ORIGINAL ARTICLE

First-year follow-up costs of myocardial infarction management in Poland from the payer's perspective

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ABSTRACT

Background: Myocardial infarction (MI) remains a major burden for healthcare systems. Therefore, we intended to analyze the determinants of cost management of patients hospitalized for MI in Poland.

Methods: Data on patients hospitalized and discharged with the diagnosis of acute MI were derived from the public payer claims database. Adult patients, reported between October 1, 2017 and December 31, 2019, were included. Costs of hospitalization for acute MI and cumulative one-year follow-up were analyzed.

Results: The median (IQR) of the total direct cost was €3804.7 (2674.1–5712.7) per patient and 29% (€1113.6 [380.5–2490.4]) of these were costs related to the use of post-hospitalization healthcare resources. The median cost of cardiovascular disease management was €3624.7 (2582.1–5258.5), and 26% of this sum were follow-up costs. The analysis of the total cost for individual years showed a slight increase in median costs in subsequent years: €3450.7 (2407.8–5205.2) in 2017, €3753.8 (2642.6–5681.9) in 2018, and €3944.9 (2794.8–5844.4) in 2019. Male sex, heart failure, atrial fibrillation, diabetes, kidney disease, chronic obstructive pulmonary disease, and history of stroke in addition to hospitalization in a department other than cardiology or internal disease were independently related to the cost of MI patient management.

Conclusions: The high cost of management of MI patients was independently related to sex, heart failure, atrial fibrillation, diabetes, kidney disease, chronic obstructive pulmonary disease, and history of stroke as well as hospitalization in other than cardiology or internal disease department.

Key words: acute myocardial infarction, healthcare costs, invasive management

WHAT'S NEW?

We present a pioneering study that comprehensively captures and quantifies hospitalization and post-hospitalization costs of managing myocardial infarction (MI), which were not previously explored in Poland. The identification of cost predictors and sex disparities highlights the necessity for tailored and evidence-based approaches to confront economic challenges posed by MI. By focusing attention on optimal healthcare management programs, we can promote more sustainable outcomes and mitigate the financial burden on both the healthcare system and affected individuals.

INTRODUCTION

Cardiovascular disease (CVD) remains a major threat to public health worldwide [1]. Notably, ischemic heart disease, including its most important manifestation (i.e., myocardial infarction [MI]) is the main cause of mortality, contributing to 16% of the world's total deaths [2]. In addition, patients with acute MI often incur high medical expenditures following the event. These expenditures include frequent rehospitalization, multiple drug prescriptions, and device-related therapies as well as cardiac rehabilitation [3]. MI is also related to substantial indirect costs, resulting from either premature mortality or MI-related disability limiting return to work. In addition, contemporary societies are under the pressure of increasing general health-related expenditures [4]. Therefore, identification of factors associated with the increased cost of management could help in planning a strategy for cost reduction and more affordable healthcare as well as save more lives.

Over 80 thousand patients suffer from acute MI in Poland yearly with one-year mortality exceeding 17% [5]. Moreover, almost half of all patients are rehospitalized for various reasons within one year following MI [5–7]. However, there are a few scientific reports available that have estimated costs related to CVD entities such as MI, heart failure (HF), hypertension, and percutaneous coronary intervention (PCI) in Poland [6–9]. In addition, only a few reports have analyzed factors related to resource use in patients hospitalized for MI. Therefore, the present analysis aimed to explore the determinants of the management cost of patients hospitalized for MI in Poland.

METHODS

Study population

We included all adult (≥18 years of age) patients who had been discharged from the hospital with the diagnosis of acute MI between October 1, 2017 and December 31, 2019 in Poland. We classified hospitalization for MI according to ICD-10 codes I21 or I22 as the main diagnosis at any of the hospital wards. The index hospitalization for MI was defined as a continuous hospital stay, including all possible transfers between wards or hospitals for any reason until a patient's discharge home or death.

Patient histories were determined using claims data. A patient was coded as having a disease (e.g. hypertension or chronic kidney disease) if the disease was reported by any hospital or outpatient clinic. The follow-up period was defined as one year after discharge or the period from discharge the patient's death. Hospitalization was defined as admission to a healthcare facility lasting >24 hours unless the patient died within 24 hours.

Ethics committee approval was not needed as we analyzed a fully anonymous national database. Informed consent was not required.

Cost analysis

We focused on direct costs (including hospitalization and post-hospitalization costs) from the payer's perspective. In addition, we only considered costs associated with management of cardiovascular diseases. The original costs are given in Polish zloty (PLN), and we converted them into Euro (EUR), by adopting the EUR to PLN exchange rate of 4.61, which is the value for the date of the last observation day (Dec 31, 2020). Resources used by healthcare providers and financed by the National Health Fund were identified. Total costs included costs of all services provided for the patient, which were calculated starting from the index hospitalization to the end of the follow-up period. Follow-up costs encompassed all expenses incurred after hospital discharge after MI and for one year or until the patient's demise. Costs associated with CVD management included an additional restriction on the ICD-10 code.

