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Personal characteristics, health status, physical activity, and quality of life in cardiac rehabilitation participants

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Abstract

The purpose of this study was to examine the relationships between personal factors, health status, and adherence to physical activity behavior, and quality of life in cardiac rehabilitation participants. The record of 146 subjects, who met inclusion criteria were obtained from the University Cardiac Rehabilitation Database. Change scores in physical activity were used as a proxy for adherence. Participants who were categorized as not working, female gender, and at high-risk health status had lower means and lower improvement scores from repeated measures analysis of variance. This study found that some personal factors and health status are significant factors influencing the participant's adherence to physical activity recommendations and quality of life in this cardiac rehabilitation program.

Keywords: Cardiac rehabilitation program; Physical activity; Adherence; Quality of life

1. Introduction and background

Healthy People 2010 (US Department of Health and Human Services, 2000) stipulated physical inactivity is an important health indicator. Physical activity has a wide variety of health benefits not only in enhancing quality of life (Belardinelli et al., 1999) but also in improving physical fitness (Ishikawa et al., 1999; Shin, 1999), in reducing body fat and weight (Fogelholm et al., 2000; Ten Have et al., 1997), in reducing diabetes incidence and progression (Maiorana et al., 2001; Manson et al., 1992), in blood pressure reduction (Taylor-Tolbert et al., 2000; Tanaka et al., 1998; Dunn et al., 1999; Vasan et al., 2002), and in depression (Greig et al., 1994). However, physical inactivity remains a major barrier for positive health outcomes in the United States. The challenge facing health care professionals today is how to encourage people to be physically active and to maintain health promoting behaviors. Studies have shown that physical activity declines dramatically in the months after a myocardial infarction (Greig et al., 1994; Miller, 1997). Between 30% and 70% of adults who start preventive health-related exercise drop out within 6 months (Miller, 1997).

Numerous factors influence adherence to physical activity recommendations. Personal factors, such as biological, psychological, and sociocultural are important for adherence. People differ on many factors that affect changes of physical activity behavior and health outcomes (Pender, 1996). For example, women tend to have higher dropout rates in cardiac rehabilitation than men (McGee and Horgan, 1992). Older people are less likely to participate in cardiac rehabilitation program than younger people (Sotile and Miller, 1998). Full time employment has been shown to be associated with lack

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of exercise (Cohen et al., 1991). Studies (Kulik and Mahler, 1993; Bovbjerg et al., 1995; Stenstrom et al., 1997) have reported a positive association among social support, exercise adherence, and quality of life. Married patients had higher emotional support, and support was positively related to emotional status (lower anxiety and depression), perceived quality of life, and compliance with recommended ambulation in patients undergoing non-emergency coronary artery bypass graft surgery (Kulik and Mahler, 1993). Fewer functional limitations due to health was a significant factor influencing adherence to an exercise program in older adults (Resnick and Spellbring, 2000; Resnick, 2001). Several clinical trials (Smith et al., 1995; Dugmore et al., 1999; Willenheimer et al., 1998) have shown that lifestyle changes can effectively extend overall survival and improve quality of life in patients with cardiovascular disease (CVD).

CVD is a major health concern and a common condition resulting in the loss of independence and reduced quality of life for many people (Mayou et al., 2000). Anxiety and depression, loss of interest in environment and social interactions, sexual difficulties, and sleep disturbances can often result in reduced quality of life among post-myocardial infarction patients (Crilley and Farrer, 2001; Schoemaker and Smits, 1994).

Cardiac rehabilitation programs provide exercise, education, and assistance in a medically supervised environment to help people with CVD make recommended behavioral changes and to have better quality of life. Though it is the responsibility of the cardiac rehabilitation program to provide those services, it is also apparent that the participants are the ones who actually have to follow the service guidelines. However, limited sources are available to look at adherence and quality of life factors in people with CVD. To develop effective strategies for promoting adherence to physical activity recommendation and for improving quality of life in people with CVD, more information is needed.

