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WORK-RELATED OUTCOME AFTER ACUTE CORONARY SYNDROME: IMPLICATIONS OF COMPLEX CARDIAC REHABILITATION IN OCCUPATIONAL MEDICINE

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Abstract

Objectives: Coronary heart disease is frequent in the working-age population. Traditional outcomes, such as mortality and hospital readmission, are useful for evaluating prognosis. Fit-for-work is an emerging outcome with clinical as well as socio-economic significance. We describe the possible benefit of a cardiac rehabilitation (CR) program for return to work (RTW) after acute coronary syndrome (ACS). **Material and Methods:** We evaluated 204 patients with recent ACS. They were divided into 4 groups on the basis of their occupational work load: very light (VL), light (L), moderate (M), and heavy (H). Work-related outcomes were assessed with the Work Performance Scale (WPS) of the Functional Status Questionnaire and as "days missed from work" (DMW) in the previous 4 weeks. The variables considered for outcomes were percent ejection fraction, functional capacity expressed in metabolic equivalents (METs), and participation or non-participation in the CR program (CR+ and CR–). **Results:** One hundred thirty (66%) patients took part in the CR program. Total WPS scores for CR+ and CR– subgroups were VL group: 18±4 vs. 14±4 ($p < 0.001$), L group: 18±3 vs. 14±3 ($p < 0.0001$), M group: 19±3 vs. 16±3 ($p < 0.003$), and H group: 20±4 vs. 17±3 ($p < 0.006$). Fewer DMW were reported by the CR+ group. **Conclusions:** Non-participation in CR was a consistent cause of poorer work-related outcomes. Our findings indicate that CR and occupational counseling play a very important role in worker recovery and subsequent reintegration in the workplace, in particular among clerical workers.

Key words:
Depression, Rehabilitation, Workers, Acute coronary syndrome, Counseling, Anxiety

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INTRODUCTION

Coronary heart disease (CHD) is the main cause of death worldwide, accounting for 31% of mortality [1]. In fact, in the working population (aged < 65), CHD is the single most important cause of death in men, and in women it is preceded only by breast cancer [2–3]. It is both a medical and a socio-economic problem.

Returning to work after a coronary event produces economic benefits for the community and patients alike, improving the quality of life of their families too [4–5]. It is generally recognized that the return to work is not a simple function of clinical status and the workplace, but is also influenced by psychological factors, such as anxiety and depression [6]. In CHD patients, cardiac rehabilitation (CR) has a strong potential to improve occupational outcome [7–10]. Currently, "complex CR" consists of several elements, including pharmacological and nutritional management, motor rehabilitation, and behavioral counseling, to effectively manage CHD risk factors and promote favorable lifestyle changes [11]. Although the role of occupational medicine is clear for primary prevention, employability is often difficult to evaluate in secondary prevention, requiring an accurate evaluation of clinical and occupational factors [12].

The aim of this study was to evaluate work-related outcomes in cardiac patients at 6 months from acute coronary syndrome (ACS), identifying related individual, clinical, and interventional factors.

MATERIAL AND METHODS

We enrolled 204 working-age acute coronary syndrome (ACS) patients (Table 1–3). We asked all subjects to participate in a complex cardiac rehabilitation program that included exercise prescription, exercise training, instruction on medications, and lifestyle changes such as the cessation of smoking. The patients participating in the CR program received supervised exercise training and counseling: the exercise session included stretching, resistance training, and aerobic exercise. The education and counseling session (four 50-min counseling sessions for 1 month) consisted of advice on healthy nutrition, physical activity, maintaining a healthy body weight, and issues related to quitting smoking and alcohol consumption. Exclusion criteria were age > 65 years, severe concomitant non-cardiac diseases such as cancer, renal dysfunction (serum creatinine > 3 mg/dl), liver dysfunction (alanine aminotransferase/aspartate aminotransferase > 1.5 times the upper normal limit), and dementia, any systemic disease limiting exercise, and inability to participate in a prospective study for logistical reasons.

