

# Nurse-managed education: the effectiveness of secondary prevention after acute coronary syndromes and the prevalence and predictors of dropout from a cardiac rehabilitation programme

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## Abstract

**Introduction:** Education programmes are now very often used to limit the consequences associated with a steady increase in the incidence of cardiovascular disease. It is important to assess the effectiveness of these programmes and the reasons why people drop out.

**Aim:** To evaluate the effects of intensive education of patients undergoing acute invasive cardiology procedures compared to the control group (patients educated in a classical way).

**Material and methods:** Randomized trial. Measurements of body weight and body composition: during hospital stay, at 45 and 180 days after acute coronary syndrome. We used a self-prepared questionnaire, LOR-T and a TANITA BC1000 body composition analyser.

**Results:** The sample consisted of 73 patients aged 48 to 89 years. Men constituted 58.9% of the participants. 43.8% of the respondents appeared for a follow-up visit after 45 days, and after 180 days 32.8% came. Body weight, body mass index (BMI), and health condition of the patients did not change significantly during the study. 67.1% of respondents dropped out from the nurse-managed cardiac education programme. People who were in better health, smoking, without comorbidities, having a heart attack, living far from the place of education more often dropped out from follow-up visits.

**Conclusions:** Patient education proved ineffective. Body weight, BMI, and health condition of the subjects, both at the time of inclusion and during the long-term evaluation, were very unfavourable.

**Key words:** education, prevention, myocardial infarction, nurse, acute coronary syndrome.

## Summary

The main aim of this study was to evaluate the effects of intensive education of patients undergoing invasive cardiology procedures compared to the control group (patients educated in a classical way). The secondary objectives were: (1) assessment of the differences in the outcomes of patient education from the intervention and measurement analysis group (GIA) and the intervention group without measurement analysis (GIB); (2) assessment of the percentage of patients who drop out of active education in the intervention group (GI) and from follow-up visits in general. Patient education proved ineffective. Body weight, body mass index, and health condition of the subjects, both at the time of inclusion and during the long-term evaluation, were very unfavourable.

## Introduction

Percutaneous coronary intervention (PCI) procedures are only the beginning of the treatment of a patient with acute coronary syndrome, which also includes rehabili-

tation, education and secondary prevention as well as long-term patient follow-up. Patients after myocardial infarction (MI) should be encouraged and mobilized to modify their lifestyle [1–3].

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Unfortunately, despite the existence of an extensive medical infrastructure, patients are often re-hospitalized for another MI [4–6].

It turns out that patients not only do not change their lifestyle positively, but often do not believe at all in the positive effects of modifying their current lifestyle. They trust in the effectiveness of pharmacotherapy and interventional treatment, neglecting physical activity and diet [7].

In the entire Polish population, a constant increase in the number of people with modifiable cardiovascular risk factors can be observed. According to the authors of the Multicenter National Population Health Survey (WOBASZ), between 2003–2005 and 2013–2014 the prevalence of obesity in Poles increased by 4.1 percentage points (p.p.) (26% in 2014), hypertension by 6.9 p.p. (42.8% in 2014), diabetes by 3 p.p. (9.8% in 2014) and low physical activity by 1.4 p.p. (55.4% in 2014). The only positive phenomenon was the decline in the number of cigarette smokers (31% vs. 25%) [8].

The above cited data, along with the aging of Polish society, make it necessary to consider the issue of a rapid increase in the incidence of cardiovascular diseases in the coming years [9, 10]. This will entail the necessity to increase the already high financial outlays for the treatment of cardiac patients [9].

The Ministry of Health in Poland, in cooperation with the Polish Cardiac Society, has developed the KOS-infarction programme, the purpose of which is coordinated, comprehensive specialist care for patients after an MI. This programme includes therapy, rehabilitation, as well as education and secondary prevention in patients after acute coronary syndrome (ACS) [11].

Education and secondary prevention are also encouraged by the European Society of Cardiology, the American Heart Association (AHA) and the American College of Cardiology Foundation (ACC) by regularly publishing guidelines on the prevention of cardiovascular diseases [5, 12, 13].

