

# Influence of In-Hospital Cardiac Rehabilitation on Psychological Status after Myocardial Infarction in Patients with D-type Personality

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## ABSTRACT

*The aim of this study was to determine the number of D-type personality patients in the group with a history of myocardial infarction (MI) and the influence of comprehensive in-hospital cardiac rehabilitation (iCR) on their psychological status (PS). The study included 316 consecutive patients aged 18 to 65 with MI in the last six months admitted into the programme of iCR. Surgical revascularized patients, clinically unstable patients and patients with severe chronic diseases and disorders were excluded. At the beginning and in the end of iCR diagnostic exam, hematological/biochemical blood analysis, ergometric testing was conducted. At the beginning and four weeks after the finish of the iCR estimation of PS was conducted. Distress scale 14 (DS14) questioner was used for that purpose. In the period of three weeks, patients were included in the programme of comprehensive iCR. Out of 316 patients in the study group 83.2% were male, while 16.8% were female. Average age of the patient was 51.3±7.2. When being admitted to iCR 42.7% patients had characteristics of D-type personality. Those patients had substantially lower level of body mass and body mass index. In the same time there were no differences among groups in risk factors, values of clinical, laboratory and diagnostic parameters. During iCR study group had more complications in comparison to the control group. At the end of iCR substantial rise of functional capacity of patients, improvement of lipid profile and lowering of glycaemia was recorded. Also at the end of iCR antiarrhythmics and psychopharmaceutical medicaments were more often prescribed to the patients in the study group. Four weeks after the iCR share of D – type personality patients was 41% and 71% of study group patients kept their D-type structure.*

**Key words:** influence, myocardial infarction, cardiac rehabilitation, in-hospital, psychological status, type D personality

## Introduction

Cardiovascular diseases (CVD) are the leading cause of death and early working inability in the majority of industrialized European Union (EU) and American states. The case is true for Croatia, as well<sup>1,2</sup>. 16.5 million people die from CVD worldwide annually. 4.35 million and more than 1.9 million people annually die in 53 World Health Organization (WHO) member states and in the EU member states respectively<sup>1</sup>. Available data show that in 2009 the share of deaths resulting from CVD in Croatia was about 50% – 25.976 people, with the mortality rate of 586 per 100.000 people<sup>2</sup>. CVD is a socioeconomic problem in economically partly and highly developed societies, not only because of early loss of working ability and patients'

deaths but also because of specific and complex acute and critical care procedure. The estimate CVD costs in the EU member states are 169 billion EUR annually<sup>1</sup>. It is, therefore, understandable that health care systems aspire to the appropriate and efficient solutions which should result with decreased losses, either human or financial, connected to direct and indirect patients' care costs. Since prevention is the best treatment procedure, in 1990 the European Atherosclerosis Society, European Society of Cardiology (ESC) and European Society of Hypertension initiated common definition of CVD prevention procedures and formed Guidelines of cardiovascular disease in clinical practice<sup>1,3</sup>. The basic goals of ESC

Guidelines of Cardiovascular Disease from 2003 are the decrease of first and continuous clinical manifestations of CVD, especially myocardial infarction (MI), early prevention of working inability and total death rate prevention. Those goals should be accomplished primarily with an adequate modification of the known main (high blood pressure, high lipids in blood and smoking) and additional (age, sex, bad eating habits, overweight, physical inactivity and diabetes) CVD risk factors. As the results of the Framingham Heart Study from the middle of the 20<sup>th</sup> century, managed to explain the IHD outbreak in only half of the patients who suffered from the new illness, some psychosocial aspects of a patient's life as possible risk factors become the goal of the research. Among mentioned psychosocial aspects special attention is paid to the states of stress, social support perception and personality types of the patients<sup>4</sup>. The wish to define personality and illness itself properly and to recognize their mutual influence dates back at the beginnings of medicine. Hippocrates and Galen developed a theory of four temperaments (melancholic, sanguine, choleric, phlegmatic), based on the cognition about psychology and physiology of a man at their times. In the middle of the 20<sup>th</sup> century, Flanders Dunbar, one of the founders of psychosomatic movement, developed her theory of temperaments as causes of illnesses, all based on Hippocrates' theory of four temperaments. Her thesis is that specific types of personality are causes of physiological damages and she supports it with clinical observations and research results which show the significant correlation between some illnesses and specific marks connected to types of personalities (coronary, peptic ulcer, diabetes and traumatized personality)<sup>4</sup>.

#### *A-type personality and ischemic heart disease*

In the second half of the 20<sup>th</sup> century, cardiologists Ray Roseman and Mayer Friedman conducted the study on influence of smoking, physical inactivity and overweight on IHD outbreak. During the researches of the study process they noticed that the majority of the patients had similar personality characteristics set and behaviors. Hostility, competitiveness, hastiness, impatience, »workaholicity«, multitasking, constant lack of time, brisk speech with gesticulation, are only some of the mentioned personality characteristics in A type »coronary risk behavior« persons, according to the mentioned cardiologists. Persons who do not show these types of personalities are called B types<sup>5</sup>. In order to confirm their hypothesis on correlation of A-type personality and IHD, they started prospective study of 3.510 healthy males age 39–59 during the period of 8.5 years. The results of the study – called Western Collaborative Group Study (WCGS) – showed that A type personality persons suffer from angina pectoris, MI or sudden coronary death twice as much as compared to B type personality patients. Higher IHD breakout risk in A type personality was sustained despite the control and regulation of the known risk factors (hypercholesterolemia, high blood pressure, smoking, heritage). During the mid 1980es

many studies on psychophysiological changes in persons with IHD were conducted in order to confirm the correlation between A type and IHD. The results, however, did not confirm the correlation. The inconsistency problem between A type and IHD was partly caused by not clearly defined A type concept. It is still not clear if this is a personality type or type of behavior<sup>6,7</sup>. Initial enthusiasm with A type slowly decreased and a new scientific evaluation, not of the total A type concept, but some of its components was needed<sup>6–8</sup>.

