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EFFECT OF SHORT-TERM CARDIAC REHABILITATION ON QUALITY OF LIFE ACCORDING TO SOCIOECONOMIC STATUS

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ABSTRACT

Background

Cardiac rehabilitation (CR) lowers the recurrence of cardiovascular disease and has strong and positive physical and psychological effects. The purpose of this study was to analyze the quality of life (QoL) of CR participants according to their monthly income and education levels in the early phase after percutaneous coronary intervention (PCI).

Material and methods

There were 128 participants (98 men and 30 women). Their socioeconomic status (SES) was evaluated and QoL was assessed using the 36-item Short Form Health Survey. CR was initiated 3 weeks after treatment and remeasured after 3 months. The pre-post analysis was performed using the paired t-test. The participants' education levels were defined in terms of a middle school group (low education [LE]), high school group (middle education [ME]), and above college group (high education [HE]). Monthly household income was divided into tertiles: up to US$2000 (low income [LI]), up to US$4000 (middle income [MI]), and more than US$4000 (high income [HI]).

Results

There was a significant increase in mental health status—from 54.9 to 63.3—in the HE group, but no significant changes were observed in the LE and ME groups. Physical changes were observed in all education-level groups.

The physical changes in the group according to monthly income significantly increased by 9.1% (66.8–73.5) in the LI group, 7.8% (65.9–71.5) in the MI group, and 12.1% (62.7–71.3) in the HI group. Physical changes were observed in all monthly income groups. Changes in occupational physical activity levels significantly improved physical and mental status in the middle and high activity groups, but not in the low activity group.

Conclusion

Changes in QoL as an effect of short-term CR were effective. Changes in mental QoL were significant in higher SES levels and physical QoL was effective in all groups.

Key Words: *cardiac rehabilitation, quality of life, socioeconomic status*

INTRODUCTION

Cardiovascular disease (CVDs) is very common and dangerous, and is one of the leading causes of death worldwide.[1] Its contributing factors are associated with increased consumption of high-calorie and high-cholesterol diets.[2]

One of the treatments for CVD—percutaneous coronary intervention (PCI)—requires the patient to be hospitalized for a shorter period and has a lower cost than coronary artery bypass grafting (CABG), in addition to a lower recurrence of coronary artery restenosis.[3] Nonetheless, depressive symptoms have been reported in approximately 20–30% of PCI patients.[4–6] Because depression and anxiety are major causes of low quality of life (QoL), specialist efforts are necessary to improve depression in such patients, and cardiac rehabilitation (CR) should include stress counseling as well as modifying health behaviors, such as exercise, nutrition, smoking, and drinking.[7–9] Previous studies related to QoL reported that those who participated in CR reported improvements in physical fitness and QoL through physical and mental consulting, especially those with very low QoL at an early phase.[10–13] However, there are relatively few QoL studies in CR early-phase patients. Therefore, this study aimed to analyze the changes in QoL according to socioeconomic status (SES) in PCI patients in the early phase, in which QoL is likely to be low.

MATERIALS AND METHODS

Participants and Procedure

The subjects were referred to a CR clinic after PCI by a cardiologist, and agreed to participate in the CR program. Of the first CR patients, 335 were examined for QoL. Among them, 128 (98 men and 30 women) were finally selected, except those who could not be followed up with, incomplete SES questionnaires, and those who did not provide consent.

The participant characteristics are presented in Table 1. Participants included 26 middle school graduates, 49 high school graduates, and 53 with above college qualifications; the average age of the participants was 62.4±8.7, 57.5±10.0, and 54.6±10.0 years, respectively, and the average monthly income was US\$ 2015.2±893.1, 3608.5± 1986.8, and 5626.4±3719.1, respectively.

CR includes exercise and nutritional assessment, stress management, and guidelines for emergencies. The initial visiting in CR occurs 3 weeks after discharge, whereas the postvisiting and measurement is performed 3 months later.

The study was conducted in accordance with the Declaration of Helsinki and was approved by the Institutional Review Board of Asan Medical Center (2015-0594).