1.1. Aim

The aim of this study was to assess whether personal factors and the health status of the cardiac rehabilitation program participants would predict exercise program attendance, adherence with physical activity behavior during the program and at 1 year follow-up, and quality of life.

2. Method

2.1. Design

This was a retrospective study with repeated measures design based on a secondary analysis of prospectively collected data from participants completing the University of Alabama at Birmingham cardiac rehabilitation program. The database, Cardiopulmonary Outcomes: Prospective Evaluation (COPE) (Sanderson et al., 1997), included detailed demographic, clinical, and outcome information collected at program entry, completion, and 1 year following program completion for each participant. Approvals from the Institutional Review Board (IRB) for the protection of human subjects and the medical director and the program manager of the UAB Cardiac Rehabilitation Program were obtained prior to accessing the data.

2.2. Sample

People who were eligible for cardiac rehabilitation services, attended measurement points at baseline, program completion and 1 year follow-up, and had complete data on all of the key variables of interest were included in the analysis. Participants with missing data on any of the key variables (personal factors, health status, physical activity scores, quality of life scores) were excluded. To overcome the problem of having insufficient observations within some of the demographic variables of work and marital status, similar categories were collapsed. Specifically, marital status was divided into two groups, married and not married. Prior to collapsing the categories, the not married group included divorced (11.4%), single (5.4%), widowed (10.1%), and others (1.3%). Work status was divided into working, not working, and retired. The not working group included disabled (15.4%) and unemployed (4%).

3. Cardiac rehabilitation program

The cardiac rehabilitation program consisted of 8–14 weeks of contact, with two to three 1-h sessions each week. Interventions provided included exercise prescription and training, and education and counseling on disease management and risk reduction. Outcomes measured in the cardiac rehabilitation program specific to this study included quality of life with the Short Form-36 (SF-36) (Ware and Sherbourne, 1992), physical activity behavior with the Physical Activity Questionnaire (Sallis et al., 1985), health status with the American Association of Cardiovascular and Pulmonary rehabilitation (AACVPR) (American Association of Cardiovascular and Pulmonary Rehabilitation, 2001) risk stratification, and adherence with exercise program with number of sessions attended. Adherence to physical activity recommendations was proxy measured with change scores in physical activity.

The initial demographic data were entered at the time of participant referral. All clinical data were obtained

from the medical record, the rehabilitation assessment form, and relevant questionnaires, including the physical activity and quality of life measurements. Standardized protocols for data collection were used within the clinical setting.

3.1. Instruments

Data collection instruments used in the cardiac rehabilitation program for assessing participant outcomes in this study included physical activity and quality of life questionnaires. Personal factors (age, gender, race, marital status, and working status) and health status (AACVPR risk stratification) were abstracted from the participants' medical records by the rehabilitation staff and entered into the database. Cardiac rehabilitation attendance was measured by the rehabilitation staff and entered into the database.

The Physical Activity Questionnaire assesses the participant's recent (7-day) energy expenditure in both leisure/recreation activity and work/home activity. This questionnaire was modeled after the Seven-Day Physical Activity Recall in estimating energy expenditure by calculating the number of minutes spent in moderate and vigorous activity. Test-retest reliability of the Seven-Day Physical Activity Recall, measured over 2 weeks, has been reported as r=0.83 ($p<0.0001$) for vigorous activities, and $r=0.75$ ($p<0.0001$) for moderate activities (Sallis et al., 1985). Responses to the Physical Activity Questionnaire were used to calculate total metabolic equivalent hours (totmethrs) by converting the participant's self-reported minutes into hours and multiplying the approximate MET level reported for both moderate and vigorous activities. Moderate-intensity physical activity was approximated at 4 METS and vigorous-intensity was approximated at 6 METS.