However, in the light of the previously cited data the question seems justified: is the education of cardiac patients/patients after myocardial infarction effective? Does secondary prevention in people after MI and PCI work?

## Aim

The main aim of this study was to evaluate the effects of intensive education of patients undergoing invasive cardiology procedures compared to the control group (patients educated in a classical way). The secondary objectives were: (1) assessment of the differences in the outcomes of patient education from the intervention and measurement analysis group (GIA) and the intervention group without measurement analysis (GIB); (2) assessment of the percentage of patients who drop out of active education in the intervention group (GI) and from follow-up visits in general.

## Material and methods

The study was performed between February 2018 and April 2019 in the Department of Interventional Cardiology GVM Carint in Ostrowiec Świętokrzyski, Poland. The inclusion criteria were: age over 18 years, hospitalization in the Invasive Cardiology Department for ACS, previous PCI (balloon/stent), discharge directly to the home. Informed consent for inclusion in the study was provided by all patients. The approval of the Bioethics Committee at the Świętokrzyska Chamber of Medicine was obtained for the study: “Resolution No. 14/2018 Kielce, 08.02.2018”.

A survey method was used with a self-prepared, non-standardised questionnaire and the standardized Life Orientation Test (LOT-R) questionnaire authored by Scheier, Carver and Bridges, adapted from Poprawa and Juczyński [14]. A categorized observation was conducted using the TANITA BC-1000 body composition analyser as a tool [15].

The LOT-R test consisted of 10 statements: 6 which diagnosed the level of dispositional optimism, and 4 buffer statements, which did not affect the result. The truthfulness of each of the statements was assessed by the respondents on a Likert scale, where 0 meant “definitely does not refer to me”, and 4 “definitely refers to me”. The test result was assessed by counting the points awarded for 6 diagnostic statements. The score for positive statements corresponded to the scale number, while for negative statements, the score was the opposite: 0 = 4, 1 = 3, 2 remained unchanged, 3 = 1, 4 = 0. The overall test score was on a scale of 0 to 24 points. A score below 13 points is a low level of optimism, and a score above 16 points is a high level, indicating an optimistic attitude [14].

