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## Original Research Article

# Analysis of socioeconomic factors and their influence on the incidence of complications in patients with acute coronary syndrome in Warmia and Mazury Province



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## ABSTRACT

**Introduction:** Socioeconomic status (SES) has the influence on the course and prognosis of acute coronary syndrome (ACS).

**Aim:** Assessment of the effect of certain socioeconomic factors on the incidence of cardiovascular complications of ACS during hospitalization and 3-month follow-up.

**Material and methods:** Patients enrolled in the study had ACS, diagnosed by ECG changes, positive markers of myocardial damage and angiography: ST segment elevation myocardial infarction (STEMI), non-ST segment elevation myocardial infarction (NSTEMI), and unstable angina (UA). Patients were given questionnaires regarding place of residence, education, occupation, and work status. The incidence of complications of ACS during hospitalization and 3-month follow-up was evaluated.

**Results and discussion:** The study included 160 subjects (30 female and 130 male) aged  $57.6 \pm 9.4$  years. 70% of patients had STEMI, 18% NSTEMI, and 12% UA. In the study group 72% of patients lived in cities, 57.5% of patients had primary or vocational education. Men significantly more frequently had primary and vocational education in comparison with women ( $P < 0.005$ ). 48% of patients were active workers, 66% of whom had physical work. The remaining subjects (52%) were not working with disability pension (25%) and retirement pension (75%). Men were significantly more frequently on pension than women ( $P < 0.033$ ). Complications of ACS during hospitalization were observed in 56 patients (35%), after 3-month follow-up in 26 (16%) patients. Having a job before the occurrence of ACS correlates with a higher incidence of complications both during hospitalization and a 3-month follow-up ( $P < 0.04$ ).

**Conclusions:** High rates of unemployment in Warmia and Mazury Province probably force patients to return to work shortly after ACS episode.

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## 1. Introduction

Ischemic heart disease (IHD) and its complications constitute one of the major causes of morbidity and mortality among the inhabitants of industrialized countries. In spite of the increasing development of methods of treatment of IHD complications, high mortality in the population of subjects with acute coronary syndrome (ACS) is still noted. Other than classic risk factors of ACS complications are thus being identified. Socioeconomic status (SES) is one of the non-classic risk factors, the importance of which is increasingly more emphasized in studies.<sup>1–4</sup>

## 2. Aim

Assessment of the effect of certain socioeconomic factors on the incidence of cardiovascular complications of ACS during hospitalization and a 3-month follow-up.

## 3. Material and methods

The analysis included patients hospitalized for ACS in the Department of Cardiology of the Provincial Specialist Hospital in Olsztyn during the years 2005–2008, who met the following criteria: age above 18 years; no history of diabetes mellitus, cancer, mental illness; ACS diagnosed based on patient history, physical examination, electrocardiography, positive markers of myocardial damage, coronary angiography.

A questionnaire was developed, which assessed:

- (1) classic cardiovascular risk factors: physical activity (at least 30-min walk daily); smoking; lipid profile (total cholesterol, LDL-cholesterol, HDL-cholesterol); arterial hypertension ( $\geq 140/90$  mmHg) or antihypertensive treatment; body mass index (BMI);
- (2) socioeconomic factors – SES components: place of residence (city – above 100 000 inhabitants, town – below 100 000 inhabitants, village); education (primary, vocational, secondary, higher); work status (employed, disability pension, retirement pension); type of work (professional worker; physical worker);
- (3) incidence of cardiovascular complications of ACS, such as: stroke, myocardial infarction (MI), heart failure, cardiac arrhythmias (during hospitalization and after 3 months) based on questionnaires, follow-up in Cardiology Clinic, hospitalization data and echocardiography.

Laboratory tests were performed with the use of diagnostic equipment of the Provincial Specialist Hospital in Olsztyn (Modular analyzer P800 and E170).

