

Research Article

Cardiovascular Patient's Adherence to the Exercise Component of a Cardiac Rehabilitation Program: Role of Patient's Perceived Autonomy Support, Motivation, and Competence

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Abstract

Objectives

Adherence to the exercise component of a Cardiac Rehabilitation (CR) remains low. Up to 50% of patients do not complete CR program. Autonomy support (i.e. encouraging patients to carryout a behavior by providing a meaningful rationale and minimizing pressure) had improved health behaviors but its role on adherence to CR has been rarely studied. Our objective is to examine relationships among autonomy support, perceived competence to exercise, type of motivation (autonomous/controlled) and adherence to the exercise component of CR.

Methods

In a cross-sectional design, we recruited 50 patients (66% male, 92% whites, 70% ≥60 years) who attended a hospital based CR program for at least 1 month in a midwestern city. We collected data on patients' perceived autonomy support from their rehabilitation staff, type of motivation and competence to exercising using theory-based questionnaires. Adherence to the exercise component of the CR was

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assessed by asking patients whether they attended all the exercise sessions in the past 2 weeks.

Results

Autonomy support was correlated positively with perceived competence ($\rho=0.62$, $p<0.001$) and negatively with controlled motivation ($\rho=-0.37$, $p=0.01$). Unexpectedly, perceived autonomy support, competence and type of motivation were not correlated significantly with adherence to exercise sessions ($p>0.05$ in all).

Conclusion

Our findings demonstrated that autonomy support from rehabilitation personnel may increase patients' perceived competence and decrease controlled motivation to exercise in a CR. Further studies with a longitudinal designs and bigger sample size are needed to better understand the influence of these concepts on adherence to exercise component of CR.

Keywords: Adherence to cardiac rehab; Autonomy support; Competence; Motivation,

Introduction

Cardiovascular Disease (CVD) is the leading cause of mortality in the United States and worldwide [1]. Patients with some CVD, such as Myocardial Infarction (MI) and heart failure, are at high risk of developing new events and dying after a first event. Cardiac Rehabilitation (CR) is a supervised program for patients who have had cardiac events and includes physical exercise as well as health education, smoking cessation, nutritional counseling and emotional support [2]. Among patients with coronary heart disease, participation in exercise during CR can reduce all-cause mortality by 27% and cardiac mortality by 31% [3].

In spite of the benefits of CR, patient's level of adherence in the exercise component of CR program is very low. Up to 33% of CR patients stop attending the exercise sessions within the first month and up to 50% stop within 3 months [4]. Up to 70% of patients with MI drop out of the exercise component by the 6th week of the program [5]. After completing a CR program, the proportion of patients who do not meet a recommended minimum of 150 minutes/weeks of physical activity [6] reaches 46% by 2 months and 59% by 1 year [7]. Strategies to increase adherence to CR, such as referral programs, evening classes, and providing transportation, have been tested but had limited success [8]. This may be partly a consequence of our limited understanding of the factors that influence people's adherence to CR. Patients' non-adherence with health care advices may be partly due to health care professionals not identifying patients' needs and responding to those needs within the context of patients' particular beliefs [9].

Self-Determination Theory (SDT) is a theory of human motivation [10]. According to SDT, health-related behaviors, such as adherence to CR, are more likely to be maintained if individuals are motivated autonomously to carry out the behavior [11]. SDT identifies two types of motivation for engaging in activities: autonomous and controlled motivation. Autonomous motivation is characterized by a sense of choice because activities are important, interesting, and

satisfying, whereas controlled motivation is characterized by engagement in activities because of external forces, such as trying to please others or responding to anxiety or guilt [10,11]. According to SDT, if healthcare practitioners interact with patients in an autonomy supportive way, then patients are more likely to be autonomously motivated to initiate and sustain a particular behavior [11]. Autonomy supportive interactions with patients refers to meeting patients inherent needs by acknowledging patients' feelings and perspectives, providing a meaningful rationale and minimizing pressure [11]. Autonomy supportive interaction have been demonstrated to enhance both perceived competence, that is believing in one's effectiveness in carrying out particular behavior, and perceived relatedness, that is feeling connected to and carried for by others [11].