#### *D type personality and ischemic heart disease*

At the beginning of 1990s, a group of Belgian authors led by Denollet started the research of negative emotions (NE) and suppressing reactions on IHD breakout and outcome in order to recognize personality characteristics and their correlation with IHD<sup>9</sup>. According to their hypothesis, NE is a method of how a person experiences and deals with psychological challenges, physical disabilities or illnesses and self-perception<sup>9,10</sup>. NE is identified with neuroticism which is described as the state of permanently present NE accompanied with the sense of worry and insecurity<sup>11,12</sup>. According to Tupes and Christal five-factor model, neuroticism is one of five personality structure characteristics. Together with extraversion, it represents the most stable characteristic<sup>12</sup>. Therefore, NE is not a basic temper type, but a complex concept which includes various behavioral and character types of individuals, which influence their stress and health perception<sup>13</sup>. Individuals who have an accented NE are not capable of successful confrontation with everyday, and especially greater challenges, for example changes in their health status. They feel distress most of the time<sup>10,14</sup>. Evaluation tests show the presence of NE in A type coronary risk behavior<sup>15</sup>. NE as a part of A type is the cause of a bad reaction to stress on the one hand, and bad health perception and IHD development on the other. Denollet pays special attention to the situation in which NE is not accented because there is a chance that weak expression of individual NE is a cause of inhibition rather than the fact that NE is really low in general<sup>10</sup>. According to Denollet, inhibition reaction has a significant influence on modification of anxiety and health relation. This is the result of the researches which show the increased activity of the autonomous nervous system in persons who deal with stress in this way<sup>10,16</sup>. Psychosocial model of coronary risk personality cannot come down to only one characteristic, but is a complex of a few of them. Denollet includes neuroticism and social inhibition among those characteristics, and connects them with depression<sup>17</sup>. Emotional distress is generated by individual personality characteristics and positively influences survival after MI<sup>17</sup>. That is a complex activity made of various NEs and their inhibitions, which causes violation of natural homeostasis and illness breakouts<sup>10,16,17</sup>. In the prospective study conducted on 105 male patients after MI during two to five years, Denollet found out that distressed types of persons (D type), those who experienced NE, and tended to inhibit them, had a higher car-

diac death possibility and lower functional capability<sup>18</sup>. Total mortality rate in distressed examinees (D type patients) was eight times higher, and cardiac death six times higher compared to control non D type subjects from general population. D type person experiences life challenges with more difficulty than healthy persons and tends to depression and somatization<sup>18,19</sup>. D-type personality is made of two main and stable characteristics, NE and social inhibition (SI). NEs are temporary or permanent emotional states which overlap with anxiety and neuroticism, and include feelings of tension, worry, anxiety, anger and sadness which a person experiences in various life situations<sup>16</sup>. SI, as another basic characteristic of D type, presents individual tendency not to express NEs either verbally or behaviorally in social contact. Moreover, D type persons inhibit them from conscious levels. Persons with SI as characteristic of their temper feel insecure in company, they lack self-confidence, often are shy and less talkative. NE and SI interaction presents chronic stress state with negative effects on health and influences IHD status<sup>17,18,20</sup>. The array of researches conducted on D type personality, organized by Denollet, confirm their independent prognostic value of MI breakout, and mortality outcome of conservative and percutaneous coronary intervention (PCI) treated IHD<sup>18–21</sup>. According to the results of the research conducted on 3.678 examinees, 2.508 of those were from general population, 438 with IHD and 732 hypertonics, Denollet found prevalence of D type in 21% of general population, 28% with IHD and 53% of hypertonics<sup>18</sup>.

#### *D type personality and cardiac rehabilitation*

Positive effects of ambulatory cardiac rehabilitation (aCR) in patients with IHD and D type personality are documented. A three-month program consisted of a dosed physical training, individual target psychological and behavioral interventions in D type patients which lowered mortality rate<sup>16</sup>. The other research results show that post standard aCR patients' functional capacity is improved, but there are no significant changes in D type construct<sup>23</sup>. The influence of overall in-hospital CR (iCR) on D type patients' psychological state has not been documented so far. The ratio of D type personality connected to cooperation of patients with iCR programs is still not determined either. The aim of this study was to determine the number of D-type personality patients in the group with a history of MI and the influence of iCR on psychological status of coronary patients.

#### **Materials and Methods**

There were 316 consecutive six-month-post-MI patients older than 18 included in the research. The patients were checked in iCR in the period of September 2007 and September 2008. Patients older than 65, coronary artery bypass grafting patients, IHD patients in need of invasive cardiac treatment, persons with more significant psychological challenges and illnesses, patients who were not able to understand test questions or