The SF-36 (Ware and Sherbourne, 1992) was used to measure health-related quality of life. The SF-36 has two summary scores, physical domain scales and mental domain scales. The physical domain subscales were physical functioning (limitation in physical activity due to physical health), role-physical (problems with work and daily activities due to physical health), bodily pain (severity of pain), and general health (evaluation of physical health and likelihood of improvement). The mental domain subscales were vitality (energy level), social functioning (interference in social activities due to physical and emotional health problems), role-emotional (problems with work and daily activities due to emotional problems), and mental health (anxiety and depression). In this study, analysis was done with the summary scores. Higher scores on the SF-36 indicated greater satisfaction and healthy functioning and low scores indicated poorer satisfaction and functioning (Fauerbach et al., 1999). Scores were transformed to a range of 0–100. The SF-36 summary scores are norm-based to the general U.S. population with a mean of 50 and standard deviation of 10, and have been extensively tested for reliability and validity (McHorney et al., 1994, 1993).

Clinical risk stratification (high, moderate, low risk) was used as a proxy for health status. The clinical risk stratification reflects severity of disease based on the AACVPR criteria.

Adherence was proxy measured with change scores of physical activity from baseline to completion of cardiac rehabilitation.

4. Analysis

All statistical analyses were performed using SPSS. The level of significance was set at 0.05 two-sided. Descriptive statistics were used to describe distributions of participant characteristics and to determine if there were differences in personal factors and health status in people who returned for 1 year follow-up and those who did not. Paired t-tests were used to assess change of physical activity and quality of life from baseline to completion. Pearson's Product Moment Correlational analyses were used to investigate the relationships among baseline measures of personal factors, health status, number of sessions attended, physical activity behavior, and quality of life. Repeated measures analysis of variance was used to look at the influence of personal factors and health status on physical activity behavior and quality of life over time.

5. Results

5.1. Sample

The record of 146 of 206 participants who had completed the cardiac rehabilitation program between December 1996 and August 2000 met the inclusion criteria for entry into the study. The subjects in the study exhibited a mean age of 60 years old (SD: 10.8, range 31–81), and were married (73.3%), white (71.2%), retired (42.5%), and male (68.5%) (see Table 1). Of these 146 subjects, only 35 had complete data at 1 year follow-up and were included in these analyses. Mean age for those who returned for 1 year follow-up was 59 years old (SD: 10.6, mode: 56, median: 58), whereas the mean for those who did not was 61 years old (SD: 10.9, mode: 68, median: 62). Females, African Americans, married people, and people who were working and in lower risk group were slightly more likely to return for 1 year follow-up.

Table 1
Sample characteristics

Variable	N	%
Age		
<56	47	32.2
56–66	53	36.3
>66	46	31.5
Gender		
Female	46	31.5
Male	100	68.5
Race		
African-American	42	28.8
White	104	71.2
Marital Status		
Married	107	73.3
Not-married	39	26.7
Work		
Not-working	28	19.2
Retired	62	42.5
Working	56	38.4
Clinrisk		
H (high)	50	34.3
I (intermediate)	78	53.4
L (low)	18	12.3

5.2. Correlations among baseline measures

Correlations among baseline measures were conducted on personal factors, health status, physical activity behavior, and physical and mental components of quality of life. Results indicated negative correlations between age and physical activity behavior ($r=-0.17$, $p<0.05$), and between gender and physical component of quality of life ($r=-0.19$, $p<0.05$). In addition, there was a significant positive correlation between health status and physical activity behavior ($r=0.24$, $p<0.001$) as shown in Table 2. Seventy-three percent achieved a 100% attendance rate, and 19% showed a less than 80% attendance rate. Participants who attended fewer than two thirds of the exercise sessions (14%) were considered to be dropouts from the exercise program. There was a significant correlation ($r=0.61$, $p=0.003$) between race and number of sessions attended. Sixty-seven percent ($n=14$) of the dropouts were white.

5.3. Personal factors, health status, and physical activity behavior

Paired t-test showed significant improvement in physical activity behavior from baseline to end (mean scores, 7.5 ± 12.5 to 21.5 ± 15.8; $t=-9.781$, $p<0.001$). Given the significant improvement in physical activity scores, repeated measures analysis of variance was used to assess whether personal factors and health status had any influence on physical activity behavior.