Interventional studies have shown that higher perceptions of autonomy support and autonomous motivation predicted starting and persisting in a health behavior, including medication adherence [12], smoking cessation [13], dental hygiene [14], glycemic control [15]. However, relationships of SDT concepts with patients' adherence to CR has been rarely studied. The aim of this study was to assess the relationships among autonomy support, autonomous motivation, perceived competence, perceived relatedness and adherence to exercise during CR.

Methods

Design and sample

We conducted a cross-sectional study using a sample of 50 patients with CVD admitted to St. Mary's Cardiac Rehabilitation Center at Madison WI for phase-II of CR program. Inclusion criteria were: admission to the CR program for at least 4 weeks, ability to read and understand English language per self report, and consent to participate in the study. We sought patients who had attended CR for at least 4 weeks because we wanted to assess patients' perceived autonomy support by their CR personnel. Based on prior research, we proposed that four weeks was long enough for patients to experience CR personnel and to rate degree of autonomy support [16]. The study protocol was approved by the institutional review boards of the University of Wisconsin-Madison and St. Mary's Hospital ethics committee. Written informed consent was obtained from all participants.

Setting

At a visit to the CR program, patients were initially approached by a rehabilitation staff to ask about their interest to participate in our study. A research assistant gave information about the study to interested patients. Consent was taken from patients who were willing to participate and a research assistant gave questionnaires to patients at the rehabilitation center. Most participants completed questionnaires in a private room in the rehabilitation center. Some participants took and completed the questionnaires at home and returned them in sealed envelopes (given to them with the questionnaires) to rehabilitation staff on their next visits.

Measures

Autonomy support: The short-form (6 items) of the Health Care Climate Questionnaire (HCCQ) [17], was used to assess participants' perceptions of autonomy support from rehabilitation staff. Example item includes "I feel the rehabilitation staff has provided me choices." Each item is rated on a 5-point scale from (1) "not true" to (5) "very true". Overall sum score varies from 5-30 and an average score was computed from the 6 items. Williams et al. [13], found the HCCQ had reliability in his study with Cronbach's alpha of 0.94 among patients with chronic

illnesses. Hagger et al. [18], also demonstrated constructive validity of the HCCQ by showing that HCCQ predicted autonomous but not controlled motivation in an exercise setting.

Autonomous motivation: The Treatment Self-Regulation Questionnaire (TSRQ) [19], was used to measure autonomous and controlled motivation for exercising in CR. The TSRQ has 13 items and each item begin with phrase, "I am participating in the program because", followed by reason that may be autonomous or controlled. Participants respond on a 5-point scale from (1) "not" to (5) "very true". Five items were averaged to form the sub-scale of autonomous motivation and eight items were averaged to form the sub-scale of controlled motivation. Marques et al. [20], show TSRQ had reliability in his study with Cronbach's alpha of 0.86 for controlled items and 0.79 for autonomous items. Marques et al. [20], also demonstrated constructive validity of the TSRQ by showing that autonomous but not controlled motivation predicted degree of physical activity.

Perceived competence and relatedness: The Perceived Competence Sub-scale (PCS) [21], was used to assess how capable participants believed they were to maintain regular exercise as part of CR. The Perceived Relatedness Sub-scale (PRS) [21], was used to assess how connected participants feel to CR personnel. Each sub-scale has 3 items, such as "I feel confident to exercise regularly" and "I feel a lot of closeness and intimacy with the rehabilitation personnel". Each item is rated on a 5-point scale from (1) "not true" to (5) "very true". Responses were averaged to compute scores of perceived competence and perceived relatedness. The PCS and PRS sub-scales had been found to be reliable measures of perceived competence and relatedness, respectively, with regard to exercise with a Cronbach's alpha value of ≥ 0.90 [21]. Construct validity for PCS and PRS had been supported by [21]. A significant and moderate to strong positive correlations were found between scores of PCS and another measure of perceived competence for exercise as well as between scores of PRS and a measure of belongingness [21].