could not, for objective or subjective reasons, participate in the rehabilitation procedure activities were excluded from the research. Also, those who did not want to participate in the research for other reasons or had to stop iCR early were not included in the research. Patients with certain criteria for participation in the research were informed about the research and they were asked for a written consent for participation. The research was conducted in three phases: checking in at the iCR, right before checking out iCR and a month after checkout. At the beginning of the research, the patients went through a standard clinical examination. Height and body mass was determined on the appropriate scales. The measurements were done without clothes, in underwear. Waist volumes were measured in the belly height with a tailoring meter. After that, DS14 psychological evaluation questionnaire was done in psychological cabinet<sup>22</sup>. After explanations and instructions on how to complete the DS14, the patients completed them individually. Then blood samples were taken for analysis. Biochemical blood analysis was done on Olympus AU 400 chemistry analyzer. After ECG done at rest, ergometry testing was in order (bicycle ergometer – recommended by European Society of Cardiology) on Cardioline ECT WS 2000 cycle ergometer, Ergoline bicycle ergometrics 900, with a software support which enables 12-channel ECG and calculations, and saving ECG for later analyses. The test was on maximum, symptoms limited. The starting exertion was 50W and it was amplified for 25W in every two minutes. During the test, the notes about Borg rating of perceived exertion were made<sup>24</sup>. After the initial evaluation, the patients were included in a standard three-week iCR procedure which consisted of a dosed physical training, counseling on lifestyle and diet, psychological counseling, doctors talks during the rounds, coronary disease lectures and secondary prevention, and medicament therapy correction if needed. According to ergometry test results and evaluated general patients' states, the starting exertion was determined for everyday physical training during iCR. The patients were divided into three groups according to intensity of physical training: group one: patients who can stand ergometry exertion of 125W and more; group two: those who can stand ergometry exertion of 75–100W and group three: those who can stand ergometry exertion of 50–75W. The physical training was conducted through the period of six days a week (work days and Saturday) in groups. It was done in intervals in a gym or in the open (depending on weather conditions), in a pool with cooled thermal water and on recreational polyvalent courts. The training was supervised by educated physiotherapists. The patients spent at least two days in a psychology cabinet on counseling and had one lecture during iCR. The counseling sessions were performed in groups of maximum 15 patients. They were led by a psychologist and/or their associates, and doctors if needed. Mostly the sessions were about acquainting patients with IHD, the possibilities of adjustment to the state of illness, acquainting with stress and lectures about changes of lifestyle and diet with the goal to control IHD risk factors. According to their judgments, the

department doctors recommended patients individual psychological treatments. The psychologist made interviews and evaluation procedures (Bortner, PIE) using behavioral-cognitive techniques during counseling. Based on the results, the psychologist tried to accomplish the following goals: acquaint the patient with the specific risk factors for his IHD type, increase motivation for lifestyle changes, reduce anxiety and depression, reduce hostility, develop appropriate stress management techniques and increase lifestyle quality. Biochemical blood analysis, ECG and ergometry tests were done just prior to the end of iCR. After the medical treatment, the patients were given diet recommendations along with medical documentation and discharge letters. Four weeks after discharge from iCR, the patients received a DS14 questionnaire at their homes. In case of lack of questionnaire response within 14 days from receiving it, the researchers contacted the patients by phone only once and personally. In case the response was not received even after that, it was considered that the patients would not respond and collected data were saved for further processing.

**Statistics**

Dual computer data base (Microsoft office Excel 2003, Windows XP Professional) was programmed for collecting and processing – for D type personality patients and control group – with necessary explanations and criteria for filling in certain variables. Descriptive statistics was done for all the scanned parameters and it was a base for determination for data distribution. Basic statistic measures were calculated. T-test and ANOVA were used for processing normally distributed data to test the difference between the groups. Descriptive data were processed by  $\chi^2$ -test. Statistical tests were made on a significance level of 95% ( $\alpha=0.05$ ). The results were presented in graphs and numerically (in charts). STATISTICA 6.1 SttSoft inc. 1983–2003 was used for data processing and analysis, in cooperation with the statistician. The following modules were used: Basic Statistic and Table (Descriptive statistics, t-test, crosstabulation tables) ANOVA, Nonparametrics (comparing two dependant samples).

**Results**

314 out of 316 patients included in the research completed the process (99%). 2 of the patients from study group were excluded from the research because of certain complications. One case happened three days after check in as a result of gastrointestinal tract bleeding. The patient was transferred into other hospital for a proper treatment. The second case happened on day nine of iCR because of hemodynamic cardiac arrhythmia and the patient was transferred to intensive care unit for further treatment. D type personality was determined in 135 (42.7%) patients – a study group. A control group consisted of 185 patients. 263 (83.2%) out of 316 patients were male and 53 (16.8%) were female. The average patients’ age was 51.3±7.2 from 27 to 64 years of age. 255

(80.7%) out of 316 patients had working ability prior to MI, 103 (76.3%) in the study group and 152 (83.9%) in the control group. Most of the patients, 62%, were employed and on a sick leave at the beginning of iCR. 10.4% of them were unemployed (employment office) and 3.7% were employed and active at the beginning of iCR (Figure 1). Almost three quarters of patients were smokers prior to MI, and hypertension was present in 59% of patients. 75% of them had high blood cholesterol, and 69% hypertriglyceridemia (Table 1). 189 (59.8%) patients had PCI done in the acute illness phase, and 24.4% had a conservative treatment, without active myocardium reperfusion (Figure 2). The average acute treatment phase lasted 11.9±4.9 days in the study group and 11.1±5.0 in the control group (Table 2). 86 (27.8%) patients went through complications during the acute MI phase (Table 2). 13 (14.7%) of them in the study group and 8 (9.1%) in the control group had complex ventricular arrhythmia. During the iCR in the study group 22 patients had complications, 13 out of them had continuous ventricular single and complex extra systole (Table 2). Patients in the study and control groups had body mass index a bit higher than normal (on overweight level) (Table 3). Patients’ body mass, body mass index and waist volume were significantly lower in the study group. In the both

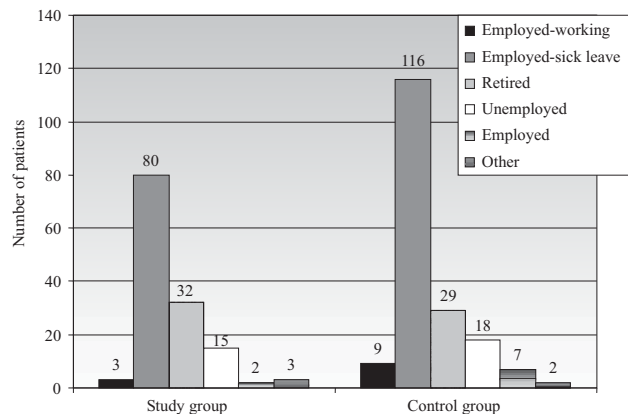


Fig. 1. Patients’ working status while on in-hospital cardiac rehabilitation in study and control group.