The average energy requirement for the patients' work activities was estimated with the aid of pre-existing, specific tables [13] that classify the various tasks on the basis of metabolic equivalents (METs): < 3 METs – very

Table 1. Characteristics of patients with recent acute coronary syndrome (ACS)

Characteristic	Patients (N = 204)
Age [years] (M±SD)	51±8
Sex [n]	
male	199
female	5
Education [n (%)]	
primary/secondary	119 (59)
high school	78 (38)
university	7 (3)
Professional category [n (%)]	
clerical	75 (37)
manual	126 (62)
managerial	3 (1)
Type of intervention [n (%)]	
PTCA	189 (93)
only medical therapy	15 (7)
cardiac rehabilitation	134 (66)

M – mean; SD – standard deviation.
PTCA – percutaneous transluminal coronary angioplasty.

Table 2. Characteristics of patients with recent acute coronary syndrome (ACS) stratified by work energy requirement

Variable	Group			
	VL (< 3 MET)	L (3–5 MET)	M (5–7 MET)	H (> 7 MET)
Patients [n (%)]	78 (38)	61 (30)	36 (17)	29 (15)
Age [years] (M±SD)	54±6	55±6	48±6	42±5
Sex [n]				
male	73	61	36	29
female	5	0	0	0
Type of intervention [n (%)]				
PTCA	71 (91)	58 (95)	31 (86)	29 (100)
medical therapy only	7 (9)	3 (5)	5 (14)	0 (0)
cardiac rehabilitation	51 (65)	44 (72)	21 (58)	18 (62)
Drugs taken at 6 months [n (%)]				
antiplatelet drugs	78 (100)	61 (100)	35 (97)	25 (86)
β-blockers	71 (91)	55 (90)	21 (58)	13 (44)
cholesterol-lowering agents	68 (87)	61 (100)	23 (64)	19 (66)
ACE inhibitors	55 (70)	44 (72)	18 (50)	11 (38)

ACE – angiotensin-converting-enzyme; VL – very light; L – light; M – moderate; H – heavy; MET – metabolic equivalent.
Other abbreviations as in Table 1.

Table 3. Health-related quality of life profile for each work group

VL group (N = 78) (M±SD)		L group (N = 61) (M±SD)		M group (N = 36) (M±SD)		H group (N = 29) (M±SD)	
CR+	CR–	CR+	CR–	CR+	CR–	CR+	CR–
0.72±0.19	0.55±0.23[1]	0.74±0.17	0.62±0.17[2]	0.73±0.14	0.62±0.16[3]	0.79±0.10	0.64±0.13[4]

"CR+" – attending cardiac rehabilitation; "CR–" – not attending cardiac rehabilitation.
Other abbreviations as in Table 1 and 2.
[1] $p < 0.0009$; [2] $p < 0.02$; [3] $p < 0.03$; [4] $p < 0.003$.

light work (VL group), 3–5 METs – light work (L group), 5–7 METs – moderate work (M group), and > 7 METs – heavy work (H group).

Health-related quality of life (HRQOL), anxiety and depression, and functional status were evaluated 6 months after resumption of work. Performance status after resumption of work and work-related outcomes were also assessed. Within each group, the variable considered for work-related outcome was carrying out CR. Traditional variables considered were percent ejection fraction (EF (%)) and functional capacity for exercise testing (expressed in METs).

All subjects taking part in the study were informed by a physician on the rationale and aims of the survey, and a written informed consent was obtained. According to Italian legislation on guidelines for observational

studies, ethical approval for conducting this survey was unnecessary, and cross-sectional studies did not require formal approval by the local Institutional Review Boards. Personal information on the subjects taking part in the study was protected in accordance with Italian law.