Table 2
Pearson correlation coefficient matrix ($N=146$)

	Physical activity	Physical component	Mental component
Age	−0.17*	−0.10	−0.07
Gender	−0.07	−0.19*	−0.16
Race	0.06	−0.11	−0.13
Work status	−0.16	−0.20	−0.16
Marital status	0.02	0.02	0.10
Health status	0.24**	0.42	−0.26

*$p<0.05$, **$p<0.001$.

Significant group differences were found for working status and health status variables. Participants who were working and in the low-risk health status showed the highest mean physical activity scores, whereas participants who were not working and in the high-risk health status had the lowest mean physical activity scores at baseline and end (Table 3). The oldest group (age >65) reported the lowest physical activity scores (3.7 ± 4.8) compared to other age groups (age 56–65: 9.6 ± 15.8; age < 56: 9.0 ± 13.0) at baseline. However, personal factors did not show significant interactions with time.

5.4. Personal factors, health status, and physical component scales

Paired t-test analyses showed significant improvement in physical component scores from baseline to end (mean scores of 47.4 ± 21.3 to 62.9 ± 24.5; $t=-10.393$, $p<0.001$). Repeated measures analysis of variance was used to assess the influence personal factors and health status had on the improvement of the physical component of quality of life.

Significant group differences were found for the gender, working status, and health status variables. Participants who were not working and in the high-risk health status showed the lowest mean physical component scores, and males and those who were working and in the low-risk health status had the highest physical component scores at baseline and at the end of the program (Table 4). However, none of the personal factors had significant interactions with time.

5.5. Personal factors, health status, and mental component scales

Paired t-tests revealed significant improvement in mental component scores from baseline to end (mean scores, 57.0 ± 23.3 to 72.4 ± 21.2; $t=-9.111$, $p<0.001$). Repeated measures analysis of variance was used

Table 3
Means and standard deviations of physical activity scores ($N = 146$)

	Entry	p	End	p	Δ	p
Age						
<56	9.0 (13.0)	0.039	22.9 (17.3)	0.438	13.9 (16.0)	0.765
56–66	9.6 (15.8)		22.4 (12.5)		12.8 (19.7)	
>66	3.7 (4.8)		19.0 (17.5)		15.4 (15.8)	
Race						
White	7.4 (12.7)	0.857	22.0 (16.6)	0.537	14.6 (18.3)	0.487
African-American	7.8 (12.4)		20.2 (13.4)		12.4 (14.5)	
Marital Status						
Married	7.4 (11.2)	0.859	21.8 (15.9)	0.71	14.4 (16.0)	0.64
Not-married	7.8 (15.9)		20.7 (15.6)		12.8 (20.5)	
Gender						
Female	6.2 (10.0)	0.391	17.8 (13.5)	0.055	11.6 (13.1)	0.263
Male	8.1 (13.6)		23.2 (16.5)		15.1 (18.8)	
Work status						
Working	10.6 (14.6)	0.054	26.1 (17.7)	0.018	15.6 (19.8)	0.561
Not-working	4.4 (6.7)		19.1 (11.7)		14.7 (11.6)	
Retired	6.2 (12.1)		18.4 (14.6)		12.2 (17.0)	
Health Status						
High	4.5 (11.9)	0.012	16.8 (12.9)	0.034	12.4 (16.6)	0.343
Intermediate	7.8 (11.1)		23.7 (17.6)		15.8 (17.8)	
Low	14.6 (17.2)		24.9 (12.0)		14.0 (17.3)	

Table 4
Means and standard deviations of physical component scores ($N = 146$)

