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Are rural patients aware of myocardial infarction's risk factors, symptoms, and management? A survey study in the COVID-19 pandemic era

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Abstract: Introduction: Mortality from myocardial infarction (MI) is determined by patients' ability to prevent it and, in case of its occurrence, to recognise its symptoms and call an ambulance immediately. There is scarce data on rural populations' knowledge of MI, even though they are disadvantaged in access to medical emergency services.
Objective: The aim of the study was to investigate the rural patients' awareness of MI risk factors, symptoms, necessity of calling an ambulance in response to MI symptoms, and its determinants.
Materials and Methods: An anonymous and voluntary survey was conducted among 194 patients and their caregivers with median age 68 years at a rural non-public healthcare facility in Poland.
Results: 60.3% perceive their knowledge of MI as insufficient. Only 26.3% were able to recognise all suggested MI risk factors. 44.8% did not know whether they are at risk of MI. Furthermore, 78% of respondents who had at least three MI risk factors were unaware of being at risk. 45.4% recognised at least three out of four suggested MI symptoms. 76.2% would call an ambulance in response to chest pain suggesting they have MI. Merely 80% were able to provide the emergency phone number. Moreover, among respondents who declared they would not call an ambulance, 38.7% were afraid of in-hospital COVID-19 infection or healthcare system collapse.
Conclusions: Rural patients' knowledge of MI risk factors, symptoms, and proper response to them is insufficient. The problem is exacerbated by the COVID-19 pandemic. To improve survival in MI an education campaign is needed.

Keywords: myocardial infarction, rural, knowledge, management, COVID-19, pandemic, fear, emergency call.

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Introduction

Cardiovascular diseases are the most common cause of death both globally and in Poland. According to the National Health Fund (NFZ) there were 74.7 thousand cases of myocardial infarction in Poland in 2018, while in-hospital mortality equalled 6.6% [1].

MI death toll may be reduced by early prevention and effective treatment, both of which are patient dependent. Firstly, patient's awareness of cardiovascular risk factors prompts them to consciously change their lifestyle. Data shows that the decrease in MI mortality by half in Poland between 1991–2005 can be attributed in 63% to better risk factors control [2].

Moreover, the length of time between the symptom onset and reperfusion is a vital determinant of treatment effectiveness [3]. This phase is mostly determined by patient's ability to recognise MI symptoms and call an ambulance.

Patients in rural areas are more vulnerable to MI because of a longer distance to the hospital. In addition, Swanoski *et al.* showed that those patients tend to be less aware of MI symptoms and risk factors [4]. Despite these findings, according to our best knowledge there are few studies targeting the rural population in Poland.

In the study we attempted to assess the knowledge of cardiovascular risk factors, MI symptoms and their proper management among rural adults. We also tried to assess whether this knowledge is influenced by the age, gender, level of education and health condition.

Material and Methods

Study design

An anonymous and voluntary survey was conducted from February to April 2021 among patients and their caregivers at the medical practice in Łapanów in Poland. Patients admitted to be vaccinated against SARS-CoV-2 were invited by the general practitioner to take part in the study and informed that the participation is voluntary, the answers are anonymous and there is no reward provided. Those who were willing to participate were asked to fill the survey during observation period after vaccination and throw it to the labelled box outside the consulting room. The response rate was 91%. 13 surveys were rejected due to missing data.

Questionnaire development

The questionnaire was prepared based on the review of the previously conducted studies. The initial version of the survey was evaluated by the cardiologist, three family

medicine practitioners and five nurses. The pre-approved version was used in the pilot study among 10 lay people to acquire participants' opinions.

Survey structure

The survey consisted of six parts. The first included patient demographic characteristics (age, gender, level of education, weight, height, medical, smoking habits). BMI was calculated for each patient based on provided data. The respondents were subsequently asked if they had a history of hypertension, diabetes, coronary artery disease, other heart diseases, and hypercholesterolemia. Additionally, data on history of MI in them and in members of their family was collected. Patients were also asked to write down other conditions they suffered from.

