

The Adherence in Chronic Diseases Scale – a new tool to monitor implementation of a treatment plan

Skala *adherence* w chorobach przewlekłych – nowe narzędzie do badania realizacji planu terapeutycznego

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Abstract

Introduction. The aim of this study was to assess adherence to treatment with use of the new scale in a population of patients with coronary artery disease (CAD) after myocardial infarction (MI) with respect to some socio-demographic and clinical factors.

Material and methods. The study was conducted in a population of 100 consecutive patients (40 women, 60 men) aged from 30 to 88 years (mean 63.4), six months after hospitalization for MI.

Results. The results of the assessment with the Adherence in Chronic Diseases Scale (ACDS) comprise between 6 and 28 points; median 24 points (21–28). Twenty-four patients had high score (> 26 pts.), 53 patients had intermediate score (between 21–26 pts.) and 23 – low score (< 21 pts.). For optimal model of multiple regression, the correlation coefficient R was 0.539; and the adjusted coefficient of determination $R^2 = 0.26$, $p = 0.000002$. Independent factors affecting adherence according to the ACDS scale were: subjective assessment of health status ($b = 0.48 \pm 0.23$, $p = 0.036$), age of the respondents ($b = -0.11 \pm 0.04$, $p = 0.004$), more than one hospitalization due to CAD ($b = -1.78 \pm 0.87$, $p = 0.044$), and diabetes mellitus ($b = -2.02 \pm 0.91$, $p = 0.029$).

Conclusions. Subjective assessment of health status, age of patients, the number of hospitalizations due to CAD and diabetes affect the adherence in the course of long-term treatment after myocardial infarction.

Key words: adherence scale, coronary artery disease

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Introduction

Implementation of treatment plan is a prerequisite for the effectiveness of treatment in patients with chronic diseases. Therapeutic effect expected based on large clinical trials can be achieved provided that the patient regularly takes medications [1]. According to the evaluation carried out by the World Health Organization in developed

countries, only about 50% of chronically ill patients follow the recommendations of his or her healthcare provider [2]. Such a large scale of poor adherence by patients not only adversely influences their health, but also implies serious social and economic consequences [3].

A paper published by the Canadian researchers evaluated the implementation of the treatment plan in terms of the use of statins [4]. Out of 112,092 patients without

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known cardiovascular disease in whom statin therapy had been initiated, 55% did not take prescribed medications. The incidence of cerebrovascular events was significantly lower (relative risk [RR]: 0.74; 95% confidence interval [CI] 0.65–0.84) in those who adhere to physician's recommendations compared with the other patients [4]. Similarly, results of the PREMIER (Prospective Registry Evaluating Myocardial Infarction: Event and Recovery) trial indicated that poor implementation of the treatment plan is the most important reason for the limited effectiveness of treatment [5]. In a population of patients after myocardial infarction (MI) assessed at one month after discharge from the hospital with the recommendation of aspirin, a beta-adrenolytic and a statin, 12% of patients discontinued taking all three drugs, 4% – two drugs, and 18% – one drug. One-year survival rate of patients who completely stopped taking the drugs was significantly lower compared with those who continued their therapy (88.5% vs. 97.7%) [5].

Analysis of the factors determining the effectiveness of antiplatelet therapy in patients after MI showed that the incidence of pseudo-resistance to therapy due to not taking drugs increases with the passage of time [6]. This is due to many factors, including the complexity of the therapy, the frequency of dosing, economic factors, the side effects of therapy, and the patient's conviction that the treatment is necessary, especially in the absence of clinical symptoms [1].

The preferred term for implementation of treatment plan is "adherence". This term denotes the joint (doctor and patient) development of treatment plans and their implementation [1, 3]. Good cooperation of medical personnel with patients is a fundamental factor for treatment effectiveness in patients with chronic diseases, such as coronary artery disease (CAD), diabetes and hypertension [7]. In everyday practice, the two parties do not always manage to have good contact, which is a prerequisite for cooperation [8].

For the implementation of the treatment plan, it is important to know the true adherence of the patient, understand the causes of low adherence and take actions to improve adherence [9]. There are some direct and indirect methods of assessing adherence; however, it is impossible to indicate the best one [3, 10–12]. Direct methods are observation of the therapy process, determining the concentration of the drug or its metabolites in body fluids and measuring biological markers. Indirect methods include: surveys of patients using developed scales, analysis of pharmacy records, the use of electronic forms of drug-taking monitoring (e.g., containers recording how often and when it was accessed), observation of the changes in patient's clinical situation, and assessment of the dynamics of the disease process [1, 3].

