 39)		(0.11)[b]		(0.14)[c]

[*] $p < 0.05$

Note. UC = UC group; METs = Metabolic equivalents

[a] Group difference scores were compared using the Mann-Whitney test; effect sizes are interpreted as: small = 0.10; medium = 0.30; large = 0.50;

[b] Results favor UC group (UC);

[c] Results favor PaTH intervention group;

[d] If effect size was < .10, changes over time were considered equal between groups; HDL = high density lipoprotein; LDL = low density lipoprotein