In the second part the respondents' self-awareness was assessed. They had to answer if their knowledge of MI was sufficient, body mass correct and if they are at risk of MI. An open-ended question was asked to provide the emergency call number. Both 999 and 112 were accepted as correct answers.

In the next section patients had to recognise MI risk factors. They were given a list of factors (hypertension, diabetes, hypercholesterolemia, obesity, smoking, heart disease, history of MI in family, lack of physical activity, vegetable consumption (trap question)) and asked whether these factors increase risk of MI occurrence ("yes"/"no"/"I don't know").

In the fourth part patients had to recognise MI symptoms. They were given a list of symptoms (isolated chest pain lasting over 20 minutes, chest pain with nausea, shortness of breath with cold sweating, epigastric pain with shortness of breath and headache (trap question)) and asked whether these can be symptoms of MI.

Then, respondents were asked how they would react if they experienced chest pain suggesting MI (calling an ambulance, going to the hospital, going to the outpatient clinic, arranging teleconsultation with the general practitioner, making an appointment with a cardiologist, waiting until the symptoms subside). Only calling an ambulance was counted as a correct reaction. If patients had chosen other answer than "calling an ambulance" or "going to the hospital", they have been asked about the causes of their fear of being admitted to the hospital (hospital-acquired COVID-19 infection, improper medical care due to the pandemic, I have no concerns, other (open-ended question)). A similar question was asked what they would do if somebody in their presence felt chest pain suggesting MI.

Finally, they responded if MI was a condition requiring immediate help, where it should be treated and if it may lead to disability.

Population

The study population consisted of 194 participants. Most of them were women (56.7%). About 60% of patients were aged 65 to 98. One third of patients presented correct BMI, the rest of them were overweight or obese with significantly higher BMI among men than women (28.38 vs. 26.77, p = 0.007). Moreover, there was considerably more smokers among men (53.1% vs. 25.5%, p <0.001). There was no difference in the level of education between the genders.

71% of respondents had at least 3 cardiovascular risk factors listed by European Society of Cardiology [5]. Two-thirds were overweight or obese and 37% were smokers. Approximately half were previously diagnosed with hypertension and a fifth with diabetes. 10% reported to suffer from ischemic heart disease and 6% had a history of MI. The detailed characteristics of the studied population are presented in Table 1.

Table 1. Population characteristics.

Variable	**N (%)**
N	194
Sex	
Women	110 (56.7)
Men	81 (41.8)
Age	
65–98	112 (58.6)
45–64	59 (30.9)
23–44	20 (10.5)
BMI	
Correct weight	59 (31.1)
Overweight	83 (43.7)
Class I obesity	38 (20.0)
Class II obesity	9 (4.7)
Class III obesity	1 (0.5)
Smoking	
Yes	72 (37.1)
No	122 (62.9)
Education	
Primary	48 (25.0)
Secondary	103 (53.6)
Higher	41 (21.4)
Hypertension	103 (53.1)
Diabetes	39 (20.1)
Hypercholesterolemia	32 (16.5)
Ischemic heart disease	20 (10.3)
History of MI	12 (6.2)

Statistical analysis

To perform descriptive analysis, the frequencies of answers for categorical variables and medians with interquartile range for continuous variables were calculated. Groups were compared using the $\chi 2$ test and Mann-Whitney or Kruskal-Wallis tests (following the rejection of normal distribution and variance homogeneity assumptions), respectively. The significance level was set to 0.05. Statistical analysis was conducted using R Software (version 1.2.5042).

Results

Self-assessment of knowledge and risk

39.7% of participants perceived their knowledge of MI as sufficient. 26.3% of respondents declared they were not at risk of MI, while 44.8% were not able to assess their risk (Fig. 1). 78% of participants with three or four and 57% with five or six MI risk factors believe not to be at risk of MI.