The simplest and most common way to assess adherence is obtaining information directly from the patient.

However, it has been shown that the data obtained in this way have limited credibility [9]. Objectification of patient-reported information on treatment plan implementation is usually difficult and costly. The use of specially developed scales to assess the risk of low adherence allows extensive screening.

The aim of this study was to assess adherence using the new scale in a population of patients with CAD 6 months after MI, in relation to sociodemographic and clinical parameters.

Material and methods

The study was conducted in a population of 100 consecutive patients (40 women, 60 men) with a mean age of 63.4 (30–88) years who were assessed six months after hospitalization for MI. The study was conducted between May 2015 and January 2016. The results of the assessment of adherence were related to sociodemographic data, selected clinical parameters and subjective health assessment (Table 1). Respondents rated their health on a scale of 1 to 10, where 1 meant very bad health and 10 – very good health.

Statistical methods

For comparison of the results obtained with the Chronic Diseases Adherence Scale (ACDS) nonparametric tests were used. Quantitative variables are expressed as medians and quartile ranges. Median values of two data series were compared using the Mann-Whitney test. For comparison of more series of data, Kruskal-Wallis test and multiple comparisons were employed. In order to assess the relationship between two quantitative variables, Spearman's rank correlation was used. Multivariate analysis was performed using multiple regression. In order to select the best regression models, backward stepwise regression was performed. Values of $p < 0.05$ were considered statistically significant. The p -values ≥ 0.05 to < 0.10 were regarded as a trend towards statistical significance. The calculations were performed with the software package Statistica 12.0, in Polish (StatSoft, Tulsa, United States).

Assessment of adherence

The ACDS (Table 2) is a new tool to assess the implementation of the treatment plan. The scale for chronic diseases includes 7 questions with sets of 5 suggested answers to each question. The questions consider the behavior directly determining adherence (Questions 1–5), as well as the situations and views that may indirectly affect adherence (Questions 6 and 7). The ACDS is designed for surveying adults treated for chronic diseases. This tool not only has to reflect the actual implementation of the treatment plan in terms of pharmacotherapy, but also indicate the mechanisms that determine adherence of patients. The results

Table 1. Characteristics of the study population

Parameter	Category/value	Number of patients
Gender	Women	40
	Men	60
Age	< 65 years	56
	≥ 65 years	44
Education	Primary	12
	Vocational	28
	Secondary	41
	Higher	19
Employment status	Employed	44
	Unemployed	2
	Retiree	45
	Pensioner	9
Marital status	Unmarried	8
	Married	73
	Widowed	19
Hospitalization for coronary artery disease	1	61
	> 1	39
Myocardial infarction	1	78
	> 1	22
Smoking (currently)	Yes	32
	No	68
Diabetes	Yes	30
	No	70
Subjective assessment of health status	1	0
	2	0
	3	3
	4	8
	5	16
	6	10
	7	16
	8	23
	9	11
	10	10

can be helpful in undertaking activities aimed at improving the regularity of medication in clinical practice.

The scale was validated previously in the group of 413 patients with coronary heart disease [13]. The ACDS is available free of charge on the website of the Department of Health Promotion CM UMK (<http://www.cm.umk.pl/wydzialy/wydzial-nauk-o-zdrowiu/jednostki-wydzialowe/katedra-i-zaklad-promocji-zdrowia.html>).

Results

The results of the assessment of adherence according to the ACDS in the study population of 100 people six months after MI were between 6 and 28 points; the median score was 24 points (21–28 pts.). Twenty-four patients had high

score (> 26 pts.), 53 patients had intermediate score (21–26 pts.) and 23 patients had low score (< 21 pts.).

Univariate analysis

There were no significant differences between women (23 pts. [19.5–26.5]) and men (24 pts. [22–26]). We found that adherence was decreasing with age (Spearman $R = -0.39$, $p = 0.00007$) (Figure 1).