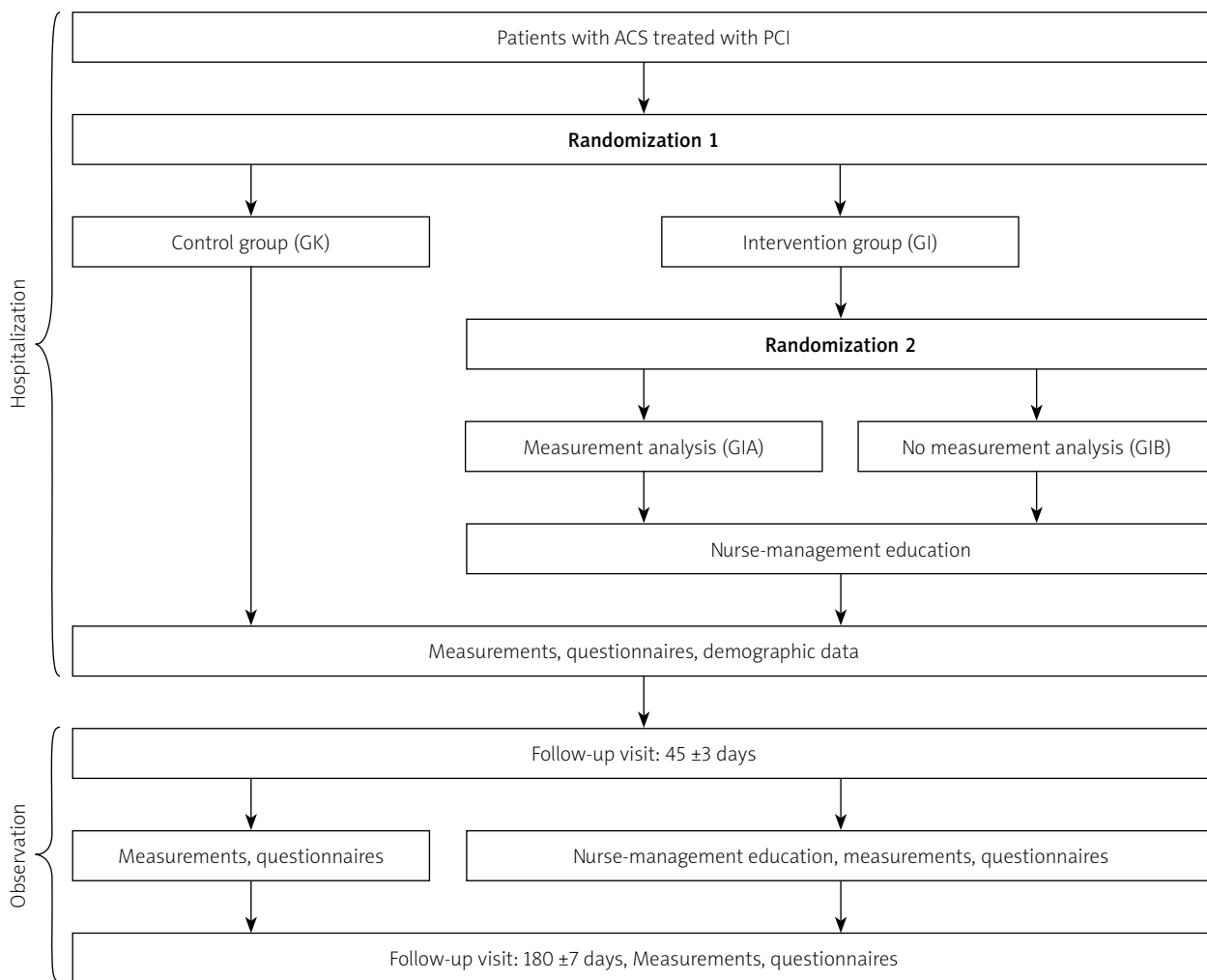
Patients were included in the study around the third day of hospital stay, that is on day 2 after PCI. Patients were randomly assigned to 1 of 2 groups: the intervention group (GI) and control group (GK). Then, people with GI were randomly assigned to the intervention group and measurement analysis (GIA) group and the intervention group without measurement analysis (GIB) (Figure 1).

The analysis of the measurements was understood as the interpretation of the results of the patient’s measurements made by TANITA BC 1000 in relation to the health condition of the participant and the applicable standards.

Half of the patients were assigned to the intervention group (1<sup>st</sup> randomization), in which a trained nurse conducted intensive education in the field of diet, physical activity and stimulants. Education was carried out by means of: conversations with the patient and his family, printed materials (leaflets, thematic guides), thematic materials on-line.

Half of the patients from the intervention group (1/4 of all subjects – 2<sup>nd</sup> randomization) analysed the measurement results with the nurse. These patients also received personalized advice on diet and exercise.

Fifty percent of all enrolled patients (GK) followed the classic course of hospitalization and discharge.



**Figure 1.** Study flowchart

Follow-up visits were scheduled for 45 and 180 days after patient enrolment. A week before each meeting each patient was contacted by phone to confirm their presence.

For the purposes of this analysis, the effects of education and secondary prevention were defined as: weight loss, body mass index (BMI) decline and improved health condition.

Health condition was assessed as the sum of the following parameters: BMI, percentage of body fat (%), total body water (%), physique rating index (independent of weight loss, difference in the proportion of body fat and muscle), metabolic age (age for which a basal metabolic test is appropriate), visceral fat index. Each parameter was assessed on a scale of 0–1 points. 1 point was awarded for the parameter score within the normal range [15]. A result above or below the norm was given 0 points. The respondents could get a minimum of 0 points and a maximum of 6 points. This scoring assessed the “absolute” level of health condition and was valid for all measurements.

During the next two follow-up visits (2<sup>nd</sup> and 3<sup>rd</sup> measurements), the “work on self” performed by the respondents was also assessed. 1 point was awarded for a positive change in a parameter or for no change in a parameter which was correct in the previous measurement. In other cases, the parameter was rated at 0 points. The respondents could get a minimum of 0 points and a maximum of 6 points. The percentage result of this measurement was defined as the “relative” health condition. The difference between the “absolute” and “relative” value of health condition was called the “self-work index” and was measured in percentage points.