Health-related quality of life

The HRQOL profile was assessed with the European Quality of Life scale 5D (EQ-5D) [14–17]. It consists of 2 components: an EQ-5D descriptive system and an EQ-5D visual analog scale (EQ-5D VAS). For the descriptive system, the respondent was asked to rate his/her health for 5 of EQ-5D dimensions, i.e., mobility, self-care, pain/discomfort, usual activities, and anxiety/depression on a 5-level scale:

- no problems,
- slight problems,
- moderate problems,
- severe problems,
- unable to perform.

Scores were transformed to produce a single index ranging from 0.59 for the worst to 1 for the best possible state of health. For the EQ-VAS, participants drew a line from a box to the point on a thermometer-like scale corresponding to their state of health (ranging from 0 "the worst imaginable state of health" to 100 "the best imaginable state of health").

Anxiety and depression

Anxiety and depression were evaluated with the Hospital Anxiety and Depression Scale (HADS) [18–19]. On this 14-item scale, 7 relate to anxiety and 7 to depression, with responses scored 0–3 (3 indicating higher symptom frequencies). The score for each subscale (anxiety and depression) ranged 0–21, with scores categorized as follows: normal (0–7), mild (8–10), moderate (11–14), and severe (15–21).

Work performance status and indicators of work-related outcomes

To determine work status before and after myocardial infarction (MI), work-related outcomes (absenteeism and perceived work performance) were assessed with the Work Performance Scale (WPS) of the Functional Status Questionnaire [20–21]. The WPS score is calculated as the mean of the 6 responses ranging 1–4, with 4 being the highest level of work performance. As indicators of work-related outcomes, we used the time to return-to-work (in weeks) and the days missed from work (DMW) over the previous 6 months. For work performance status, DMW was assessed by asking respondents how many days they had missed from work due to cardiovascular disease in the previous 4 weeks.

Statistical analysis

Data are expressed as mean ± standard deviation (M±SD). Statistical analysis was performed with ANOVA for differences between the 4 groups, and with Student's t-test for unpaired data for differences between subgroups. A $p < 0.05$ was considered statistically significant.

RESULTS

All 204 subjects enrolled in the study returned to full-time work after a variable period (1–2 months) from hospitalization. One hundred eighty nine subjects had undergone single percutaneous transluminal coronary angioplasty (PTCA), and 15 had been treated with medical therapy only. One hundred thirty (66%) subjects participated in the complex CR program (M±SD = 25±10 days after hospital discharge). There were no differences in age, gender, or level of education between CR+ and CR– subgroups. Significant differences were found in the HRQOL profile between the CR+ and the CR– subgroup for each MET work category (Table 3). For anxiety, scores were significantly different between the CR subgroups only in the VL and the L groups, whereas

Table 4. Anxiety and depression profiles for each work group

Score	Group (M±SD)							
	VL (N = 78)		L (N = 61)		M (N = 36)		H (N = 29)	
	CR+	CR–	CR+	CR–	CR+	CR–	CR+	CR–
Anxiety	8.9±3.4	12.6±4.2[1]	9.6±2.2	12.0±2.9[4]	8.8±2.5	10.6±2.9	9.0±1.7	10.0±2.8
Depression	9.0±3.2	12.3±4.5[2]	9.5±2.1	12.0±2.5[5]	8.7±2.7	10.8±2.2[7]	8.5±2.5	10.7±0.7
Total	17.9±6.4	24.9±8.3[3]	19.1±4.1	24.0±4.6[6]	17.5±5.1	21.4±4.6[8]	17.5±3.8	21.3±6.0[9]

[1] $p < 0.0001$; [2] $p < 0.00046$; [3] $p < 0.00011$; [4] $p < 0.0008$; [5] $p < 0.00031$; [6] $p < 0.00016$; [7] $p < 0.018$; [8] $p < 0.024$; [9] $p < 0.048$.
Abbreviations as in Table 1–3.