	Entry	p	End	p	Δ	p
Age						
<56	49.8 (24.8)	0.489	65.1 (28.3)	0.753	15.3 (15.4)	0.740
56–66	47.9 (19.7)		62.1 (24.3)		14.2 (20.9)	
>66	44.5 (19.4)		61.5 (20.5)		17.0 (17.0)	
Race						
White	49.0 (26.0)	0.171	65.3 (24.4)	0.057	16.3 (18.7)	0.341
African-American	43.6 (22.9)		56.8 (24.0)		13.2 (16.0)	
Marital status						
Married	47.1 (20.9)	0.779	63.2 (24.3)	0.810	16.0 (19.0)	0.508
Not-married	48.2 (22.7)		62.1 (25.3)		13.8 (14.7)	
Gender						
Female	41.4 (19.6)	0.020	56.9 (25.2)	0.046	15.5 (18.4)	0.970
Male	50.2 (21.6)		65.6 (23.8)		15.4 (17.8)	
Work status						
Working	56.2 (20.6)	0.000	73.8 (22.8)	0.000	17.6 (17.0)	0.032
Not-working	32.1 (17.2)		39.6 (17.6)		7.5 (16.0)	
Retired	46.4 (20.0)		63.6 (21.4)		17.1 (18.9)	
Health status						
High	37.8 (16.3)	0.000	50.9 (19.9)	0.000	13.1 (17.6)	0.444
Intermediate	48.9 (21.9)		66.0 (24.8)		17.2 (19.1)	
Low	67.9 (15.0)		82.5 (17.5)		14.6 (13.6)	

to assess whether personal factors and health status had any influence on the mental component of quality of life.

Significant group differences were found for working status and health status variables. People who were not working and in the high-risk health status showed the lowest mean mental component scores, whereas people who were working and in the low-risk health status had the highest mean score at baseline as well as at the end of the program (Table 5). However, none of the personal factors had significant interactions with time.

Table 5
Means and standard deviations of mental component scores ($N = 146$)

	Entry	p	End	p	Δ	p
Age						
<56	58.9 (25.0)	0.738	72.7 (24.2)	0.794	13.8 (16.2)	0.395
56–66	57.2 (23.8)		70.9 (22.0)		13.8 (22.0)	
>66	55.1 (21.3)		73.8 (17.0)		18.7 (22.2)	
Race						
White	59.0 (23.0)	0.109	73.9 (20.9)	0.174	14.9 (21.4)	0.679
African-American	52.2 (23.7)		68.6 (21.7)		16.4 (17.8)	
Marital status						
Married	55.7 (23.2)	0.249	71.8 (21.5)	0.561	16.1 (21.0)	0.477
Not-married	60.7 (23.4)		74.1 (20.5)		13.4 (18.4)	
Gender						
Female	51.7 (22.8)	0.058	69.6 (22.5)	0.278	17.9 (20.4)	0.304
Male	59.5 (23.2)		73.7 (20.6)		14.2 (20.3)	
Work status						
Working	64.6 (19.0)	0.000	77.8 (18.3)	0.000	13.1 (16.3)	0.171
Not-working	44.0 (24.2)		55.7 (24.3)		11.7 (20.2)	
Retired	56.1 (24.0)		75.1 (18.5)		19.0 (23.2)	
Health status						
High	51.7 (22.6)	0.002	68.1 (21.0)	0.070	16.4 (20.7)	0.182
Intermediate	56.5 (23.6)		73.1 (22.6)		16.6 (20.7)	
Low	74.3 (15.3)		81.3 (10.8)		7.1 (16.8)	

5.6. Physical activity at 1 year follow-up

There was no significant relationships between personal factors, health status, and physical activity scores from end of the program completion to 1 year follow-up. Paired t-test showed no significant difference in physical activity scores from end of the program to 1 year follow-up (mean score, 20.6 ± 11.6 to 15.3 ± 12.2, $t = 1.596$, $p = 0.121$).

6. Discussion

6.1. Findings

Adherence with the exercise sessions was high. Seventy-three percent had a 100% attendance rate in this rehabilitation program. Among the dropouts, whites accounted for 67%. This result should be interpreted with caution because 71% of the participants of the rehabilitation program were white. Other baseline personal factors and health status did not show any significant relationships with adherence to the exercise sessions. In correlations among the baseline variables, age and health status showed significant correlations with physical activity behavior, and gender had a significant correlation with the physical component of quality of life. Older participants may not be as active as their younger counterparts, and people in the high-health-risk category may not be as active as those in the low risk health status because of health status. It is unclear why men had a higher scores on the physical component of quality of life at baseline, and this question needs further investigation.