**Statistical analysis**

Continuous data were described using mean, median, minimum, maximum, standard deviation, and quartiles. Normal distribution was confirmed by the Shapiro-Wilk test. The differences between studied groups were assessed using: *t*-tests, Mann-Whitney *U* test, Pearson’s  $\chi^2$  test, one-way (ANOVA), Kruskal-Wallis test and Spearman’s rank correlation. Values of  $p < 0.05$  were consid-

ered statistically significant. The Statistica ver. 13.1 (Tulsa, OK, USA) package was used for analysis.

## Results

The study included 73 patients, aged 48 to 89 years (mean: 68.29 ±10.42). On average, the respondents lived (mean: 29.32 ±52.24 km) from the place where education was provided. The level of dispositional optimism of the respondents ranged from 3 to 24 points (mean: 14.55

±4.06). Detailed characteristics of the study participants are provided in Tables I and II.

47.95% ( $n = 35$ ) of all participants in the study decided to drop out of both follow-up meetings. Factors influencing dropout of visits are presented in Table III.

People who withdrew from the first follow-up visit more often:

– From the control group ( $n = 38$ ; Presence: 31.58% vs. Dropout: 68.42%;  $p = 0.028$ ),

**Table I.** Characteristics of study participants

Variable		All		GI		GK	
		<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Sex	Male	43	58.91	18	24.66	25	34.25
	Female	30	41.09	17	23.29	13	17.81
ACS type	STEMI	36	49.32	14	19.18	22	30.14
	NSTEMI	27	36.99	14	19.18	13	17.81
	UA	10	13.69	7	9.59	3	4.11
Previous MI	No	53	72.60	27	36.99	26	35.62
	Yes	20	27.40	8	10.96	12	16.44
Comorbidities	No	8	10.96	2	2.74	6	8.22
	Hypertension	45	61.64	23	31.51	22	30.14
	Diabetes mellitus	21	28.77	8	10.96	13	17.81
Nicotinism	No	48	65.75	24	32.88	24	32.88
	Yes	25	34.25	11	16.07	14	19.18

ACS – acute coronary syndrome, STEMI – ST elevation myocardial infarction, NSTEMI – non-ST elevation myocardial infarction, UA – unstable angina, GI – intervention group, GK – control group.

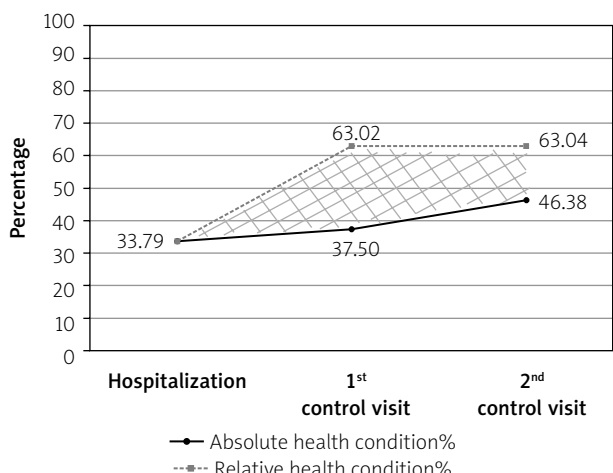
**Table II.** Presence at follow-up visits by randomization group

Group	Hospitalization		1 <sup>st</sup> follow-up		2 <sup>nd</sup> follow-up	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
GIA	17	23.29	11	15.07	6	8.22
GIB	18	24.66	9	12.33	8	10.96
GK	38	52.05	12	16.44	10	13.70
All	73	100	32	43.84	24	32.88

GIA – intervention group and measurement analysis, GIB – intervention group without measurement analysis, GK – control group.