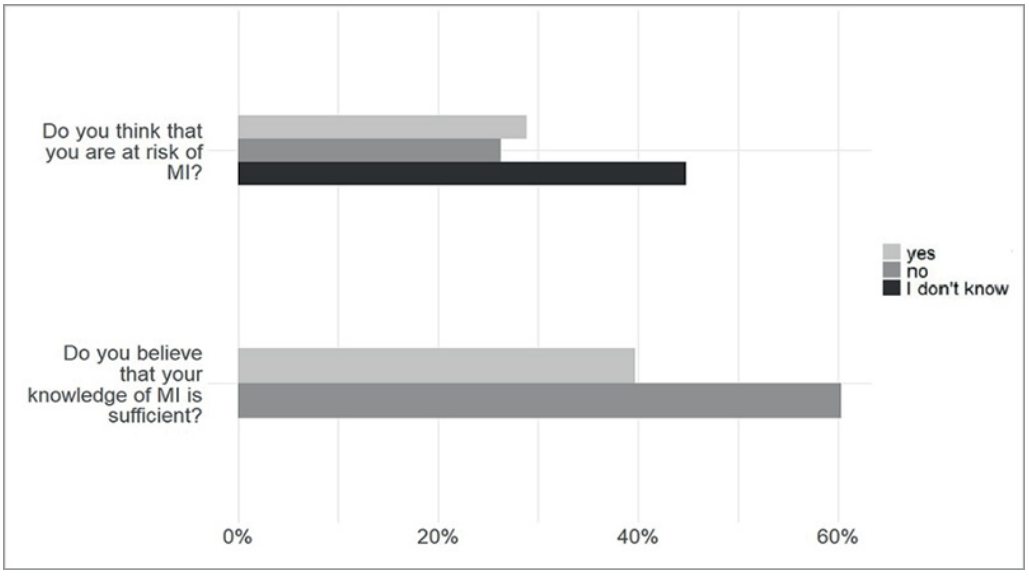

Fig. 1. The self-assessment of respondents' cardiovascular risk and knowledge of myocardial infarction.

The impact of gender, level of education, history of MI or occurrence of MI in patient's family (including their spouse) on the participants' ability to properly self-assess their knowledge or risk was not identified.

Knowledge of risk factors

Although 92.8% of respondents recognised at least 3 out of 7 suggested MI risk factors, all of them were recognised only by 26.3%. Most respondents (90.2%) indicated smoking as a risk factor, followed by overweight and obesity (89.6%), hypertension (85.0%), lack of physical activity (83.4%), and history of heart disease (80.3%). Moreover, diabetes was recognised by 67.4%, history of MI in family by 54.9%, and hypercholesterolemia by 52.8% of respondents.

Better risk factor awareness was associated with the declaration of being at risk of MI (yes: 8/9 7.75, 9.00], no: 8/9 5.25, 8.00], I do not know: 7/9 5.00, 8.00], p <0.001). Yet, exposure to specific risk factors did not increase patients' awareness. Details are presented in Table 2 and 3.

Table 2. Percentage of participants identifying MI risk factors and symptoms stratified by demographics and cardiac history.

	Knowledge of risk factors		**Knowledge of symptoms**	
	Median score [IQR] max = 9	**p-Value**	**Median score [IQR] max = 5**	**p-Value**
Total	8.0 [6.0,8.0]		3.0 [2.0, 4.0]	
Sex				
Women	8.0 [6.0, 9.0]	0.110	3.0 [2.0, 4.0]	0.769
Men	7.0 [5.0, 8.0]		3.0 [2.0, 4.0]	
Age				
65–98	7.0 [5.0, 8.0]	0.119	3.0 [1.0, 4.0]	0.274
45–64	8.0 [7.0, 9.0]		3.0 [2.0, 4.0]	
23–44	8.0 [7.0, 8.0]		3.0 [2.8, 4.0]	
Education				
Primary	7.0 [4.8, 8.3]	0.069	3.0 [1.0, 4.0]	0.826
Secondary	7.0 [6.0, 8.0]		3.0 [2.0, 4.0]	
Higher	8.0 [7.0, 9.0]		3.0 [2.0, 4.0]	
Declaration of being at MI risk group				
yes	8.0 [5.3, 8.0]	**<0.001**	3.0 [2.8, 4.0]	**0.036**
no	8.0 [7.8, 9.0]		3.0 [2.0, 4.0]	
I don't know	7.0 [5.0, 8.0]		3.0 [1.0, 4.0]	
MI history				
yes	7.5 [5.8, 8.0]	0.631	3.0 [2.0, 4.0]	0.752
no	8.0 [6.0, 8.0]		3.0 [2.0, 4.0]	
Heart disease				
yes	8.0 [7.0, 9.0]	0.158	3.0 [2.0, 4.0]	0.494
no	7.0 [6.0, 8.0]		3.0 [2.0, 4.0]	