In the group of patients younger than 65 years of age, the ACDS score was 24.5 pts. (22.5–27 pts.) and in patients aged 65 years and older it was 22 points (19.5–25 pts.), $p = 0.003$. In the surveyed population, the level of education was not the differentiating factor in terms of adherence. Due to the large disproportions in the number of patients in subgroups specified based on employment status, when analyzing the results we compared the group of employed patients (24 pts. [22.5–27]) with professionally inactive patients (combined groups of unemployed, pensioners and retirees – 22 points [20–26]), $p = 0.043$. Similarly, due to large disproportions in the number of patients in the subgroups divided according to marital status, we compared married patients (24 pts. [22–27]) with the combined group of “unmarried” and “widowed” (21 pts. [19–26]), $p = 0.06$. In the group of patients hospitalized once due to CAD, adherence was higher than in those who were hospitalized more than once: 24 points (21–27 pts.) and 23 points (19–26 pts.), respectively; $p = 0.024$. Similar results were obtained when compared people with a history of one MI to those who have had more than one MI: 24 points (21–27 pts.) and 22 points (18–24 pts.), respectively; $p = 0.015$. There was no effect of smoking on adherence. Diabetic patients were characterized by the lower ACDS scores compared to diabetes-free patients: 21 points (19–24 pts.) and 24 points (22–27 pts.), respectively; $p = 0.005$.

The higher subjective evaluation of health status, the higher was ACDA score, $p = 0.023$ (Figure 2). The correlation between these variations was weak but significant: $R = 0.37$, $p = 0.00012$ (Figure 3).

Multivariate analysis

For optimal model of multiple regression, correlation coefficient R is 0.539, and the adjusted coefficient of determination $R^2 = 0.26$; $p = 0.000002$. Independent factors affecting adherence assessed by the ACDS are: subjective assessment of health status ($b = 0.48 \pm 0.23$, $p = 0.036$), age of the respondents ($b = -0.11 \pm 0.04$, $p = 0.004$), more than one hospitalization due to CAD ($b = -1.78 \pm 0.87$, $p = 0.044$) and diabetes mellitus ($b = -2.02 \pm 0.91$, $p = 0.029$).

Discussion

In the population of our study, high adherence was found in 24% and low in 23% of patients. It should be noted,

Table 2. The Adherence in Chronic Diseases Scale (ACDS) (source [2])*

Below is a set of 7 questions with answers. Please rate, which response best reflects your behavior, your situation and your opinions. Please provide honest answers by checking the appropriate one with X.

1. Do you always remember to take all your medications according to your doctor's instructions?

- A. Always B. Almost always C. Sometimes D. Hardly ever E. Never

2. Do you happen to change the dosing of your medications without prior consultation with your doctor?

- A. Never B. Only occasionally C. Sometimes D. Frequently E. I do not adhere to my doctor's recommendations at all

3. Do you adjust the dosing of your medications according to how you feel?

- A. No, I strictly follow the prescribed dosing, no matter how I feel
 B. Yes, I reduce the dosage of some medications when I feel good
 C. Yes, I skip doses of some medications when I feel good
 D. Yes, I temporarily discontinue some medications when I feel good
 E. Yes, I discontinue all medications when I feel good

4. On the appearance of medication-related side effects (e.g. stomach pain, liver pain, rash, lack of appetite, oedema):

- A. I seek medical attention instantly
 B. I reduce the dosage of the medication and attempt to expedite the elective appointment with my doctor
 C. I discontinue the medication and attempt to expedite the elective appointment with my doctor
 D. I discontinue the medication and wait for the next elective appointment with my doctor
 E. I discontinue all my medications and wait for the next elective appointment with my doctor

5. Do you find all your medications necessary for your health?

- A. Yes, I do
 B. I find most of my medications to be beneficial for my health
 C. I find only some of my medications to be beneficial for my health
 D. I find some of my medications to be beneficial for my health, while the others to be harmful for me
 E. I find the majority of my long-term medications to be harmful for me

6. Does your doctor inquire about medication-related problems that you might possibly experience?

- A. Yes, on every appointment B. Yes, he/she usually does C. Yes, but only sometimes D. Yes, but only occasionally E. No, never

7. Do you tell truth when asked by your doctor about medication-related problems?

- A. Yes, always
 B. Almost always
 C. I try to be honest, but sometimes it is hard to admit to non-compliance with doctor's recommendations
 D. Sometimes yes, another time no
 E. No, I don't. I find it my own private business