Acute coronary syndrome was diagnosed on the basis of the following electrocardiographic criteria: ST segment depression of at least 0.05 mV in two contiguous leads; ST segment elevation of at least 0.05 mV in two contiguous leads; T wave inversion (of at least 0.1 mV; pseudo-normalization of inverted T wave); simultaneous ST segment elevation and depression.<sup>5</sup>

A 12-lead electrocardiogram (ECG) was recorded using ASPEL apparatus, echocardiography was performed using GE Vingmed System Five Ultrasound with a 3.5 Hz transducer in a Non-Invasive Laboratory of the Provincial Specialist Hospital in Olsztyn.

Coronary angiography was performed using Judkins technique<sup>6</sup> in Invasive Cardiology Unit of the Provincial Specialist Hospital in Olsztyn.

### 3.1. Statistical analysis

Statistical analysis was performed using the Statistica 7.0 PL software. The verification of hypotheses on the existence or lack of correlation between categorical variables was performed with the use of Pearson's  $\chi^2$  test and  $G^2$  maximum likelihood estimation. For comparison of average values of measurable variables variance analysis ANOVA or Student's t test were used. For multiple comparison of the group means post hoc tests were used: Tukey HSD for unequal N. Nonparametric U Mann-Whitney test (for two groups) and the Kruskal-Wallis test (for many groups) were used for the analysis of measurable variables which do not have normal distribution (Schapiro-Wilk test) or homogeneity of variance (Levene's test). Correlation was measured with the Spearman's test.

Confidence intervals (95% CI) were generated for the analyzed values. Level of significance was  $P < 0.05$ .

### 3.2. Bioethics committee

The study was approved by Bioethics Committee of Warmia and Mazury Regional Chamber of Physicians on January 27, 2006 (no. 104/2006). It included analysis of results of standard diagnostic tests and voluntary anonymous (maintaining the confidentiality of personal data) survey of patients hospitalized in the Department of Cardiology of the Provincial Specialist Hospital in Olsztyn.

## 4. Results

The study enrolled 160 patients with ACS aged  $57.6 \pm 9.4$  years. In this group, 72% of patients lived in cities (the rest lived in villages), 58% of patients had primary or vocational education. Men significantly more frequently had primary and vocational education in comparison with the group of women ( $P = 0.005$ ). 48% of patients were active workers, 67% of whom had physical work. The remaining subjects (52%) were not working with disability pension (13%) and retirement pension (39%). Men were significantly more frequently on pension than women ( $P < 0.033$ ) (Table 1).

In the study group mean BMI was  $27.7 \pm 3.8$  kg/m<sup>2</sup>, and with no statistical relationship with gender. Arterial hypertension (AH) was diagnosed in 42% of patients, while significantly more frequently it occurred in women ( $P = 0.001$ ). More than a half of patients (52%) were smokers. The average concentration of total cholesterol was 197.9 mg/dL, LDL cholesterol 126.3 mg/dL, and HDL cholesterol 47.1 mg/dL. 63% of patients had a sedentary lifestyle (Table 2).

In addition, 70% of patients were diagnosed with STEMI, 18% NSTEMI, 12% UA.

**Table 1 – Socioeconomic factors in the study population.**

Factors	Study group, n (%)			P
	Total 160 (100)	Women 30 (19)	Men 130 (81)	
Age, years	57.6 ± 9.4	59.6 ± 8.5	57.1 ± 9.5	ns
Place of residence, n (%)				
City	50 (31)	12 (40)	38 (29)	ns
Town	66 (41)	10 (33)	56 (43)	
Village	44 (28)	8 (27)	36 (28)	
Education, n (%)				
Primary and vocational	92 (58)	13 (43)	79 (61)	0.005
Secondary and higher	68 (42)	17 (57)	51 (39)	
Type of work, n (%)				
Professional worker	53 (33)	13 (43)	40 (31)	ns
Physical worker	107 (66)	17 (57)	90 (69)	
Work status, n (%)				
Employed	77 (48)	12 (40)	65 (50)	ns
Unemployed	83 (52)	18 (60)	65 (50)	ns
– Disability pension	21 (13)	1 (3)	20 (15)	0.033
– Retirement pension	62 (39)	17 (57)	45 (35)	0.033

Comments: ns – not specified.