Table 5. Work performance status for each work group

Score	Group							
	VL (N = 78)		L (N = 61)		M (N = 36)		H (N = 29)	
	CR+	CR–	CR+	CR–	CR+	CR–	CR+	CR–
Work performance status								
item 1 (M±SD)	2.7±1.1	2.2±1.0[1]	2.8±1.0	2.1±1.1[2]	2.9±0.9	2.7±1.0	3.2±0.8	3.3±0.6
item 2 (M±SD)	3.1±0.9	2.5±0.8[1]	3.2±0.8	2.5±0.7[8]	3.1±0.6	2.4±0.9[5]	3.1±1.0	2.4±1.1
item 3 (M±SD)	2.7±11.0	2.1±1.0[2]	3.2±1.0	2.2±0.7[9]	3.5±0.5	3.1±0.7[4]	3.5±0.7	3.0±0.8
item 4 (M±SD)	3.0±0.8	2.4±0.9[1]	3.3±0.6	2.5±0.9[3]	3.2±0.8	2.5±0.9[4]	3.4±0.6	3.0±0.7
item 5 (M±SD)	3.1±0.8	2.2±1.1[3]	3.0±0.9	2.5±0.7[4]	3.2±0.7	2.6±0.8[2]	3.4±0.7	2.8±0.8[1]
item 6 (M±SD)	3.1±0.8	2.6±0.8[4]	3.0±0.7	2.5±0.8[4]	3.4±0.7	2.9±0.7	3.3±0.8	2.8±0.7
average (M±SD)	3.0±0.7	2.3±0.8[5]	3.1±0.5	2.4±0.6[7]	3.2±0.5	2.7±0.5[10]	3.3±0.6	2.9±0.4
total (M±SD)	18.0±4.0	14.0±4.0[5]	18.0±3.0	14.0±3.0[7]	19.0±3.0	16.0±3.0[10]	20.0±4.0	17.0±3.0
patients with ≥ 1 DMW[a] [n (%)]	4 (7)	7 (25)[6]	5 (11)	6 (35)[6]	1 (4)	2 (13)	1 (5)	1 (9)
Work-related outcomes								
RTW [weeks] (M±SD)	6.9±1.8	8.6±1.5[7]	7.1±1.8	8.4±1.6[5]	7.9±1.5	8.9±1.0[1]	8.0±1.3	9.1±0.9[4]
DMW[b] (M±SD)	7.4±4.5	11.9±4.4[5]	6.8±4.8	9.5±4.4[2]	5.7±3.3	8.5±4.3[2]	3.0±2.9	5.7±3.9[1]

DMW – days missed from work; RTW – time of return to work. Other abbreviations as in Table 1–3.
[a] Patients with at least 1 DMW in the previous 4 weeks; [b] Days missed from work in previous 6 months.
[1] $p < 0.04$; [2] $p < 0.03$; [3] $p < 0.0002$; [4] $p < 0.02$; [5] $p < 0.01$; [6] $p < 0.029$; [7] $p < 0.0001$; [8] $p < 0.007$; [9] $p < 0.001$; [10] $p < 0.003$.

differences in depression scores were always significant except in the H work group (Table 4).

Similarly, total WPS scores were significantly different between CR subgroups except in H workers (Table 5). The number of patients taking time off from work was lower for the CR+ subgroup in VL and L workers, but there were no significant differences in the other 2 work groups. However, the 2 work-related outcomes taken into consideration (i.e., time to return-to-work and number of days off work) were always significantly lower in patients attending CR (Table 5). No significant differences in EF (%) and functional capacity for exercise were found

Table 6. Percent ejection fractions (EF (%)) and metabolic equivalent (MET) scores of functional capacity for exercise in each work group

Variable	Group (M±SD)							
	VL (N = 78)		L (N = 61)		M (N = 36)		H (N = 29)	
	CR+	CR–	CR+	CR–	CR+	CR–	CR+	CR–
EF [%]	50.0±9.9	51.1±6.2	51.1±5.6	51.4±4.8	53.8±3.7	53.7±4.5	53.6±3.7	53.7±4.6
MET	4.5±1.0	4.2±1.3	4.3±0.8	4.4±0.7	5.7±1.1	6.0±1.2	5.9±1.3	6.2±1.4

Abbreviations as in Table 1–3.

between the CR subgroups of any of the work groups (Table 6).