Evaluation of the results

Results are within the range of 0–28 points

Score	Total score < 21 points	Low adherence
A – 4		
B – 3		
C – 2	Total score 21–26 points	Medium adherence
D – 1		
E – 0	Total score > 26 points	High adherence

*The Adherence in Chronic Diseases Scale is available on the website of the Faculty of Health Science of the Nicolaus Copernicus University, *Collegium Medicum* (<http://www.cm.umk.pl/wydzialy/wydzial-nauk-o-zdrowiu/jednostki-wydzialowe/katedra+zaklad-promocji-zdrowia.html>)

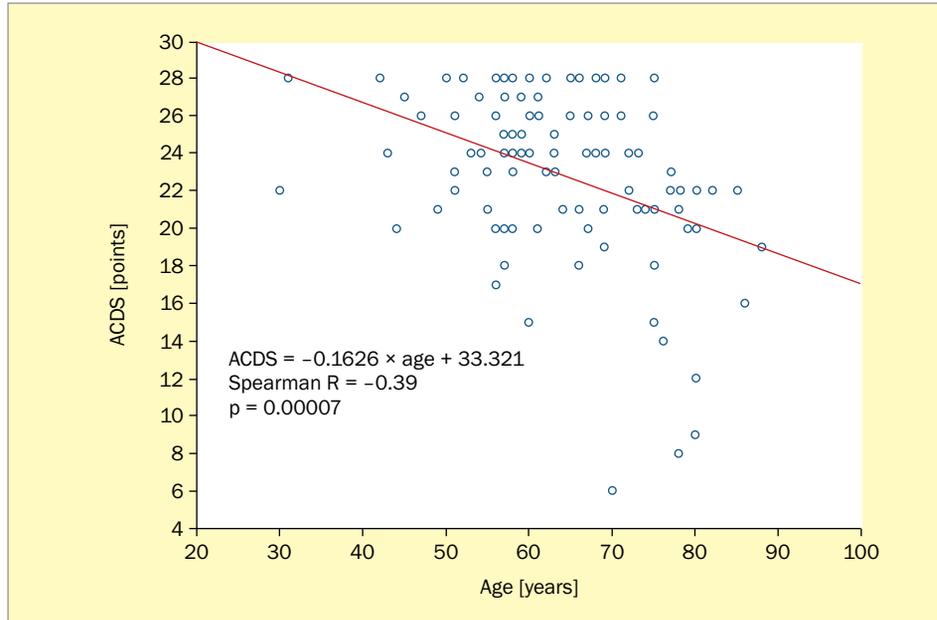


Figure 1. Relationship between the Adherence in Chronic Diseases Scale (ACDS) score and age

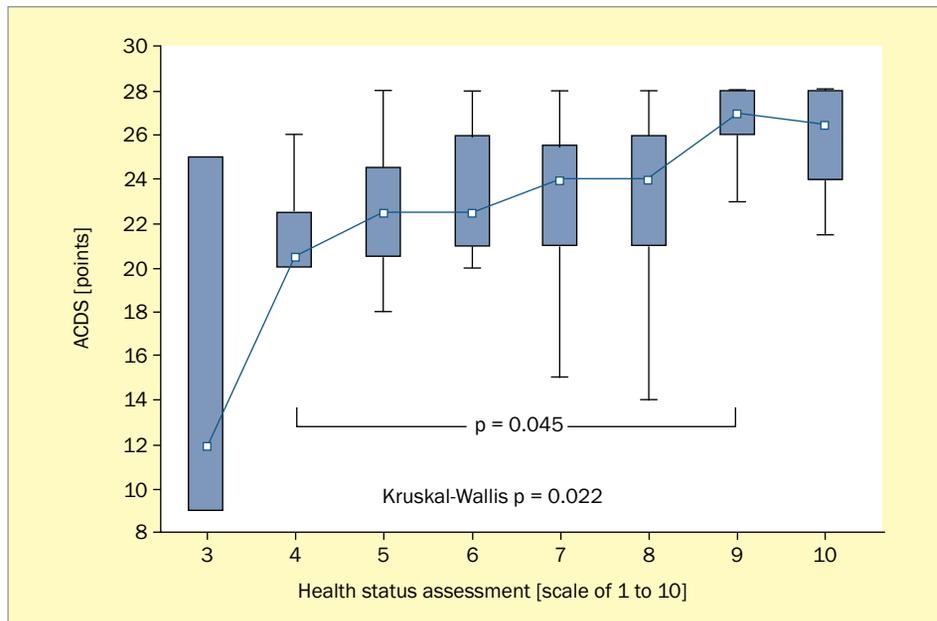


Figure 2. Results of the Adherence in Chronic Diseases Scale (ACDS) in groups divided by subjective health status assessment (marker – median, box edges – upper and lower quartile, whiskers – non-outlier range)