**Table III.** Dropout predictors for both follow-up visits

Predictor	All ( $n = 73$ )		Participation in visits		Dropout		Test	P-value
	M	SD	M	SD	M	SD		
Health condition on enrolment	33.79	32.63	26.75	30.64	41.48	33.42	U M-W	0.053
Health condition on enrolment > 42%	28.77%	$n = 21$	33.33%	$n = 7$	66.67%	$n = 14$	$\chi^2$	0.042
Distance from home [km]	29.32	52.24	17.14	22.59	42.55	69.85	U M-W	0.037
Distance from home > 20 km	31.51%	$n = 23$	20.55%	$n = 15$	10.96%	$n = 8$	$\chi^2$	0.049
Previous MI	27.4%	$n = 20$	8.22%	$n = 6$	19.18%	$n = 14$	$\chi^2$	0.021
No comorbidities	10.96%	$n = 8$	1.37%	$n = 1$	9.59%	$n = 7$	$\chi^2$	0.018
No history of hypertension	38.36%	$n = 28$	13.70%	$n = 10$	24.66%	$n = 18$	$\chi^2$	0.027
Nicotinism on enrolment	34.25%	$n = 25$	12.33%	$n = 9$	21.92%	$n = 16$	$\chi^2$	0.048



**Figure 2.** 'Self-work' – performed by all participants during the study

- Having no comorbidities ( $n = 8$ ; Presence: 0.00% vs. Dropout: 100.00%;  $p = 0.008$ ),
- Not suffering from hypertension ( $n = 28$ ; Presence: 25.00% vs. Dropout: 75.00%;  $p = 0.011$ ),
- Smoking on the day of enrolment ( $n = 25$ ; Presence: 20.00% vs. Dropout: 80.00%;  $p = 0.003$ ).

Factors influencing not attending the second follow-up visit were:

- Age (Present: mean  $70.51 \pm 9.08$  vs. Dropout: mean  $63.75 \pm 10.39$ ;  $p = 0.008$ ),
- Previous MI ( $n = 20$ ; Present: 5.00% vs. Dropout: 95.00%;  $p = 0.002$ ),

Education was offered to 35 people. In the intervention group, 40% ( $n = 14$ ) of people completely dropped out of education. Dropout predictors were: previous MI ( $n = 8$ ; Education: 25.00% vs. Dropout: 75.00%;  $p = 0.021$ ), no history of hypertension ( $n = 12$ ; Education: 25.00% vs. Dropout: 75.00%;  $p = 0.002$ ).

**Table IV.** Educational outcomes

Outcomes	Intervention		Control		Test	P-value
	Mean	SD	Mean	SD		
Hospitalization ( $n = 73$ )						
Body weight [kg]	77.26	12.45	80.06	12.77	t	0.351
BMI [kg/m <sup>2</sup> ]	28.47	4.14	28.57	3.85	t	0.918
Absolute health condition (%)	35.72	29.47	32.02	35.6	U M-W	0.309
1 <sup>st</sup> follow-up visit ( $n = 32$ )						
Body weight [kg]	79.48	12.45	78.64	15.01	t	0.867
BMI [kg/m <sup>2</sup> ]	28.50	3.32	27.51	3.97	t	0.462
Absolute health condition (%)	37.50	31.00	37.50	39.0	U M-W	0.726
Self-work index (p.p.)	25.00	22.26	26.39	20.67	U M-W	0.969
2 <sup>nd</sup> follow-up visit ( $n = 24$ )						
Body weight [kg]	80.75	11.76	83.16	14.74	t	0.666
BMI [kg/m <sup>2</sup> ]	28.93	3.35	28.50	5.11	t	0.807
Absolute health condition (%)	46.15	32.03	46.67	43.60	U M-W	0.975
Self-work index (p.p.)	15.39	20.93	18.33	27.72	U M-W	0.733

BMI – body mass index.

At the first follow-up visit, there were 57.14% ( $n = 20$ ), and at the second 40.00% ( $n = 14$ ) of patients from the intervention group. Both visits were more likely to be left by people who had previously had MI (1<sup>st</sup> visit:  $p = 0.037$ ; 2<sup>nd</sup> visit:  $p = 0.009$ ) and had no history of hypertension (1<sup>st</sup> and 2<sup>nd</sup> visits:  $p = 0.006$ ).

Despite some efforts made by the participants of the study (Figure 2), the education of patients after ACS turned out to be ineffective. None of the effects of education changed significantly over the course of the study (Table IV).