Quality of Life Questionnaire: The 36-Item Short Form Health Survey

QoL was assessed using the Korean version of the 36-item Short Form Health Survey (SF-36), which is a self-report questionnaire.[14] The total obtainable score is 3600 points, with 100 points each for all 36 items. The SF-36 consists of a physical health component and a mental health component. The physical health component evaluates physical function (PF), role limitation (RP) due to health problems, bodily pain (BP), and general health (GH) perceptions, whereas the mental health component measures role limitation (RE) due to emotional well-being (EW), fatigue (FA), and social functioning (SF).

TABLE 1. Characteristics of Subjects

Variables	LE (n=26)	ME (n=49)	HE (n=53)	p
Men /women (n)	14/12	35/14	47/6	
Age (years)	62.4±8.7	57.5±10.0*	54.6±10.0†	0.004*
Height (cm)	155.6±7.7	164.4±8.0*	168.4±6.1†, §	<0.001*
Weight (kg)	62.1±9.0	66.8±10.6	73.7±8.7†	<0.001*
BMI (kg/m²)	25.5±2.0	25.9±2.3	24.6±2.7	0.069
TC (mg/dL)	154.3±37.9	142.5±36.0	133.7±29.4†	0.042*
HDLC (mg/dL)	48.9±9.1	46.9±11.3	48.5±12.3	0.066
LDLC (mg/dL)	90.6±35.9	85.6±33.5	76.3±26.7†	0.027*
TG (mg/dL)	148.1±85.0	111.7±42.2	123.7±67.4	0.126
Monthly income (US$)	2015.2±893.1	3608.5±1986.8	5626.4±3719.1†, §	<0.001*
Occupational PA style				
Sedentary	7(26.9%)	9(18.4%)	4(7.5%)	0.224
Middle	10(38.5%)	24(49.0%)	28(52.8%)	
High	9(34.6%)	16(32.7%)	21(39.6%)	

*p-value for ANOVA is significant at p<0.05; *LE versus ME, † LE versus HE, § ME versus HE.
HE = high education (above college group); LE = low education (middle school group); ME = middle education (high school group); HDLC = high-density lipoprotein cholesterol; LDLC = low-density lipoprotein cholesterol; PA = physical activity; TC = total cholesterol; TG = triglyceride.

Socioeconomic Survey and Daily Occupational Physical Activity Questionnaire

The SES survey assessed only education and monthly household income. The participants were divided into the following three groups based on education level: middle school group (low education [LE]), high school group (middle education [ME]), and above college group (high education [HE]). Household income was based on income per month, based on which participants were divided into three groups: low income (LI) (up to US$2000), middle income (MI) (up to US$4000), and high income (HI) (more than US$4000). Finally, a questionnaire on daily occupational PA was used to divide participants into three categories: low activity (LA), middle activity (MA), and high activity (HA).

Data Analysis

The data were analyzed using SPSS 25.0 (IBM Corp., Armonk, NY, USA). The means and standard deviations were calculated for the continuous variables, and numbers and percentages were obtained for the discontinuous variables. The general characteristics were analyzed using one-way analysis of variance (ANOVA) and the chi-squared test. The paired t-test was performed for each group according to education, income, and PA levels. A repeated two-way ANOVA was performed to confirm the changes over time and in each group. The accepted significance level was p<0.05.

RESULTS

General Characteristics

Table 1 shows the sample's general characteristics. The mean ages of the ME and HE groups were significantly lower than that of the LE group (p<0.05). There was a significant difference in height, with the HE group being the tallest (p<0.05). The household monthly income was significantly different according to education level; the HE group had the highest income, which

was significantly higher than that of the LE and ME groups (p<0.001).

Education and Quality of Life

Table 2 shows the results for QoL according to educational level. Although this was a short-term study, there was more significant QoL improvement observed in the HE group than in the LE and ME groups. The physical and mental health comprehensive scores were as follows. The mental health status score significantly increased from 54.9 to 63.3 in the HE group, but no significant changes were observed in the LE and ME groups. Physical changes were demonstrated in all groups, which indicated that the recovery of PF was faster than that of mental health.

Monthly Household Income and Quality of Life

The total QoL scores significantly improved in all groups, along with physical improvements

(Table 3). The physical health score increased by 9.1% from 66.8 to 73.5 in the LI group, by 7.8% from 65.9 to 71.5 in the MI group, and by 12.1% from 62.7 to 71.3 in the HI group. The mental health score significantly increased only in the HI group, from 54.0 to 63.4 (14.8%).