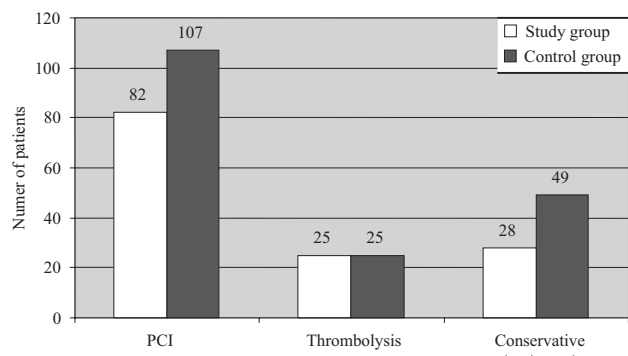


Fig. 2. Treatment in acute phase in study and control group. PCI – percutaneous coronary intervention.

**TABLE 1**  
CASE HISTORY DATA ABOUT CARDIOVASCULAR RISK FACTORS AND CASE OF CARIOVASCULAR AND CEREBROVASCULAR DISEASE IN CLOSE FAMILY MEMBERS (PARENTS) IN STUDY AND CONTROL GROUP

	Study group (N=135)	Control group (N=181)	p*
Ischemic heart disease in family	32.6%	23.8%	0.142
Cerebrovascular disease in family	6.7%	8.3%	0.144
Early case of ischemic heart disease	5.9%	9.4%	0.092
Smoking	71.9%	73.5%	0.747
– No. of cigarettes per day	28.5 (N=94)	28.4 (N=123)	0.598
Hypertension	62.2%	55.8%	0.265
Diabetes	11.8%	19.3%	0.109
Hypercholesterolemia	76.3%	75.1%	0.812
Hypertriglyceridemia	73.3%	64.6%	

\*p-values from  $\chi^2$ -test

groups the systolic blood pressure value was significantly lower at the end of iCR. Compared to the control group, the systolic blood pressure values were significantly lower at the beginning and at the end of iCR. Also, the pulse rate values were significantly higher at the beginning than at the end of iCR (Table 3). 49 (21%) out of 230 smokers continued with the habit during rehabilitation (Table 4). In both groups the blood glucose level significantly decreased, but there was no significant difference

between the groups. Lipidogram levels – total cholesterol values and LDL fractions were significantly decreased at the end of iCR. HDL cholesterol fraction showed increase in the control group while the study group showed value decrease, but the changes were not statistically significant. Triglyceride values for both groups were significantly lower at the end of iCR, and there were no statistic significant differences between the groups (Table 5). Acetylsalicylic acid and hypolipemics were the most com-

**TABLE 2**  
DURATION OF ACUTE PHASE TREATMENT AND IN-HOSPITAL CARDIAC REHABILITATION AFTER MYOCARDIAL INFARCTION AND COMPLICATIONS IN STUDY AND CONTROL GROUP

	Study group (N=135)	Control group (N=181)	p
Treatment duration (days)			
MI acute phase	11.9±4.9	11.1±5.0	0.157*
iCR	20.3±2.2	20.6±1.3	0.131*
MI acute phase complications			
Patients (N=86)	40 (46.5%)	46 (53.5%)	0.419**
Ventricular extrasystole	13 (14.7%)	8 (9.1%)	0.059**
Ventricular extrasystole with heart failure	–	4 (4.5%)	
Ventricular extrasystole with cardiac arrest	4 (4.5%)	5 (5.7%)	0.634**
Atrial fibrillation	1 (1.1%)	2 (2.3%)	0.426**
Atrioventricular block	4 (4.5%)	2 (2.3%)	0.275**
Heart failure	5 (5.7%)	4 (4.5%)	0.629**
Cardiac arrest	–	5 (5.7%)	
Myocardial re-infarction	3 (3.4%)	3 (3.4%)	1.000**
Stenocardia	2 (2.3%)	5 (5.7%)	0.139**
Hypertension	8 (9.1%)	8 (9.1%)	1.000**
Cardiac rehabilitation complications			
Patients (N=33)	22 (66.7%)	11 (33.3%)	0.036**
Ventricular extrasystole	13 (39.4%)	5 (15.2%)	0.053**
Stenocardia	3 (9.1%)	2 (6.1%)	0.314**
Hypertension	2 (6.1%)	–	
Other	4 (12.1%)	3 (9.1%)	0.371**

\* p-values from t-test, \*\*p-values from  $\chi^2$ -test, MI – myocardial infarction, iCR – in-hospital cardiac rehabilitation

**TABLE 3**  
RESULTS OF CLINICAL EXAMINATION AND COMPLETED TESTS WHEN CHECKING IN AND OUT IN-HOSPITAL CARDIAC REHABILITATION IN STUDY AND CONTROL GROUP

Parameters	Study group		Control group		p* (ci/co)	p (sg/cg)
	Beginning of iCR-a	End of iCR-a	Beginning of iCR-a	End of iCR-a		
Body mass (kg)	85.1	84.7	88.0	87.5	0.589	0.008
Body mass index	28.2	28.0	28.8	28.6	0.524	0.047
Waist (cm)	97.8	96.1	100.1	99.8	0.218	<0.001
Systolic blood pressure (mmHg)	132.9	124.0	129.8	123.3	<0.001	0.052
Diastolic blood pressure (mmHg)	83.6	84.6	82.1	78.5	0.570	0.123
Pulse rate	68.3	70.1	68.6	70.7	0.027	0.619