Table 2. Cont.

MI in the family				
yes	8.0 [6.0, 8.0]	0.995	3.0 [2.0, 4.0]	0.533
no	8.0 [6.0, 8.0]		3.0 [2.0, 4.0]	
Three or more MI risk factors				
yes	7.0 [6.0, 9.0]	0.699	3.0 [2.0, 4.0]	0.614
no	8.0 [6.0, 8.0]		3.0 [2.0, 4.0]	

Table 3. Percentage of respondents recognising MI risk factors according to their exposure.

Risk factor	Total N (%)	People without risk factor exposure N (%)	People exposed to the risk factor N (%)	p-Value
Hypertension	n = 193	n = 91	n = 102	
yes	164 (85.0)	74 (82.2)	90 (87.4)	.572
no	8 (4.1)	4 (4.4)	4 (3.9)	
I don't know	21 (10.9)	12 (13.3)	9 (8.7)	
Diabetes	n = 193	n = 154	n = 39	
yes	130 (67.4)	102 (66.2)	28 (71.8)	.123
no	10 (5.2)	6 (3.9)	4 (10.3)	
I don't know	53 (27.5)	46 (29.9)	7 (17.9)	
Hypercholesterolemia	n = 193	n = 161	n = 32	
yes	102 (52.8)	81 (50.3)	21 (65.6)	.221
no	4 (2.1)	3 (1.9)	1 (3.1)	
I don't know	87 (45.1)	77 (47.8)	10 (31.2)	
Overweight and obesity	n = 193	n = 58	n = 131	
yes	173 (89.6)	52 (89.7)	118 (90.1)	.304
no	4 (2.1)	0 (0.0)	4 (3.1)	
I don't know	16 (8.3)	6 (10.3)	9 (6.9)	
Smoking	n = 193	n = 121	n = 72	
yes	174 (90.2)	105 (86.8)	69 (95.8)	.095
no	4 (2.1)	4 (3.3)	0 (0.0)	
I don't know	15 (7.8)	12 (9.9)	3 (4.2)	
Heart disease	n = 193	n = 156	n = 37	
yes	155 (80.3)	125 (80.1)	30 (81.1)	.235
no	4 (2.1)	2 (1.3)	2 (5.4)	
I don't know	34 (17.6)	29 (18.6)	5 (13.5)	
History of MI in family	n = 193	n = 138	n = 55	
yes	106 (54.9)	71 (51.4)	35 (63.3)	.246
no	18 (9.3)	15 (10.9)	3 (5.5)	
I don't know	69 (35.8)	52 (37.7)	17 (30.9)	

Knowledge of symptoms

At least one out of four suggested symptoms was recognised by 87.6% of patients, while only 22.7% of respondents could indicate all of them. Chest pain with nausea and isolated chest pain lasting over 20 minutes were recognised as MI symptoms by 74.1% and 73.1% of respondents, respectively. Shortness of breath with sweating was identified by 54.4% of patients and epigastric pain with shortness of breath by 35.8%.

The respondents declaring themselves as being in cardiovascular risk group could better recognise MI symptoms (yes: 3.0 2.8, 4.0], no: 3.0 2.0, 4.0], I don't know: 3.0 1.0, 4.0], $p = 0.036$). The impact of gender, level of education, heart disease, history of MI, and exposure to the MI risk factors on symptom identification has not been identified.