DISCUSSION

Many occupational physicians base their opinion on a patient's suitability for work after a pathological event, such as ACS, on the results of a maximal exercise test performed under optimized drug therapy. However, many other factors can affect the reintegration of ACS patients into employment. In our study, we found that work performance (assessed using the WPS) was positively influenced by participation in the CR program. However, not all workers seemed to benefit: in fact, the differences found among high intensity workers (H group) did not reach statistical significance (WPS total score = 20±4 in CR+ vs. 17±3 in CR–, p = 0.06). A similar trend was also found for quality of life (assessed with the EQ-5D scale): there were benefits for patients attending CR, but there was not always a statistically significant difference in scores for anxiety and depression in patients with a high work intensity (H group anxiety score: 9±1.7 in CR+ vs. 10±2.8 in CR–, p = 0.077; depression score: 8.5±2.5 in CR+ vs. 10.7±0.7 in CR–, p = 0.062).

Cardiac rehabilitation favorably affected indicators of work outcome (time to return-to-work and DMW) in all groups. Patients with a more strenuous work activity (M and H groups) returned to work later than those with a less physically active job (VL and L groups), but in all 4 groups the patients that had undergone CR resumed work in a significantly shorter period of time. This produces a twofold benefit: the disease has lower social and economic costs, and there is a positive psychological effect caused by the recovery of the social and economic role of the patient-worker. However, workers with lighter activities (VL and L groups) took more working days off (in the 6 months after work resumption) than workers with more physically strenuous jobs (M and H groups), despite returning earlier to work. Nevertheless, in all 4 groups, CR was again effective in achieving a reduction in working days lost due to illness.

The data obtained is consistent with evidence in the literature [22–24], according to which white-collar workers (i.e., most of the VL group) have a less favorable outcome than blue-collar workers (corresponding to groups L, M, and H) in terms of the number of working days lost due to illness. This is probably attributable to a higher prevalence of anxiety and depression [25]. This finding was also reflected in the population examined by us, in which anxiety and depression scores were higher in the VL and L subgroups that did not attend CR. The counseling part of the CR program probably acts to reduce anxiety, and this effect was significant in the VL and L groups; counseling also reduced depression, an effect significant in the VL, L, and M groups.

Finally, participation in CR did not ameliorate clinical outcome, as assessed by EF (%) and functional capacity to

conduct exercise. This finding is most likely due to the use of best diagnosis and therapy in the acute phase of the disease, which have already led to reductions in mortality rates in the short term. Thus, these traditional parameters have a limited role in the evaluation of workers with heart disease attending CR programs, as suggested in the literature [26–28].

CONCLUSIONS

Our study indicates that non-participation in CR is a consistent cause of poorer work-related outcomes. Cardiac rehabilitation, and occupational counseling in particular, plays a very important role in worker recovery and subsequent reintegration into the workplace, especially for clerical workers. It may thus be beneficial to develop specific "complex CR programs" that take into account not only traditional clinical parameters (ventricular function expressed as EF (%), and functional capacity expressed in METs), but also all occupational co-factors, such as psychosocial factors and the type of work done.

Study limitations

Our study group comprised only a small number of subjects. They were not randomized as this would have been ethically unacceptable: indeed, it is well known that participation in a complex CR program reduces mortality and prevents recurrence of ACS, as previously described in others studies [24]. Also, it was not possible to conduct our study for more than 6 months after resumption of work. Future trials will be needed to assess the efficacy of supervised exercise training over a longer period.

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