\*p-values from two-level variation analysis (ANOVA), iCR – in-hospital cardiac rehabilitation, (ci/co) – values of tested parameters when checking in and out, (sg/cg) – values of tested parameters between the groups

**TABLE 4**  
SMOKING ABSTINENCE IN STUDY AND CONTROL GROUP DURING IN-HOSPITAL CARDIAC REHABILITATION

	Study group	Control group	p*
Smokers (N=230)	97 (42.2%)	133 (57.8%)	
Abstain after MI	76 (78.3%)	105 (78.9%)	0.898
Do not abstain after MI	21 (21.0%)	28 (21.1%)	0.966

\*p-values from  $\chi^2$ -test, MI – myocardial infarction

**TABLE 5**  
BIOCHEMICAL PARAMETERS AT THE BEGINNING AND AT THE END OF IN-HOSPITAL CARDIAC REHABILITATION IN STUDY AND CONTROL GROUP

Parameters	Study group		Control group		p* (ci/co)	p (sg/cg)
	Beginning of iCR-a	End of iCR-a	Beginning of iCR-a	End of iCR-a		
Blood glucose	6.7	5.7	7.0	5.8	<0.001	0.129
Triglycerides	2.23	1.90	2.28	1.80	<0.001	0.757
Total cholesterol level	5.5	4.1	5.7	4.0	<0.001	0.485
HDL -cholesterol	1.22	1.17	1.13	1.16	0.967	0.083
LDL -cholesterol	3.4	2.4	3.6	2.4	<0.001	0.076

\*p-values from two-level variation analysis (ANOVA), iCR – in-hospital cardiac rehabilitation, (ci/co) – values of tested parameters when checking in and out, (sg/cg) – values of tested parameters between the groups

monly prescribed medications for both groups, followed by  $\beta$  blockers, ACE inhibitors and nitrates. Statistically significant difference can be seen in anti-arrhythmic group of medicines. Two times more patients in the study group started anti-arrhythmic medication at the end of rehabilitation (Table 6). Also, psychopharmacs are significantly more present in the treatment of the study group patients at the beginning and at the end of the treatment (Table 6). Study group patients evaluated the training program more exhausting by Borg scale, compared to the control group<sup>24</sup>. Other examined parameters were almost equal for both groups (Table 7). 38(28.1%) study group patients and 31 (17.1%) control group patients had changes in a telemetric ECG, high pulse rate or some other difficulties which initiated program modifications during iCR procedure (Table 8). Every patient

who participated in the research underwent a maximum bicycle ergometer symptoms limited test at the beginning of iCR. Ergometry tests were made for three people less at the check out. Two patients stopped the treatment earlier due to complications and the third patient left the treatment 2 days before check out, and did not undergo final ergometry test, due to family reasons (death of a close family member). Both groups showed significantly better results in maximum load level at the end of the iCR. Maximum pulse rate and systolic blood pressure were higher at maximum load. Fatigue perception by Borg scale was significantly higher on the final ergometry test for both groups but there were no differences within the groups (Table 9). Every of 316 examinees completed DS14 evaluation questionnaire at the beginning of iCR. After data processing, 135 (42.7%) of the pa-

**TABLE 6**  
MOST COMMONLY PRESCRIBED MEDICATIONS IN STUDY AND CONTROL GROUP

Medication	Study group			Control group			
	Beginning of iCR-a	End of iCR-a	p* (ci/co)	Beginning of iCR-a	End of iCR-a	p (ci/co)	p (sg/cg)
Acetylsalicylic acid	129 (95.6%)	122 (91.7%)	0.096	176 (97.2%)	167 (92.3%)	0.034	0.238
Hypolipemics	125 (92.6%)	130 (96.3%)	0.184	167 (92.3%)	171 (94.5%)	0.398	0.578
β-blockers	109 (80.7%)	113 (83.7%)	0.524	145 (80.1%)	152 (83.9%)	0.953	0.337
ACE inhibitors	99 (73.3%)	102 (75.6%)	0.675	149 (82.3%)	135 (74.5%)	0.238	0.074
Nitrates	75 (55.6%)	83 (61.5%)	0.323	112 (61.9%)	111 (61.3%)	0.913	0.433
Psychopharmacs	28 (21.5%)	22 (16.3%)	0.276	24 (13.3%)	21 (11.6%)	0.632	0.025
Ca-blockers	15 (11.1%)	20 (14.8%)	0.365	24 (13.3%)	33 (18.2%)	0.326	0.194
Antiarrhythmics	9 (6.7%)	10 (7.4%)	0,812	6 (3.3%)	5 (2.7%)	0.759	0.019

\*p-values from  $\chi^2$ -test, iCR – in-hospital cardiac rehabilitation, (ci/co) – values of tested parameters when checking in and out, (sg/cs) – values of tested parameters between the groups

**TABLE 7**  
NUMBER OF WORKING DAYS, INTENSITY AND NUMBER OF TRAININGS IN PROGRAM OF IN-HOSPITAL CARDIAC REHABILITATION, PERCEPTION OF EXHAUSTION ACCORDING TO BORG SCALE IN STUDY AND CONTROL GROUP

Parameter	Study group	Control group	p*
Number of iCR working days	16.1	16.2	0.492
Number of arrivals			
– Exercises	13.8	13.6	0.802
– Ergocycle	14.3	13.5	0.415
– Exercises – afternoon	13.8	13.6	0.235
iCR intensity program (W)	76.1	76.3	0.952
Exhaustion perception (Borg)	12.7	12.3	0.047

\*p-values from t-test, iCR – in-hospital cardiac rehabilitation, Borg – subjective exhaustion perception by Borg scale from 6 to 20