however, that patients' adherence differs considerably between different groups of patients. Differences are also observed in relation to specific drugs [14]. The PURE study showed that adherence to secondary prevention therapy was more influenced by general socioeconomic factors at the national level than to individual factors, such as age, gender, education level, smoking, body mass index (BMI), hypertension and diabetes [15].

As reported by Ho et al. [5], based on the data from the PREMIER (Prospective Registry Evaluating Myocardial Infarction: Event and Recovery) study in a group of 1,521 patients after myocardial infarction discharged from the hospital with the recommendation of combination therapy with 3 drugs (aspirin, a beta-blocker and a statin), one month after discharge more than 1/3 of the patients failed to follow, to a greater or lesser extent, the treatment

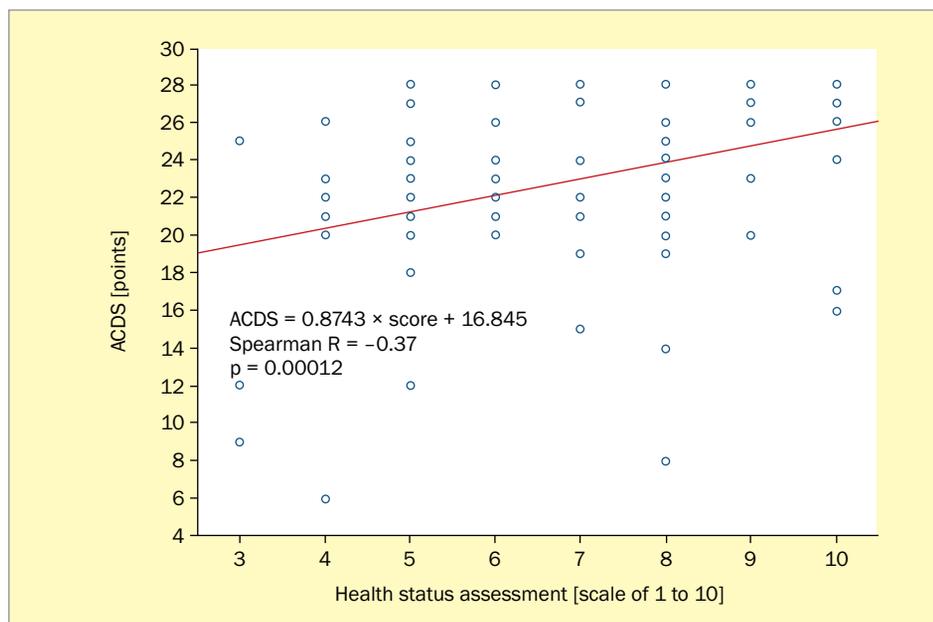


Figure 3. Relation between the Adherence in Chronic Diseases Scale (ACDS) score and subjective assessment of health status

plan. Multivariate analysis showed that the probability of discontinuation of all three drugs was higher among those with higher education (hazard ratio 1.76). The impact of older age on treatment discontinuation was higher among women (hazard ratio 1.77) than among men (hazard ratio 1.23). Discontinuation of treatment was an independent risk factor for death (hazard ratio 3.81) [5]. The lack of correlation between education level and adherence evaluated based on the ACDS score might have been related to the relatively small sample size in our study.

The age of patients is one of the most frequently reported factors affecting adherence [16–21]. Also our study confirmed these observations. Comorbidity burden increasing with age is associated with the necessity of polypharmacy. Elderly patients often do not understand the reasons for the complexity of the treatment and have problems with remembering of, adaptation to and compliance with the treatment schedule [22]. This is confirmed by the results of PACE (Pennsylvania Pharmaceutical Assistance Contract for the Elderly), a retrospective cohort study. The analysis of the results of logistic regression showed that in elderly patients with hypertension, adherence to the treatment plan was worse in the coexistence of asthma or chronic obstructive pulmonary disease (odds ratio [OR] = 0.43), depression (OR = 0.5), gastrointestinal disorders (OR = 0.59), or musculoskeletal diseases (OR = 0.63) compared with hypertensive patients without concomitant diseases (OR = 1.0) [23]. At the same time, it has been shown that polypharmacy negatively impacts the implementation of the treatment plan [17]. In our

study, the co-existence of diabetes was an independent factor reducing adherence. Indirectly, it also corresponds to negative correlation between the subjective assessment of the health status and the ACDS score that was observed in our patients.