MI management

76.2% of respondents would call an ambulance in case of chest pain suggesting MI in themselves, while 80% could provide emergency call number. 4.7% would go to hospital on their own. 9.8% would go to the outpatient clinic, and 2.6% would arrange a teleconsultation with a general practitioner. 4% would make an appointment with a cardiologist. 0.5% would wait until the symptoms subside and 2.1% did not know what they would do. Among those who would not call an ambulance nor present to hospital 38.7% declared to be afraid of hospital-acquired COVID-19 infection or improper medical care due to the ongoing pandemic.

If the symptoms occurred in another person in respondents' presence, 78.4% would call an ambulance and 5.2% would advise them to go to the hospital. 7.7% would advise to go to the outpatient clinic, 5.2% to arrange a teleconsultation with a general practitioner and 3.1% would recommend making appointment with a cardiologist. 0.5% would recommend waiting and 5.2% would not know the course of action.

Patients declaring themselves at risk of MI were more prone to call an ambulance in case of MI symptoms in themselves (yes: 85.7%, no: 78.4%, I don't know: 67.8%, $p = .045$). The influence of exposure to MI risk factors, heart disease, history of MI, sex, and level of education on correctness of suspected MI management has not been identified.

Only 76.3% of participants could provide a correct emergency call number. 91.8% of respondents believe MI to be a condition requiring immediate medical action. Only 64.4% realise that MI may lead to disability. Details are gathered in the Table 4.

Table 4. Percentage of participants calling the ambulance in case of MI symptoms in themselves and others, being able to provide correct emergency number, and to assess the risk of disability as a result of MI according to their demographics and cardiac history.

	Calling the ambulance in case of MI symptoms in participant		**Calling the ambulance in case of MI symptoms in other person**		**Correct emergency phone number**		**Correct handicap risk assessment**	
	N (%)	**p-Value**	**N (%)**	**p-Value**	**N (%)**	**p-Value**	**N (%)**	**p-Value**
Sex								
Women	82 (74.5)	.585	84 (76.4)	.375	94 (85.5)	**.004**	64 (58.2)	.053
Men	64 (79.0)		67 (82.7)		54 (66.7)		59 (72.8)	
Age								
65–98	86 (76.8)	.945	90 (80.4)	.399	86 (76.8)	.119	76 (67.9)	.302
45–64	44 (74.6)		43 (72.9)		43 (72.9)		33 (55.9)	
23–44	15 (75.0)		17 (85.0)		19 (95.0)		13 (65.0)	
Education								
Primary	37 (77.1)	.666	39 (81.2)	.775	35 (72.9)	.338	29 (60.4)	.410
Secondary	80 (77.7)		79 (76.7)		78 (75.7)		65 (63.1)	
Higher	29 (70.7)		33 (80.5)		35 (85.4)		30 (73.2)	
Declaration of being at MI risk group								
yes	48 (85.7)	**.045**	46 (82.1)	.085	44 (78.6)	.869	42 (75.0)	.102
no	40 (78.4)		44 (86.3)		39 (76.5)		33 (64.7)	
I don't know	59 (67.8)		62 (71.3)		65 (74.7)		50 (57.5)	
MI history								
yes	11 (91.7)	.328	9 (75.0)	1.000	9 (75.0)	1.000	11 (91.7)	.085
no	136 (74.7)		143 (78.6)		139 (76.4)		114 (62.6)	
Heart disease								
yes	30 (78.9)	.766	29 (76.3)	.904	27 (71.1)	.526	27 (71.1)	.446
no	117 (75.0)		123 (78.8)		121 (77.6)		98 (62.8)	
MI in the family								
yes	42 (76.4)	1.000	42 (76.4)	.819	40 (72.7)	.585	33 (60.0)	.519
no	105 (75.5)		110 (79.1)		108 (77.7)		92 (66.2)	
Three or more MI risk factors								
yes	107 (77.5)	.475	108 (78.3)	1.000	101 (73.2)	.159	92 (66.7)	.393
no	40 (71.4)		44 (78.6)		47 (83.9)		33 (58.9)	

Discussion

Risk factor awareness

Rural adults have limited knowledge of MI risk factors. What is striking, nearly half of the respondents were not able to assess, whether they belong to the cardiovascular risk group. However, over 80% could correctly point out smoking, overweight and obesity, hypertension, lack of physical and history of heart disease as MI risk factors, which significantly exceeds the values obtained by Waśniowska *et al.* in the M-CAPRI study [6].