Daily Occupational Physical Activity and Quality of Life

Physical and mental QoL changes were not significant in the LA group compared to those in the MA and HA groups (Table 4). Therefore, there was no significant change in the LA group in terms of total QoL scores, but significant increases were observed in the MA and HA groups (p<0.05).

DISCUSSION

Although there are various QoL measures, questionnaires are generally affected by individual circumstances, such as age, health status, or

TABLE 2. Education and Quality of Life

Variables	LE (n=26)		ME (n=49)		HE (n=53)		T × G
	Baseline	3 months	Baseline	3 months	Baseline	3 months	p
Scale							
PF	79.6±13.4	84.0±12.4	81.0±18.9	84.4±15.2	75.4±20.6	80.8±21.5*	0.736
RP	52.9±41.4	66.3±33.9*	59.7±40.1	67.3±34.7	45.8±39.1	66.5±38.3*	0.253
BP	65.9±17.0	72.0±24.9	69.0±18.9	78.1±15.9*	61.0±21.6	69.8±21.7*	0.825
GH	47.7±20.3	58.3±18.5*	52.0±18.0	54.4±15.5	46.4±17.4	52.5±18.8*	0.070
RE	57.7±37.2	78.2±37.6*	57.8±43.5	63.9±40.2	45.3±43.9	67.9±38.1*	0.119
FA	52.9±15.2	54.8±14.3	53.1±16.7	55.7±16.4	50.3±15.4	55.9±16.3*	0.487
EW	63.9±12.7	64.2±15.5	62.9±17.0	64.1±13.6	61.1±15.2	63.8±14.3	0.767
SF	71.2±16.9	73.1±16.5	67.4±18.0	74.0±17.3*	63.0±19.0	70.0±20.0*	0.459
Sectional and total score							
Physical score[a]	65.6±16.7	73.4±15.8*	68.9±17.6	73.4±15.2*	61.5±18.2	70.3±19.6*	0.259
Mental score[b]	60.5±14.8	65.8±16.8	59.6±17.9	63.1±16.8	54.9±16.9	63.3±15.9*	0.229
Total score	63.0±14.5	69.8±14.7*	64.5±16.1	68.9±14.4*	58.3±16.6	67.1±17.3*	0.241

*p<0.05, compared by paired t-test between baseline and 3 months of each group.
T × G, p-value for repeated two-way ANOVA is significant at time and group.
HE = high education (above college group); LE = low education (middle school group); ME = middle education (high school group);
BP = body pain; EW = emotional well-being; FA = fatigue; GH = general health perception; PF = physical function; RE = role limitation due to emotion problems; RP = role limitation due to physical health; SF = social functioning.
Physical score[a], PF + RP + BP + GH; Mental score[b], RE + FA + EW + SF.

TABLE 3. Monthly Household Income and Quality of Life

| Variables | LI (n=43) | | MI (n=43) | | HI (n=42) | | T × G |
	Baseline	3 months	Baseline	3 months	Baseline	3 months	p
Scale							
PF	79.3±19.0	83.8±17.1*	79.9±18.1	83.5±15.9	76.0±19.3	81.2±19.9*	0.598
RP	55.2±38.4	66.9±33.5*	53.5±39.9	66.9±38.1*	48.8±42.8	66.7±36.5*	0.341
BP	67.4±21.3	75.9±22.6*	64.1±16.7	72.6±18.2*	63.6±21.6	71.8±21.0*	0.934
GH	50.8±19.3	57.2±19.4*	48.7±16.6	50.9±14.4	46.9±19.0	55.1±18.2*	0.302
RE	59.7±38.2	70.5±39.3*	52.7±45.0	69.0±39.4*	45.2±44.1	65.9±38.6*	0.459
FA	54.2±15.7	56.3±15.4	51.5±15.8	54.3±15.6	49.9±16.0	56.3±16.7*	0.570
EW	65.7±14.3	65.7±12.9	61.5±14.7	62.0±13.9	59.7±16.8	64.3±15.7	0.510
SF	70.6±20.9	75.3±18.6	66.9±15.6	69.8±18.9	61.3±17.2	71.4±17.1*	0.210
Sectional and total score							
Physical score[a]	66.8±18.6	73.5±17.9*	65.9±17.0	71.5±16.0*	62.7±18.1	71.3±17.9*	0.318
Mental score[b]	61.8±17.1	65.4±15.7	57.5±16.9	62.4±16.5	54.0±16.2	63.4±17.0*	0.200
Total score	64.2±16.7	69.7±15.4*	61.9±15.6	67.5±15.5*	58.6±16.0	67.8±16.3*	0.205