Some researchers have indicated the female gender as a risk factor for low adherence [16, 17, 23–25], but this was not confirmed by our findings. In contrast to the results of other studies [15, 16], we did not observe the impact of the level of education on adherence in our patients.

Haynes et al. [26] suggested the following causes of nonadherence to physician's recommendations: adverse effects of therapy, insufficient instructions, patients having memory problems, poor financial status preventing purchasing of medicines, lack of acceptance of the need for treatment by the patient, poor relationship between the patient and medical staff.

It seems that higher number of hospitalizations due to CAD and MI should be related to better understanding of the causes of the disease and a greater reflection on the need for following the treatment regimen, and consequently to a better adherence. However, the opposite tendency was observed in our study. It can be assumed that MI was a consequence of a lack of implementation of the treatment plan after previous ischemic events. Such an interpretation of the results may be questionable, but to obtain a definite answer, further prospective studies are necessary, since no data on that issue are available in the literature. Unexpected results emphasize the practical value of the ACDS in identifying populations at particularly

high risk of the recurrence of ischemic events. Identification of these patients will allow for providing personalized educational intervention.

Failure to follow the treatment plan is a relatively common problem characterized by population-based differences, which is a serious and often underestimated factor limiting the effectiveness of treatment. At the same time there is no “gold standard” or a universal tool for determining the level of adherence. Using a well-designed questionnaire gives medical staff the opportunity to identify the barriers, gaps in patients’ knowledge and the problems in cooperation with patients. The scale is easy to use and can be utilized everyday medical practice. Its strength is

the ability to assess a wide range of the attitudes and behaviors of the patient including the essential elements of the treatment process.

Conclusions

Subjective assessment of health status, age of patients, the number of hospitalizations due to CAD and the co-occurrence of diabetes are independent factors affecting adherence to chronic therapy after MI. The Adherence in Chronic Diseases Scale can be successfully used as a tool to support medical staff in identifying patients requiring personalized educational activities.

Streszczenie

Wstęp. Celem pracy była ocena *adherence* z zastosowaniem nowej skali w populacji osób z chorobą wieńcową (CAD) po zawale serca (MI) w odniesieniu do parametrów socjodemograficznych i klinicznych.

Materiał i metody. Badanie przeprowadzono w populacji 100 kolejnych osób (40 kobiet, 60 mężczyzn) w wieku 30–88 lat, średnio 63,4 roku, pół roku po hospitalizacji z powodu MI.

Wyniki. Wyniki oceny w *Adherence in Chronic Diseases Scale* (ACDS) zawierały się między 6 a 28 punktów; mediana wynosiła 24 punkty (21–28). Wynik wysoki (> 26 pkt.) osiągnęły 24 osoby, 53 badanych uzyskało wynik średni (między 21 a 26 pkt.), a 23 – niski wynik (< 21 pkt.). Dla optymalnego modelu regresji wielorakiej współczynnik korelacji R wyniósł 0,539, a skorygowany współczynnik determinacji $R^2 = 0,26$ ($p = 0,000002$). Niezależnymi czynnikami wpływającymi na *adherence* ocenianymi w ACDS były: subiektywna ocena stanu zdrowia ($b = 0,48 \pm 0,23$; $p = 0,036$), wiek badanych ($b = -0,11 \pm 0,04$; $p = 0,004$), więcej niż jeden pobyt w szpitalu z powodu CAD ($b = -1,78 \pm 0,87$; $p = 0,044$) oraz cukrzyca ($b = -2,02 \pm 0,91$; $p = 0,029$).

Wnioski. Subiektywna ocena stanu zdrowia, wiek pacjentów, liczba hospitalizacji z powodu CAD oraz współwystępowanie cukrzycy wpływają na *adherence* w terapii przewlekłej po zawale serca.

Słowa kluczowe: skala *adherence*, choroba wieńcowa

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