Adherence to exercise in CR program: We sought to measure the participants' level of adherence to the exercise component by asking them about their attendance at the exercise sessions of CR in the past two weeks. Participants' response options were: 1 (attended all the sessions), 2 (attended more than half of the sessions), 3 (attended half of the sessions), 4 (attended less than half of the sessions) and 5 (did not attend any of the sessions). However, all our participants responded either 1 (attended all) or 2 (attended more than half) of the sessions. Consequently, we created a dichotomous variable to reflect either full (attended all sessions) or partial attendance (not attended all sessions).

Covariates: Based on the findings from prior studies [4,5], we measured other factors that could explain adherence to CR program, including: knowledge about the usefulness of CR, presence of health insurance, distance from home to CR center, lack of transportation, illness severity, other health problems, work and family responsibilities, exercising at home or other places, cost of participation at CR, lack of support from a physician, and time constraints.

Data Analysis

Means and standard deviations for continuous variables and percentages for categorical variables were calculated to describe the distribution of socio-demographic factors and constructs of SDT among all participants. Independent t-test was used to assess mean

differences in autonomy support, autonomous motivation, perceived competence and perceived relatedness by adherence to exercise session (full or partial adherence). The associations among autonomy support, motivation, perceived competence, relatedness and adherence to the exercise session of CR were estimated using Spearman's correlation coefficient. In all the analyses, statistical significance was set at $P < 0.05$. All analyses were performed using Stata 13 [22].

Results

Table 1 shows participant demographic characteristics. Seventy percent of the participants were ≥ 60 years of age, 66% were male, 92% were white, 60% were at least college graduates, 72% were married or living with a couple, 42% were currently employed, 52% retired, 61.2% were living in urban area and 16.3% living in both urban and rural areas. All participants had either public or private health insurance to attend CR. Participants' reported barriers to attend the exercise sessions of the CR program were: attending other exercise program outside of a CR (22.9%), lack of knowledge about the usefulness of a CR program (19.4%), other health problems (14.5%), transportation problem (8.3%), lack of encouragement from a doctor (6.3%).

Participant characteristics	All participants (N=50)	Attended all days (n=36)	Did not attend all days (n=13)
Age (≥ 60 years)	35.0 (70.0)	22.0 (61.1)	12.0 (92.3)
Sex (male)	33.0 (66.0)	24.0 (66.7)	9.0 (69.2)
Race (white)			
White	46.0 (92.0)	32.0 (88.9)	13.0 (100.0)
Black	3.0 (6.0)	3.0 (8.3)	0.0 (0.0)
Asian	1.0 (2.0)	1.0 (2.8)	0.0 (0.0)
College graduate or more	30.0 (60.0)	20.0 (55.6)	10.0 (76.9)
Married or coupled	36.0 (72.0)	28.0 (77.8)	8.0 (61.5)
Annual household income $> 50k$	25.0 (62.5)	17.0 (60.7)	8.0 (66.7)
Employment status			
Employed	21.0 (42.0)	16.0 (44.4)	4.0 (30.8)
Unemployed	3.0 (6.0)	3.0 (8.3)	0.0 (0.0)
Retired	26.0 (52.0)	17.0 (47.2)	9.0 (69.2)
Residence			
Urban	30.0 (61.2)	22.0 (62.9)	8.0 (61.5)
Rural	11.0 (22.5)	7.0 (20.0)	3.0 (23.1)
Urban and rural	8.0 (16.3)	6.0 (17.1)	2.0 (15.4)
Insured for health care	50.0 (100.0)	36.0 (100.0)	13.0 (100.0)

Table 1: Participant demographic characteristics.

Table 2 shows the mean (SD) of SDT constructs. Mean (SD) of autonomy support was 4.7 (0.4) and the score ranged from 3.5 to 5 points. Similarly, the mean (SD) of autonomous motivation, controlled motivation, perceived competence and perceived relatedness were 4.6 (0.5), 2.1 (0.9), 4.7 (0.5) and 4.3 (0.7), respectively, and their scores ranged from 3.4-5 point for autonomous motivation, 1-5 points for controlled motivation, 3.3-5 points for perceived competence and 2.7-5 points for perceived relatedness. Approximately, 74% (n=36) of the participants attended all the exercise sessions of their CR in the prior two weeks.