**TABLE 8**  
CHANGES IN TELEMETRIC ELECTROCARDIOGRAM AND SUBJECTIVE PROBLEMS DURING IN-HOSPITAL CARDIAC REHABILITATION TRAINING PROGRAM IN STUDY AND CONTROL GROUP

	Study group (N=135)	Control group (N=181)	p*
Complications during training (total)	38 (28.1%)	31 (17.1%)	0.019
Pulse rate	11 (8.1%)	13 (7.2%)	0.765
Electrocardiogram changes	19 (14.1%)	16 (8.8%)	0.138
Angina	2 (1.5%)	–	–
Dyspnea	1 (0.7%)	1 (0.5%)	0.818
Leg fatigue	2 (1.5%)	–	–
General fatigue	1 (0.7%)	–	–
Other	2 (1.5%)	1 (0.5%)	0.59

\*p-values from  $\chi^2$ -test

tients were evaluated as D type personality<sup>22</sup>. At the end of iCR, in the study D group there was a statistically insignificant decrease of both D type components (Figure 3 and 4), 87 (71%) of them keeps D type personality structure, and 36 (29%) of them lost D type personality characteristics. 30 (18%) of the patients from the control

group became D types, primarily because of a significant increase of NE component of D type results (Table 10, Figure 3 and 4). Table 11 shows the results of a simple attitude category questionnaire about the iCR benefits for both groups and about following the prescribed instructions and their working ability after leaving iCR.

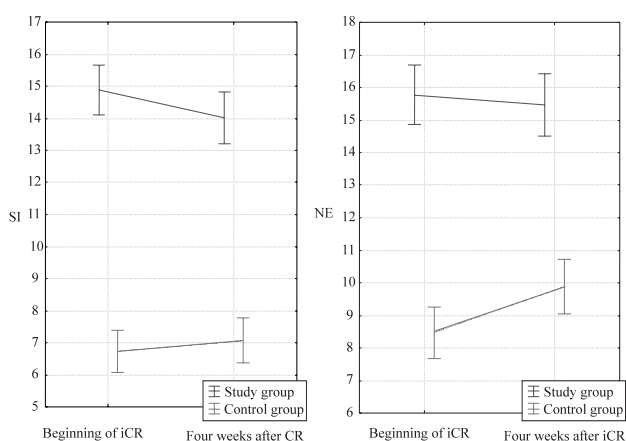


Fig. 3. Results of DS14 psychological evaluation test at the beginning of cardiac rehabilitation and four weeks after its finish in study and control group. iCR – in-hospital cardiac rehabilitation, NE – negative emotions, SI – social inhibition.

### Discussion and Conclusion

DS14 questionnaire results show that the ratio of D type personality patients participating in this research in stationary CR after MI and four weeks after iCR, is higher than in Belgian, Dutch, German and Chinese IHD patients for 42.7% and 41.0% respectively. Grande and Jordan examined D type and found prevalence of 25%

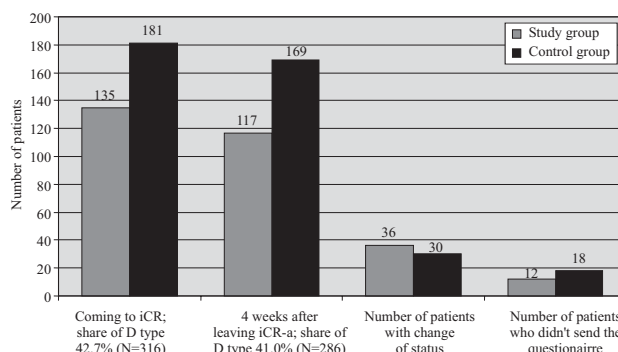


Fig. 4. Share of D-type personality patients coming to cardiac rehabilitation, and four weeks after its finish, the number of patients who didn't respond and the number of patients who experienced psychological status change. iCR – in-hospital cardiac rehabilitation.

among German<sup>23</sup>, Pelle and associates of 27% among Dutch examinees with IHD<sup>25</sup> and Yu of 31% among Chinese examinees with IHD<sup>26</sup>. A possible explanation for this fact can be found in the prevalence of A type coronary risk behavior research results by Čatipović and associates. The research was conducted on 1084 employed Croats. It resulted in higher prevalence of A type (65.5%) compared to French examinees (42.2%) and with a high hostility and anger levels<sup>27</sup>. At the end of the research, 71% of the examinees keep D type. That is less if com-

TABLE 9  
ERGOMETRY TEST RESULTS AT THE BEGINNING AND AT THE END OF IN-HOSPITAL CARDIAC REHABILITATION IN STUDY AND CONTROL GROUP

Parameter	Study group		Control group		p* (ci/co)	p (sg/cg)
	Beginning of iCR-a	End of iCR-a	Beginning of iCR-a	End of iCR-a		
Achieved load (W)	104.5	137.7	104.7	143.9	<0.001	0.120
Achieved max. O <sub>2</sub> consumption (ml)	1554	1942	1557	2027	<0.001	0.325
Ratio of achieved and theoretical max. O <sub>2</sub> consumption (%)	71	88	69	88	<0.001	0.162
MET	5.3	6.7	5.1	6.7	<0.001	0.351
Pulse rate at rest (.../min)	72.4	75.1	73.5	73.0	0.930	0.456
Pulse rate at max. load	122	138	123	137	<0.001	0.876
Ratio of max. achieved and max. theoretical pulse rate (%)	72	83	73	83	<0.001	0.563
Systolic blood pressure at rest (mmHg)	137	136	136.5	133.9	0.164	0.320
Diastolic blood pressure at rest (mmHg)	89.1	88.9	89.4	88.0	0.234	0.590
Systolic blood pressure at max. load (mmHg)	176	184	177	186	<0.001	0.344
Diastolic blood pressure at max. load (mmHg)	102.5	103.5	102.7	104.1	0.185	0.602
Systolic blood pressure three min. after test stopping (mmHg)	136	140	136	144	0.940	0.558
Diastolic blood pressure three min. After test stopping (mmHg)	88.0	87.5	88.0	87.1	0.346	0.777
Sum of max. systolic blood pressure and max. pulse rate	21.5	25.0	22.0	26.0	<0.001	0.172
Fatigue perception – Borg	14.4	15.3	14.3	15.0	<0.001	0.941