The amount of work done to improve health after hospitalization was influenced by gender and the level of dispositional optimism. Men performed more 'self-work' (Men: mean  $31.06 \pm 22.00$ ; vs. Women: mean  $13.33 \pm 17.21$ ;  $p = 0.036$ ) than women. 'Self-work' positively correlated with the level of dispositional optimism ( $R = 0.42$ ;  $p = 0.017$ ). People with a low level of optimism, on average, performed 'self-work' with the value of mean  $18.52 \pm 19.44$  p.p., people with high level of optimism mean  $30.30 \pm 17.98$  p.p.. No factors significantly influenced the 'self-work' after the first follow-up visit.

The factors significantly influencing the BMI level were not established during the research. It was determined that BMI was not influenced by: age (1<sup>st</sup> visit:  $p = 0.526$ ; 2<sup>nd</sup> visit:  $p = 0.319$ ), sex (1<sup>st</sup> visit:  $p = 0.657$ ; 2<sup>nd</sup> visit:  $p = 0.508$ ), belonging to the intervention group (GI) (1<sup>st</sup> visit:  $p = 0.503$ ; 2<sup>nd</sup> visit:  $p = 0.476$ ), type ACS (1<sup>st</sup> visit:  $p = 0.929$ ; 2<sup>nd</sup> visit:  $p = 0.431$ ), present in history: previous myocardial infarction (1<sup>st</sup> visit:  $p = 0.499$ ; 2<sup>nd</sup> visit:  $p = 1.000$ ), diabetes (1<sup>st</sup> visit:  $p = 0.657$ ; 2<sup>nd</sup> visit:  $p = 0.270$ ), thyroid disorders (1<sup>st</sup> visit:  $p = 0.502$ ; 2<sup>nd</sup> visit:  $p = 0.970$ ), main source of income (1<sup>st</sup> visit:  $p = 0.155$ ; 2<sup>nd</sup> visit:  $p = 0.122$ ), relationships with loved ones (1<sup>st</sup> visit:  $p = 0.142$ ; 2<sup>nd</sup> visit:  $p = 0.166$ ), previous physical activity (1<sup>st</sup> visit:  $p = 0.559$ ; 2<sup>nd</sup> visit:  $p = 0.378$ ), nicotine use on

enrolment (1<sup>st</sup> visit:  $p = 0.276$ ; 2<sup>nd</sup> visit:  $p = 0.682$ ), disposable optimism (1<sup>st</sup> visit:  $p = 0.339$ ; 2<sup>nd</sup> visit:  $p = 0.362$ ), time since previous meeting (1<sup>st</sup> visit:  $p = 0.845$ ; 2<sup>nd</sup> visit:  $p = 0.104$ ).

Of all the people who reported smoking during study enrolment, 30% ( $n = 6$ ) attended the follow-up visits. It constituted only 8.22% of all participants and did not allow for assessing whether nurse-management education influences the breaking of the addiction.

## Discussion

The conducted research shows that body weight, BMI and health condition of the subjects, both at the time of inclusion and during the long term evaluation, were very unfavourable and practically did not change. Nurse management education for patients after MI had no effect on patient outcomes.

However, many researchers believe that education and secondary prevention are effective [16–20].

Michalski *et al.* reported a decrease in the number of risk factors in educated people [20]. The international EUROASPIRE III study also showed positive effects obtained through secondary prevention (decrease in the number of smokers, improvement of the lipid profile, improved control of drug intake) [18], although the EUROASPIRE V study showed that among CVD patients many lead unhealthy lifestyles and most patients did not achieve the blood pressure, LDL cholesterol and glucose targets [21].

Giannopoulos *et al.*, who conducted a study similar to this one, found a relationship between the education of patients after MI and the change in the body mass index of the subjects. However, the authors did not want to interpret this result unequivocally, because it was associated not with a decrease in body weight of patients, but only with a lack of an increase in the number of kilograms in the intervention group [22].

In the studies by Pająk *et al.* education of cardiac patients contributed to an increase in physical activity among patients from the intervention group and caused favourable changes in their diet, which were maintained with long-term (1-year) follow-up. There were no differences in the frequency of smoking, blood pressure, and BMI between the group of patients participating in the education programme and the group subjected to usual care. Nevertheless, changes in the lifestyle of educated people may have contributed to the reduction of their mortality [23].