Diabetes, hypercholesterolemia, and history of MI in the family were the least recognised MI risk factors (67%, 53% and 55% consecutively). Remarkably, being exposed to these conditions did not have any impact on patients' awareness. It is consistent with research conducted by Homko *et al.* who showed that patients with high cardiovascular risk had limited knowledge of CVD risk factors [7]. Authors suggest that doctors who diagnose and treat conditions affecting CVD risk should actively inform the patients of being at cardiovascular risk group and of its possible consequences.

Patients' awareness of being at risk was associated with better recognition of MI risk factors, symptoms as well as proper first response to them. However, it requires further inquiry to understand this association.

Symptom awareness

Our study shows that adults from rural areas lack awareness of MI symptoms. Isolated chest pain and chest pain with nausea were recognised by 75% and shortness of breath with cold sweating by 55%. The trend is consistent with other studies, however our population had significantly lower scores. In a study conducted on rural U.S. population by Swanoski *et al.* over 90% recognised chest pain and 85% shortness of breath [4]. Kopeć *et al.* in their study among urban adults in Cracow, Poland showed that 90% identified chest pain and 72% shortness of breath [8]. Similar results were obtained in meta-analysis by Birnbach *et al.* – chest pain was recognised by 88.5% and shortness of breath by 77.2% [9]. Kopeć *et al.* showed that the problem could be resolved by routine advice from a doctor [8].

Furthermore, only 35% identified epigastric pain. This is consistent with meta-analysis by Birnbach *et al.* which found that barely 23.4% were able to recognise stomach discomfort [9]. This finding points to the necessity of a focus on less common symptoms in patient education.

MI management during the COVID-19 pandemic

Patients' awareness of MI management needs to be improved. Less than 80% of respondents would call an ambulance in case of MI suspicion in themselves or in others. Moreover, only 80% could provide an emergency call number — this shows that barely 60% of respondents would be willing to and capable of calling an ambulance immediately after symptom onset. The results are similar to those obtained among urban adults in Cracow, Poland [8].

To tackle the problem, its roots need to be established. In the pre-pandemic period Lozzi *et al.* observed that half of the patients having heart attack symptoms who presented to the hospital on their own felt their symptoms did not warrant calling an ambulance [10]. However, approximately 40% of our respondents who decided not to call an ambulance nor present to the hospital admitted being afraid of hospital-acquired SARS-CoV-2 infection or improper medical care due to the pandemic. This observation may explain the significant decrease in amount of PCI procedures on patients with MI during the pandemic observed in many countries, including Poland [11–13].

Moreover, the COVID-19 pandemic caused a significant increase in time from symptom onset to treatment leading to worsening of patients' prognosis. Freitas *et al.* attributed it to a significant decrease in the proportion of patients with MI transported in pre-hospital emergency medical transportation during the COVID-19 pandemic (20% vs 40% in the pre-pandemic era) [14]. Perrin *et al.*, Aldujeli *et al.*, and Grech *et al.* observed that also time from symptom onset to first medical contact has increased in the pandemic [15–17]. Our work shows that fear of COVID-19 is a large contributor to these delays, and it is crucial that this fear be addressed in future waves of the pandemic.

Conclusions

Rural adults have poor knowledge of MI risk factors, symptoms and proper first response to them. An alarmingly high proportion of them is not aware of being at risk of MI despite having numerous risk factors. A significant amount is not able to recognise its symptoms nor to react properly to them. The problem might be exacerbated by the pandemic rendering patients more reluctant to contact with healthcare. These challenges need to be tackled — a broad education campaign and routine, complex advice from the doctor or the nurse at the local level could be a solution.

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