*p<0.05, compared by paired t-test between baseline and 3 months of each group.
T × G, p-value for repeated two-way ANOVA is significant at time and group.
HI = high income (above US$4000); LI = low income (up to US$2000); MI = middle income (up to US$4000); BP = body pain; EW = emotional well-being; FA = fatigue; GH = general health perception; PF = physical function; RE = role limitation due to emotion problems; RP = role limitation due to physical health; SF = social functioning.
Physical score[a], PF + RP + BP + GH; Mental score[b], RE + FA + EW + SF.

SES.[15] Although SF-36 has a relatively large number of questions, it has the feature of distinguishing physical and mental factors that affect QoL.[16] The purpose of this study was to investigate the effect of early CR on patients' QoL and to analyze the differences in terms of SES.

According to previous studies, highly educated people generally have higher incomes. Furthermore, a better economic status is related to better health owing to having sufficient time and adequate economic conditions for managing health and QoL.[17] There is evidence of differences in the level of healthcare of highly educated people. Ishizaki et al.[18] in their study reported that BMI was 22.35 for those with an educational period of less than 10 years, but 20.67 for those with an educational period of over 15 years. The present study showed similar results. Total cholesterol (TC) and low-density

lipoprotein cholesterol (LDLC) could explain the significant low in the HE group (Table 1). Furthermore, the effect of CR on the level of education was also shown in the change of QoL. RP, GH, and RE in the LE group and BP and SF in the ME group were found to be significant change, whereas the HE group showed significant improvement in most categories. This means that the higher the academic level, the greater the effect of CR.

However, this result may be due to the lowest baseline value of HE group. These results are similar to those in Table 3. Because the initial value was low, we believe that there was a relatively significant improvement. Some studies have reported low associations between QoL and SES. In a study of middle-aged overweight men, no significant differences were found in the mental or physical health domains of participants when low and high capital

TABLE 4. Occupational Physical Activity Style and Quality of Life

Variables	LA (n=20)		MA (n=62)		HA (n=46)		T × G
	Baseline	3 months	Baseline	3 months	Baseline	3 months	p
Scale							
PF	80.3±18.2	84.8±13.3	78.0±17.4	82.1±16.1*	78.2±21.0	83.0±21.1*	0.957
RP	47.5±42.1	61.3±38.5*	52.8±40.8	61.3±37.5*	54.3±39.2	76.6±30.5*	0.206
BP	69.0±19.2	70.0±22.4	61.9±20.3	73.0±19.4*	67.7±19.4	75.4±21.6*	0.146
GH	51.0±19.1	49.5±17.2	47.6±18.9	54.4±18.5*	49.6±17.4	56.5±16.3*	0.068
RE	51.7±43.9	53.3±45.1	48.9±41.7	67.2±39.3	58.0±43.6	76.8±33.6*	0.266
FA	49.3±15.6	51.0±13.7	48.6±15.3	52.3±15.3	57.4±15.3	62.2±15.6	0.760
EW	63.6±17.2	63.0±14.0	61.9±14.3	61.5±14.2*	62.3±16.3	67.8±13.7*	0.107
SF	66.3±16.3	70.0±14.8	64.5±18.6	71.0±20.0*	68.8±19.0	74.7±17.2*	0.844
Sectional and total score							
Physical score[a]	66.0±18.2	70.5±16.6	64.4±17.3	70.7±17.2*	65.8±18.8	74.8±17.4*	0.410
Mental score[b]	57.3±16.2	58.5±17.1	55.7±16.2	61.4±16.6*	60.9±18.0	69.1±14.3*	0.210
Total score	62.0±15.8	65.4±15.6	60.3±15.5	66.7±16.3*	63.2±17.3	71.9±14.4*	0.278

*p<0.05, compared by paired t-test between baseline and 3 months of each group.

T × G, p-value for repeated two-way ANOVA is significant at time and group.