**Table 2 – Classic cardiovascular risk factors in the study population.**

Factors	Study group, n (%)			P
	Total 160 (100)	Women 30 (19)	Men 130 (81)	
BMI, kg/m <sup>2</sup>	27.7 ± 3.8	28.3 ± 0.9	27.6 ± 3.7	ns
Arterial hypertension, n (%)	68 (43)	19 (63)	49 (38)	0.001
Smoking, n (%)	84 (52)	13 (43)	71 (55)	ns
Total cholesterol, mg/dL	197.9 ± 40.6	202.8 ± 38.8	196.8 ± 41.1	ns
LDL cholesterol, mg/dL	126.3 ± 33.8	128.8 ± 33.2	125.7 ± 34.1	ns
HDL cholesterol, mg/dL	47.1 ± 11.9	50.3 ± 10.7	46.3 ± 12.1	ns
Physical activity, n (%)				
High	3 (2)	0 (0)	3 (2)	ns
Average	56 (35)	10 (33)	46 (35)	ns
Sedentary lifestyle	101 (63)	20 (67)	81 (62)	ns

Comments: ns – not specified.

**Table 3 – Incidence of cardiovascular complications of ACS in the study population.**

Factors	Study group, n (%)			P
	Total 160 (100)	Women 30 (19)	Men 130 (81)	
Complications during hospitalization, n (%)	56 (35)	10 (33)	40 (31)	ns
Complications after 3 months, n (%)	26 (16)	4 (2)	16 (12)	ns

Comments: ns – not specified.

Early complications of ACS during hospitalization in the study group were observed in 56 patients (35%); late complications of ACS occurred in 26 (16%) patients. No differences among gender groups were determined (Table 3).

## 5. Discussion

Classic risk factors of IHD include: smoking, dyslipidemia, AH, sedentary lifestyle and family history of IHD.<sup>1</sup> In the Polish NATPOL 2011 study estimated incidence of AH in

women and men was 29% and 35%, respectively.<sup>7</sup> In our study group 42% of patients had AH (more frequently women). The mean BMI of patients was 27.7 kg/m<sup>2</sup>, obesity was diagnosed in 26% of patients. 52% of patients were smokers and even 63% of patients had a sedentary lifestyle and did not take any physical activity. Compared to population studies, high proportion of subjects leading a sedentary lifestyle and smoking is observed. In the WOBASZ study 35% of subjects had a sedentary lifestyle and in the general Polish population 42% of men and 25% of women were smokers.<sup>8</sup>

In the study group 70% of patients were diagnosed with STEMI, 18% NSTEMI, 12% UA. In data from PL-ACS registry, NSTEMI was diagnosed in 68.4% and STEMI in 31.6% of patients.<sup>9</sup> These significant differences probably result from the fact that the Polish population included also patients treated for diabetes.

Increasingly, in addition to classic risk factors in scientific researches the effect of SES on the incidence of IHD complications and prognosis after ACS is discussed.

SES is the result of many different factors. Most often in scientific researches evaluated factors include: employment, income, education and place of residence. In our study assessed elements of SES included: employment and type of work, education and place of residence.

Although subsequent studies<sup>2-4,10</sup> demonstrate that in addition to the classic risk factors SES significantly affected the incidence of cardiovascular diseases and its complications, though mechanisms of this influence remain unclear. The potential influence of chronic stress resulting from socio-economic problems on the functioning of autonomic nervous system and thus increased risk of atherosclerosis<sup>11</sup> is suggested, together with statistically higher incidence of classic risk factors in the group with low SES.<sup>3,4</sup> Another explanation may be different medical procedures in subjects with low and high SES, in favor of the second group.<sup>12,13</sup> In FINMONICA MI study, patients from high income group were more frequently treated in specialized units.<sup>14</sup>

In our study having a job before the occurrence of ACS correlated with a higher incidence of complications 3 months after the incident, regardless of the type of work performed (mental vs physical). No statistically significant correlation between the incidence of complications and education and place of residence (city/village) was observed.