The findings from this study indicated that the personal factors of working status, together with health status, appeared to influence physical activity behavior. All participants showed significant improvement in physical activity behavior from baseline to the end of the program. Despite the improvement over time, participants who were not working and in the high risk health status reported the lowest mean scores, whereas participants who were working and in the low-risk health status reported the highest mean scores in physical activity behavior at entry and at the end of the program. This result could mean that people who were not working (the majority of the not-working participants in this rehabilitation program were "disabled") and in the high-risk health status had a lower capacity to exercise at the beginning and reached their maximum capacities at the end, whereas people who were working and in the low-risk health status were physically active at the beginning and got more active at the end.

Gender, working status, and health status appeared to have differential effects on quality of life responses as well. Interestingly, men showed a higher physical component of quality of life in this program. Participants in the high-risk health status, by definition, had more comorbidities, both of which may contribute to

lower quality of life perceptions and lower quality of life. One study (Krishnan et al., 1998) has reported that severe illness was associated with higher depression in cardiac patients. The majority of the disabled, not-working participants in this study had lower quality of life compared to their counterparts. Regardless of the degree of the quality of life improvement, all participants had improved quality of life scores after the intervention. As several studies indicated, improved physical activity behavior might have played a role for the quality of life improvement (Willenheimer et al., 1998; Dugmore et al., 1999; Smith et al., 1995).

There was no significant decrease in physical activity at 1 year follow-up. One year follow-up data was based on those who returned for follow-up and probably with better health than those who did not. Long-term maintenance of physical activity behavior is important for health maintenance in people with CVD. However, studies on adherence with physical activity on follow-up are limited. Graduates of the rehabilitation program may continue to face barriers to maintain newly learned physical activity behavior after the program. More attention is needed in this issue.

Even though the lack of a control group limits a causal attribution of the observed changes to the cardiac rehabilitation program effectiveness, the observed overall increase in physical activity and quality of life scores supports previously reported findings on the effectiveness of cardiac rehabilitation programs on improving patient outcomes (Agency for Health Care Policy and Research Publication, 1995).

As this study's findings indicated, personal factors and health status influence the degree of improvement in physical activity behavior and quality of life, and are important to assess when implementing behavioral interventions. From this study, more targeted interventions for the different category groups may be needed to facilitate their recovery. For example, frequent encouragement and feedback from cardiac rehabilitation staff or making a buddy system for support may help patients with less improvement. Individualized goal setting and evaluation criteria may need to be considered. Comparing people with disabilities to those with a normal functional status using the same evaluation criteria may not be a good comparison.

6.2. Limitations

Because of the uncontrolled threats to validity in this study, the end scores may be altered by the maturation process. Thus, it is not possible to directly attribute the change to the intervention alone without a control group for comparison. In addition, this study excluded participants with missing data on any of the key variables of interest for this study. Thus, we have no data on the effectiveness of the program among those excluded from this study. Further studies focused on people who were not included in this study are needed to identify factors for them to be not adherent to the exercise program and to intervene those factors. A single rehabilitation program from one geographic location (south) was used for the sample group. Generalizability of these findings may be also limited by use of subjects from a tertiary care rehabilitation program. Therefore, caution should be undertaken in interpreting the study's results to cardiac rehabilitation participants in different settings. Study findings may be biased by use of self-reported measurements.

7. Conclusions

The intent of this study was to assess relationships among personal factors, health status, adherence to exercise behavior, and quality of life in cardiac rehabilitation participants. Personal factors and health status had varying effects on outcomes. More targeted interventions for people with less response to the intervention were needed in future studies. An intervention provided by the cardiac rehabilitation program was effective in improving the cardiac rehabilitation participants' adherence with physical activity behavior and quality of life. It would be interesting in future research to include a control group to directly test program effectiveness. Programs aimed at improving health by encouraging active participation of health care consumers have become an important priority in the health agenda for the nation. There is a strong need to identify effective interventions for people with heart disease.

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