HA = high activity; LA = low activity; MA = middle activity; BP = body pain; EW = emotional well-being; FA = fatigue; GH = general health perception; PF = physical function; RE = role limitation due to emotion problems; RP = role limitation due to physical health; SF = social functioning.

Physical score[a], PF + RP + BP + GH; Mental score[b], RE + FA + EW + SF.

values were compared.[19] In an analysis of the SF-36 and annual household income, QoL was found to be strongly associated with income in men, whereas this was not the case for women. Moreover, there was no significant difference in QoL for women who worked full time, except for GH perception.[20] For the health-related factors, SES and healthcare did not have a positive relationship with each other. Somrongthorng et al.[21] studied SES, QoL, and activities of daily living in older adults and found that although these variables were not associated with income and daily life activities, education and activities of daily living were highly related. Moreover, another study found that there is no relationship between SES and metabolic syndrome in white and black men.[22] In addition, it is reported that a good economic status does not guarantee satisfaction and happiness.[23]

Nevertheless, more studies are positive about SES and QoL. Many previous studies have suggested that the better the SES, the better the QoL. In a study by Mielck et al., low education level was significantly associated with higher pain/discomfort as well as anxiety/depression,[24] In other studies, lower QoL scores are associated with lower educational status.[25] Bielderman et al. also reported a relatively high association between SES and QoL, with a direct effect of 0.456 and an indirect effect of 0.987.[26]

A recent study reported that financial incentives increase participation in CR.[27] In other words, it is conceivable that higher SES can be considered to induce higher CR participation, thus improving QoL effects.

One of the main results of this study was that the improvement in physical health was more

prominent than the improvement in psychological health. This is presumably because the use of stents and medical advances have resulted in a shorter hospital stay compared to CABG treatment and a faster physical recovery without sternal incision.[3,28,29] Psychological recovery appears to be difficult compared to physical improvement over a short period, and further research conducted over a longer term is needed. Furthermore, various techniques to improve QoL should be applied more actively. This is because SES (education and income), which the present study focused on, does not change over a short period. A low QoL score, such as low grip strength and a low score in the 3 m walk test, has been found to have an effect on physical exercise.[30,31] Psychological intervention such as meditation is also a way to improve QoL.[32]

The results of this study indicated that there was a difference in the ratio of male and female participants according to the education level. The proportion of women was high in the HI group (n=12, 46.1%), but low in the HE group (n=6, 11.3%). This should be considered in terms of gender-based education inequalities of the 1970s and the 1980s before economic development, rather than as differences in the incidence of male illness and CR.[33]

The limitations of this study are as follows. The SF-36 was developed for measuring health-related QoL and has been shown to have very reasonable validity and reliability.[16,34] The 36 items of this QoL questionnaire are certainly not a small number of questions. According to a previous study, 73.8% of respondents completed the SF-36 questionnaire, whereas 26.2% submitted unfinished answers.[35] This is because QoL is characterized by the fact that it presents different results depending on individual situations, characteristics, and type of questionnaire. A comparison of the EQ-5D questionnaire and SF-36 in hip fracture patients showed good responsiveness, but a relatively low correlation of 0.39 (p<0.001).[36]

The 3-month short-term CR effect was primarily significant for the highly educated or high-income earners; however, we did not analyze what the consequences were for people with low levels of education and income over a longer period. Furthermore, many people refused to reveal sensitive personal information, such as their level of education and household income.

In addition, as we did not have a control group, we cannot ignore the possibility that the improvement of the QoL score occurred because of natural recovery. In future studies involving a greater number of participants, it would be more appropriate to conduct a long-term follow-up study separately for men and women. Another limitation of the study is that it was possible that participants could not come to the CR center because of the long distance. To date, studies have shown that high-income countries have a lower incidence of cardiac disease and death, but developing countries are reported to have an increasing incidence of CVD.[37,38] Furthermore, in this study, gender could not be analyzed separately because of the small number of women participants. As heart diseases continue to be on the rise, relevant studies on the QoL of heart patients should be conducted.

CONCLUSIONS

The patients after PCI demonstrated positive effects of CR in the better SES groups; in addition, the higher the occupational PA, the better the QoL. The changes in the QoL according to SES appeared in terms of physical health rather than mental health. Therefore, early phase of CR should include program for enhancing the mental aspects of people with low SES.

CONFLICT OF INTEREST

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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