\*p-values from two-level variation analysis (ANOVA), iCR – in-hospital cardiac rehabilitation, (ci/co) – values of tested parameters when checking in and out, (sg/cg) – values of tested parameters between the groups, MET –oxygen consumption (load equivalent) at ergometry expressed in metabolic unit (1 MET equals approximately 3.5 mlO<sub>2</sub>/ kg body mass), Borg – subjective exhaustion perception by Borg scale from 6 to 20



**TABLE 10**

DS14 QUESTIONNAIRE RESULTS IN STUDY AND CONTROL GROUP AT THE BEGINNING OF IN-HOSPITAL CARDIAC REHABILITATION AND FOUR WEEKS AFTER ITS END FOR NE AND SI COMPONENTS OF D-TYPE PERSONALITY

Parameter	Study group		Control group		p* (ci/co)	p (sg/cg)
	Beginning of iCR-a	4 weeks after iCR-a	Beginning of iCR-a	4 weeks after iCR-a		
Negative emotions (NE)	15.8	15.5	8.5	10	0.050	<0.001
Social inhibition (SI)	15	14	6.7	7.1	0.488	<0.001
Q1	1.3	0.5	1.3	0.6	0.232	<0.001
Q2	3.0	2.8	2.0	2.2	0.836	<0.001
Q3	3.1	2.9	2.7	2.5	0.026	<0.001
Q4	1.7	1.8	0.8	1.1	0.024	<0.001
Q5	2.5	2.3	1.2	1.4	0.989	<0.001
Q6	2.2	1.9	0.7	0.8	0.026	<0.001
Q7	1.3	1.5	0.3	0.5	0.037	<0.001
Q8	2.1	2.0	0.6	0.8	0.443	<0.001
Q9	1.6	1.8	0.5	0.9	0.003	<0.001
Q10	1.9	2.0	0.5	0.6	0.108	<0.001
Q11	2.4	2.1	1.3	1.2	0.023	<0.001
Q12	3.4	3.0	2.8	2.8	0.009	<0.001
Q13	2.3	2.3	0.9	1.2	0.134	<0.001
Q14	1.9	1.9	0.6	0.6	0.773	<0.001

\*p-values from two-level variation analysis (ANOVA), iCR – in-hospital cardiac rehabilitation, (ci/co) – values of tested parameters when checking in and out, (sg/cg) – values of tested parameters between the groups, Q1-Q14 – questions 1–14 of evaluation questionnaire DS14, NE (Q2, Q4, Q5, Q7, Q9, Q12, Q13) and SI (Q1, Q3, Q6, Q8, Q10, Q11, Q14)

pared to the Pelle and associates and Denollet and associates research results, which show 78% and 80% D type personality consistence<sup>22,25</sup>. 29% of the patients went through changes of personality, loss of D type characteristics as the result of NE and SI components decrease

(Figure 3). This can be explained by positive effects of the overall iCR program which includes dosed trainings and group and individual psychological interventions. Four weeks after iCR there were 18% of patients from the control group with D type characteristics in psychological

**TABLE 11**

ESTIMATION OF CARDIAC REHABILITATION VALUE, FOLLOWING DIET INSTRUCTIONS, MEDICAMENTS AND WORKING ACTIVITY FOUR WEEKS AFTER IN-HOSPITAL CARDIAC REHABILITATION IN STUDY AND CONTROL GROUP

	Study group (N=123)	Control group (N=160)	p*
In-hospital cardiac rehabilitation benefits			
Feels better than before	69 (56.0%)	103 (64.4%)	0.126
Feels the same as before	52 (42.3%)	52 (32.5%)	0.084
Feels worse than before	2 (1.6%)	5 (3.1%)	0.419
Diet			
Follows	110 (89.4%)	136 (85.0%)	0.326
Does not follow	13 (10.6%)	24 (15.0%)	0.213
Exercise			
Yes	92 (74.8%)	124 (77.5%)	0.560
No	21 (25.2%)	36 (22.5%)	0.554
Working activity			
Employed – work	19 (15.5%)	35 (22.2%)	0.170
Employed – sick leave	58 (47.3%)	82 (51.9%)	0.405

\* p-values from  $\chi^2$ -test

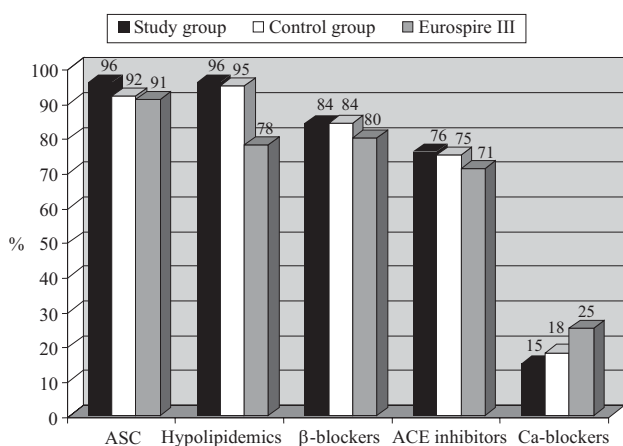


Fig. 5. Drug therapy in patients of study and control group at the end of in-hospital cardiac rehabilitation and in Eurospire III study. ASC-acetylsalicylic acid.