There is also a group of researchers who claim that (as was the case in this study) education and secondary prevention do not bring the expected results [24–27].

A meta-analysis of the studies performed by Anderson *et al.* showed no effect of education on mortality in myocardial infarction or on the rate of total revascularization [24]. Brown *et al.* emphasize the lack of consistent evidence on the influence of education on the incidence

of cardiovascular diseases (CVD) or overall mortality [25]. The lack of influence of secondary prevention measures on the final effects (activity, body weight, waist circumference) was also stated by Cohen *et al.* [28].

The contradiction in the results of the cited studies may result from different end assumptions (final effect, mortality vs. soft effect, change of habits), multiple methods of intervention, and discrepancies in the time spent on conducting the research.

This study did not show a relationship between providing personalized information and recommendations to people after an MI and a healthier lifestyle by patients. People who received counselling specifically tailored to their health status displayed similar health behaviours to those who received general, non-personalized education. There are no studies that could be referred to in this respect in the literature.

Most researchers (both those who consider education effective and the latter) admit that education and secondary prevention work in unexpected and difficult-to-measure ways.

This is due to little interest of patients in education programmes. As this study has shown, only a minority of patients who have had an MI choose to participate in a voluntary education programme. Even fewer patients wanted to continue their education after hospitalization. Kotseva *et al.* also stated that many people do not regularly participate in rehabilitation and education programmes [18]. Similarly, in the research of Meffert *et al.*, the interest in the education programme decreased with the passage of time since the first meeting with the counsellor [19].

Although patients with CVD and after ACS have knowledge resulting from education [29], they do not decide to live according to this knowledge [7, 26, 27, 30].

Therefore, it is difficult to determine whether cardiac education and secondary prevention are effective. For effective actions, there should be standardized methods (form and duration of education, educator's qualifications), the use of which would bring relatively similar results for the entire study population. Meanwhile, the results described in the literature are unpredictably variable. Depending on the research, education works very well, moderately or very poorly. There were also strengths and weaknesses in this study.

The strengths of the study were as follows: Education was conducted by 1 nurse (a common educator for all patients), and the basic printed materials provided to patients were identical. All patients who met the inclusion criteria were eligible to participate in the study. The study is easy to repeat due to the low personnel and financial costs.

Weaknesses of the study: the low number of participants in the study; limited funding – no possibility of conducting additional tests that would encourage patients to attend follow-up visits.

According to the authors, nursing education did not bring the expected results, because most patients did not want to change their lifestyle and did not want to make the effort to change their habits.

Patients agreed to participate in the study under the influence of emotions accompanying MI. However, they expected greater profits resulting from participation in the study, including additional medical checks and tests during follow-up visits. The knowledge alone was not enough to motivate them to participate in the follow-up meetings. Knowledge did not produce immediate results. Moreover, educators blamed patients with responsibility for their own health, and it is difficult to deal with the consequences of their behaviour.

Patients who came to the follow-up visits showed a greater interest in knowledge, but in most cases this did not translate into a change in diet and increased physical activity.

The obtained results lead to unpopular conclusions – education is not as effective as it is commonly assumed. So it is worth considering in detail the issue of education and secondary prevention, determining how to test their effectiveness and determining the factors that influence this effectiveness.

## Conclusions

Of the enrolled patients, 1/2 did not use the option to attend a follow-up visit to monitor their health condition after an MI if the follow-up was to be performed by a nurse. The meetings were attended more often by patients living in close proximity to the place where education was provided, people with comorbidities and poor health condition, but not smoking and experiencing ACS for the first time. Probably encouraged by the unusual amount of time devoted to them, as well as the materials received, patients from the intervention group appeared at the first arranged meeting more often than those from the control group. It is possible that the education itself disappointed the patients because being a member of the GI did not affect the presence at the next follow-up visit. Patients who attended the meetings showed some progress in taking care of their health. Unfortunately, these advances were slow and the improvement in health was statistically insignificant.

## Conflict of interest

The authors declare no conflict of interest.

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