We examined the mean difference of SDT constructs by status of attendance using independent t-test (Table 2). The mean (SD) of autonomy support among participants who attended all the sessions was 4.70 (0.43) and among those who did not attend all the session was 4.71(0.35) and there was no significant difference ($p=0.97$). Similarly, there was no difference in the mean of autonomous motivation (4.54 vs. 4.53, $p=0.95$), controlled motivation (2.20 vs. 1.88, $p=0.29$), perceived competence (4.70 vs. 4.71, $p=0.92$) and perceived relatedness (4.43 vs. 4.27, $p=0.45$) between participants who attended all and those who did not attend all the exercise sessions.

SDT constructs	Adherence to CR program				
	All participants (N=50)	Attended all days (n=36)	Did not attend all days (n=13)	t-test	p-value
	Mean (SD)	Mean (SD)	Mean (SD)		
Autonomy support	4.71 (0.40)	4.70 (0.43)	4.71 (0.35)	0.04	0.97
Autonomous motivation	4.54 (0.46)	4.54 (0.48)	4.53 (0.12)	-0.06	0.95
Controlled motivation	2.11 (0.93)	2.20 (1.02)	1.88 (0.61)	-1.06	0.29
Perceived competence	4.71 (0.45)	4.70 (0.46)	4.71 (0.45)	0.10	0.92
Perceived relatedness	4.37 (0.65)	4.43 (0.62)	4.27 (0.74)	-0.76	0.45

Table 2: Mean score of self-determination theory constructs among all participants and by status of adherence to cardiac rehabilitation.

Abbreviations: CR: Cardiac Rehabilitation; SD: Standard Deviation; SDT: Self-Determination Theory.

Correlations among SDT constructs and attendance to the exercise session were assessed using Spearman's correlation coefficient (Table 3). Autonomy support was correlated moderately and positively with perceived competence (Spearman's correlation - $\rho=0.62$, $p < 0.001$), perceived relatedness ($\rho=0.54$, $p < 0.001$), and as expected correlated negatively with controlled motivation ($\rho = -0.37$, $p = 0.01$). There was weak and non-significant correlation between autonomy support and autonomous motivation ($\rho=0.07$, $p=0.66$). Perceived competence and relatedness were correlated moderately and positively ($\rho=0.61$, $p < 0.001$). Contrary to our expectation, attendance was not correlated with any of the SDT constructs.

SDT constructs	1	2	3	4	5	6
1. Attendance to CR	1					
2. Autonomy support	-0.02	1				
3. Autonomous motivation	-0.02	0.07	1			
4. Controlled motivation	0.10	-0.37*	0.22	1		
5. Perceived competence	0.08	0.62‡	0.18	-0.29	1	
6. Perceived relatedness	0.14	0.54‡	0.13	-0.16	0.61‡	1

Table 3: Spearman's correlation between self-determination theory constructs and adherence to exercise component of a cardiac rehabilitation program.

P-value: * < 0.05 , † < 0.01 , ‡ < 0.001 . Abbreviations: CR: Cardiac Rehabilitation; SDT: Self-Determination theory.

Discussion

We applied a motivational theory (SDT) and examined whether meeting cardiac patients' need for relatedness, autonomy support, and

perceived competence would explain adherence to the exercise session of CR. More specifically, as expected from SDT, we found that participants' autonomy support from CR staff was positively related to their perceived competence about exercising in CR program and to their perceived relatedness with the rehabilitation staff. Contrary to our expectation based on SDT, there were no differences in SDT concepts by status of adherence to exercise in CR program.