evaluation (Figure 4). A possible explanation of this change is a stress status occurring as a result of sudden changes of a health state and IHD manifestation. This includes not only medical treatment, but also lifestyle changes with an uncertain outcome of the recovery and IHD, which brings to the increase of NE. The results of a control evaluation procedure four weeks after iCR in the control group patients showed significantly higher NE component (Table 10, Figure 3). The ratio of cardiovascular risk factors in the study and control group was high (Table 1). At the MI initiation there were 72% of smokers in the study group and 74% of smokers in the control group. Eurospire III study shows the ratio of 17% of smokers<sup>28</sup>. There were more hypertension patients in the study group than in the control group (62%:56%,  $p=0.265$ ). The number of hypertensive patients is also higher than in Eurospire III study which shows 56% of hypertensive patients. The diabetes ratios are 12:19:25 % (study: control: Eurospire III) and hypercholesterolemia ratio 76:75:51%<sup>28</sup>. Acute MI phase complications did not show any significant differences between the groups. Ventricular extra systole occurred in the study group as a complication in the acute MI phase and during the iCR more often than in the control group, but that was still not statistically significant (Table 2). In both groups significant changes occurred in biochemical reports which showed the decrease of negative lipid status and blood glucose level at the end of iCR. That is the result of a positive influence of dosed physical trainings, diet and hygiene measures and hypolipemic therapy during the

iCR. At the end of iCR, blood glucose, total cholesterol and LDL cholesterol values were within normal levels. Triglyceride and HDL cholesterol levels decreased significantly, but still were not within normal levels for both groups (Table 5). In this research, compared to Eurospire III, there were a slightly larger number of patients who were taking acetylsalicylic acid medications,  $\beta$ -blockers and ACE inhibitors at the end of iCR. A significantly larger number of patients from this research were taking hypolipemics. Eurospire III study examinees took more Ca channel blockers compared to our patients (Figure 5)<sup>28</sup>. At the end of iCR, a significantly lower number of the control group patients were taking acetylsalicylic acid group of medications, and the reason was nutrition problems. The study group patients were using psychopharmacs significantly more than the control group patients. Also, the study group patients were taking anti arrhythmic medications to control arrhythmia significantly more than the control group patients at the beginning and at the end of iCR (Table 6). There were no significant differences between the groups concerning work days spent in iCR treatment and the intensity of the program (Table 7). The study group patients evaluated the iCR program significantly more exhausting than the control group patients, which matched the description of D type personality<sup>19</sup>. Also, a disturbed flow of iCR program occurred significantly more often in the study group, but not because of physical changes (pulse rate, ECG), but subjective problems and fatigue which happened more often in the study group (Table 7). Ergometry test results showed a relatively positive functional capacity at the check in the iCR. A significant improvement of functional capacity was noticed at the end of iCR for both groups (Table 9). The result of this research showed that iCR, according to ergometry test results, at the end of the program brings to the significant improvement of functional capacity of cardiovascular systems, improves lipid status and glycemia, but does not bring any statistically significant changes in psychological status of the D type patients after MI. Further research, longer period of patients' supervision and extra evaluation procedures are needed for more accurate definitions of the dynamics of their psychological status, personality changes, their quality of life<sup>29</sup> and definition of possible risks for IHD outcomes. Also, evidence suggests that the D type construct, originally developed in Belgian cardiac patients, is equally applicable in other nationalities<sup>23,25,26</sup>, but more research is needed to examine the validity on D type construct in cardiac patients in Croatia.

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## **UTJECAJ STACIONARNE KARDIOLOŠKE REHABILITACIJE NA PSIHOLOŠKI STATUS BOLESNIKA SA PREBOLJENIM INFARKTOM MIOKARDA D TIPa OSOBNOSTI**

### **SAŽETAK**

Cilj istraživanja bio je odrediti promjene psihološkog statusa bolesnika s D tipom osobnosti koji su preboljeli infarkt miokarda (IM) nakon programa sveobuhvatne stacionarne kardiološke rehabilitacije (sKR). U istraživanje je uključeno 316 konsekutivnih bolesnika u dobi od 18 do 65 godina s preboljenim IM-om unutar 6 mjeseci, primljenih na sKR. Isključeni su bili kirurški revaskularizirani bolesnici, klinički nestabilni i oni s težim kroničnim bolestima i poremećajima. Na početku i kraju sKR-a obavljen je liječnički pregled, hematološke i biokemijske analize krvi i ergometrijsko testiranje. Na početku sKR-a i četiri tjedna po njegovu završetku izvršena je procjena psihološkog statusa upitnikom DS14. Bolesnici su bili uključeni u sveobuhvatni program stacionarnog sKR-a prosječnog trajanja tri tjedna. Od 316 bolesnika bilo je 83,2% muškaraca i 16,8% žena prosječne dobi 51,3±7,2 godina. Kod dolaska na sKR 42,7% bolesnika imalo je obilježja D tipa osobnosti. D skupina bolesnika kod dolaska na sKR imala je značajno nižu vrijednost tjelesne mase i indeksa tjelesne mase, dok između skupina nije bilo razlike u čimbenicima rizika i vrijednostima ostalih promatranih parametara. D skupina bolesnika tijekom sKR-a ima učestalije komplikacije u odnosu na kontrolnu skupinu. Program sKR-a koji je podjednako intenziteta za obje skupine, ispitivana skupina procjenjuje po Borgovoj skali težim od kontrolne. Na kraju sKR-a došlo je do značajnog porasta funkcionalnog kapaciteta bolesnika obje skupine, poboljšanja lipidnog profila i smanjenja glikemije. Ispitivanoj skupini na kraju sKR-a češće su prepisivani antiaritmici i psihofarmaci. Četiri tjedna nakon sKR-a udio D tipa je 41,0%, 71% bolesnika ispitivane skupine zadržava strukturu D tipa osobnosti.