The above-mentioned diversity of factors taken into consideration in the assessment of SES in currently available studies makes comparison of results difficult. Analysis of influence must be conducted separately for each component of SES.

Having a job and the related income is in studies the determinant of high SES; thus negative influence of having a job on the prognosis is surprising. Unlike in our study, Lundin et al. demonstrated the increased risk of IHD complications among unemployed.<sup>15</sup>

Also in the work of Jakobsen correlation between the prognosis and employment was statistically significant, but different than in our study in unemployed and pensioners higher risk of complications was observed. In this study the relationship between prognosis and income was evaluated (subjects with lower income had higher risk of complications).<sup>4</sup> Similar to our work no statistical differences were found in relation to education. In general, the prognosis of patients with low SES after MI treated with primary angioplasty was worse compared to subjects with higher status. At the same time however, researchers emphasize that subjects from low SES group were significantly older and had more risk factors, which suggests that poor prognosis in these patients could mainly result from the accumulation of risk factors prior to the incident.

Unfortunately income data were not available in data collected for our study, and in several researches the size of

income was considered a differentiating factor of low and high SES.

In the study of Senan and Petrosyan, in which all of the subjects were employed, it was demonstrated that educated people with high income have lower risk of cardiovascular complications compared to the lowest income and low education group. The authors emphasize that SES is an independent factor of the incidence of AH and cardiovascular complications.<sup>16</sup>

In FINMONICA MI study it was demonstrated that pre-hospital mortality is statistically higher among patients with lower SES, as the risk of complications within 12 months after ASC. Statistically significant was the relationship between prognosis and the size of income and, unlike in our study, education. Less educated subjects had higher risk of complications.<sup>14</sup>

Gerber study evaluated not only the effect of SES of an individual, but also the environment in which patients lived after MI. They found a statistical correlation between inhabiting low SES areas and prognosis after MI. In this study, patients from regions with lower SES were more frequently unemployed, less educated and in case of employment, had low income.<sup>2</sup>

In another study, Gerber et al. demonstrated correlation between low income and low education and poor prognosis after MI.<sup>3</sup>

Interestingly, recent study conducted by Shi among Australian population did not find statistically significant correlation between survival after CABG (coronary artery bypass graft) and SES, even though risk factors of IHD, such as smoking, AH, obesity, were significantly more frequent among subjects with low SES. Such different results compared to other studies are explained by the authors by easy access to medical care in the region where the study was conducted.<sup>17</sup>

In the study of Jen-Yu Wang income was also a differentiating factor of high and low SES. In this study no statistically significant relationship with post-MI complications was found but significantly higher mortality among low SES subjects was observed.<sup>18</sup>

In Firych study a relationship between the extent of lesions in coronary angiography was assessed in relation to place of residence (city vs village). No statistically significant differences were found. The authors suggested that lack of diversity results from civilizational development and reducing the differences in living conditions.<sup>1</sup> Our study also did not demonstrate statistically significant relationship between living in villages and cities and complications of ACS.

In accordance with our knowledge no study has yet been published, in which having a job was considered a risk factor for ACS complications. In the years 2005–2008, when data for this work were collected, unemployment rate in Warmia and Mazury Province was 11.4% and was one of the highest in Poland.<sup>19</sup> Maybe unemployment and the associated fear of job loss force patients who have a job to return to their duties too quickly after ACS.

No relationship between the level of education and prognosis is consistent with the results of only several of the previous studies.<sup>3</sup> In the majority of works low level of education increased the risk of complications.<sup>2,14,16</sup> This difference may result from the lack of relationship between education and income among the study population.

An important limitation of our study is lack of income data. It is impossible to isolate subjects with high and low income in the study group and compare these data with the results of numerous studies regarding income as the determinant of SES. In addition, exclusion of patients with diabetes changes epidemiology of the study group.

## 6. Conclusions

Employment prior to ACS correlates with higher incidence of cardiovascular complications both during hospitalization and a 3-month follow-up.

Probably high rate of unemployment in Warmia and Mazury Province forces patients to return to work shortly after ACS.

## Conflict of interest

None declared.

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