As far as we know, only one study [16]. Applied SDT concepts to understand adherence to the exercise component of a CR program. Similar to our study, Russell reported that the percent attendance to the prescribed exercise sessions of the CR program was not associated with autonomy support ($r=0.10$, $p>0.05$) and autonomous motivation ($r=0.16$, $p>0.05$). In an exercise setting outside of a CR program, autonomy supportive interpersonal interaction between participants and trainers was associated with higher frequency and duration of exercise behavior among patients with heart disease following hospital discharge [23], cardiac patients after completion of a CR program [16], women [24], secondary school students [25] and among participants recruited from fitness and community settings [26]. Other studies showed that autonomy support and autonomous motivation were associated positively with medication adherence, smoking cessation, dental hygiene, and glycemic control [12-15].

According to SDT, autonomy supportive interpersonal interaction between patients and health personnel can enhance patients' perception of autonomous motivation, relatedness, and competence to initiate and maintain behavioral changes [10,11]. Consequently, continuous autonomy supportive interpersonal interaction while participating in a CR program is likely to increase cardiac patient's motivation to play an active role in adopting exercise as part of their treatment plan and to feel competent to perform the exercise activities and to feel related to the CR personnel. However, because the rehabilitation services of CR is supervised program and is part of cardiac patients' treatment plan after a cardiac event [2], the effect of autonomy supportive interaction in a CR setting could be different from a non-CR exercise settings. Therefore, further study with bigger sample size, repeated measurement of SDT constructs and a better design, such as clinical trial, would be needed to better understand the association of change in autonomy support and adherence to a CR program and the potential mediating roles of autonomous motivation, perceived competence and perceived relatedness in this association [27].

Contrary to our expectation, none of the SDT constructs were associated with adherence to the exercise session of CR. This finding is consistent with the only other available study on this topic [16]. There are several reasons for these non-significant associations. Our participants were individuals who attended CR for at least 1 month. Therefore, our participants did not include those who had already withdrawn within one month after starting the program (survival bias). Participants who continued participating in CR programs are more likely to be conscious about their health and to follow their health care provider instructions and to have higher rate of adherence to the program. This is consistent with the higher and limited range of adherence in our participants. In fact, most of our participants (74%) had attended all exercises sessions and the remaining 26% attended more than half of the sessions prescribed. Adherence was measured by self-report and patients are likely to respond in a socially desirable manner and thus to over-reported their level of adherence. This may have biased the associations between SDT constructs and adherence toward the null and may have made the association non-significant [27].

Interventions intended to increase adherence to CR have had limited success [4]. In a systematic review study by Daly et al. [4], five out of seven interventions failed to show a significant intervention effect. It is possible that these interventions are not effective because they targeted the wrong factors to improve adherence. Autonomy support had been shown to improve medication adherence [12], smoking cessation [13], dental hygiene [14], glycemic control [20] and it may also improve adherence to CR. Our study and the only other study Russell and Bray [16] in which researchers investigated the associations of autonomy support and autonomous motivation with adherence to CR had only about 50 participants. Appropriately powered studies would be needed before firm conclusion can be drawn regarding the association between autonomy support and adherence to CR.

Major strength of our study is that it is only the second study, to the best of our knowledge, in which researchers applied SDT to explain the relationships of autonomy support, autonomous motivation and adherence to a CR program among cardiac patients. Participants in previous study were all men [16], but our study included both men and women. However, our study has several limitations. Our design was cross-sectional and causal inference cannot be made regarding the observed relationships. Our sample included participants who already had been in CR for a month and this may have resulted in survival bias. Because of our small sample size, we did not adjust for potential confounders, and thus, we cannot rule out effect of confounding. Adherence was measured by self-report, participants may have responded in socially desirable manner and may have over-reported their level of adherence.

Conclusion

Autonomy support of cardiac patients by CR personnel may help to increase patients' perceived relatedness with the rehabilitation personnel and patients' perceived competence at the prescribed exercise as part of their treatment. Future studies with a bigger sample, repeated measurements of variables, and a more objective measurement of adherence for the entire time of stay in a CR program would be essential to have a better understanding of the influence of autonomy support, motivation and competence on cardiac patients' level of adherence to a CR program.

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Data Accessibility: Data will be available upon requested through email.

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