Statistical analysis

Categorical variables were described as proportion and compared using the χ^2 test. Continuous variables were expressed using mean and median values and compared using the Mann-Whitney test. Dispersion of variables was measured using the standard deviation (SD) and interquartile range (IQR). We used a multivariable linear regression model to examine the association between related clinical factors and costs. Additionally, the Box-Cox method was employed to find the optimal transformation of the response variable. To report the most significant independent predictors, we ran a variable selection procedure using backward elimination and the Bayesian Information Criterion (BIC). The BIC criterion consists of two terms; the first one is related to the sum of squared residuals and measures the quality of model fit while the second one is related to the number of variables in the model and can be interpreted as a penalty for the complexity of the model. The method involves finding a subset of independent variables that minimizes the criterion. The coefficient of determination (R^2) and F test were used to assess the goodness of fit of the model. We used the Spearman coefficient to measure the strength of correlations between single variables. We assumed a significance level of 0.05 in all statistical tests. All statistical analyses were performed using R statistical software (version 4.0.3). In particular, we used R packages: stats and ggplot2.

RESULTS

Overall, 154 108 MI patients were included in the analysis, with 56 095 (36.4%) females and 98 013 (63.6%) males (Table 1). The mean (SD) age was 68.1 (11.9) years, whereas the median (IQR) age was 68.0 (60.6–76.8). The majority of patients had been hospitalized in cardiological departments (88.1%). Invasive management (at least coronary angiography) was performed in 90.4% of patients, percutaneous coronary intervention (PCI) in 74.3%, and coronary artery bypass grafting (CABG) in 4.0% (Table 1).

In-hospital mortality was 8.64%. Post-discharge one-year all-cause mortality was 8.7%. The mean number of hospital stays within one year following discharge was 1.20 (0.47). The median number of consultations with the cardiologist within one year following discharge was 1.09 (0.00–2.23). The median number of consultations with a primary healthcare physician within one year following discharge was 10.28 (6.67–14.89). Patients with diabetes consulted a diabetologist 0.71 (1.29) times, on average, the median was 0.00 (0.00–1.14).

The median total cost was €3804.7 (2674.1–5712.7) per patient and 29% (1113.6 € [380.5–2490.4]) of this was cost related to using post-hospitalization resources. The median cost of CVD management was €3624.7 (2582.1–5258.5), of this sum, 26% of costs were related to post-hospitalization expenditures (Table 2). The analysis of the total cost for individual years shows a slight increase in median costs in subsequent years: €3450.7 (2407.8–5205.2) in 2017, €3753.8 (2642.6–5681.9) in 2018, and €3944.9 (2794.8–5844.4) in 2019 (Table 3).

Table 4 presents the subgroup analysis of the total costs of medical care in patients hospitalized for MI. History of dialysis, CABG during the index hospitalization, chronic kidney disease, and HF were related to higher management costs. Males incurred significantly larger total costs compared to female patients. Patients who were hospitalized in a cardiology department cost significantly less when compared with patients hospitalized in other departments. The Spearman correlation coefficient between age and the total

Table 1. Characteristics of the analyzed group

Variable	Number (%)
Age, years, mean (SD)	68.1 (11.9)
Sex, n (%)	
Females	56 095 (36.4)
Males	98 013 (63.6)
Heart failure, n (%)	33 329 (21.6)
Hypertension, n (%)	115 757 (75.1)
Atrial fibrillation, n (%)	19 103 (12.4)
Diabetes, n (%)	47 956 (31.1)
History of myocardial infarction, n (%)	10 789 (7.0)
History of CABG, n (%)	1571 (1.0)
History of PCI, n (%)	17 623 (11.4)
History of stroke, n (%)	4977 (3.2)
Chronic kidney disease, n (%)	12401 (8.0)
History of dialysis, n (%)	1555 (1.0)
Chronic obstructive pulmonary disease, n (%)	17 495 (11.4)
History of cancer, n (%)	38 569 (25.0)
Index hospitalisation, n (%)	
Coronary angiography, n (%)	139 389 (90.4)
Percutaneous coronary intervention, n (%)	114 446 (74.3)
CABG, n (%)	6233 (4.0)
Department, n (%)	
Cardiology	135 803 (88.1)
Internal medicine	13 467 (8.7)
Other	4838 (3.1)
Type of hospital, n (%)	
District	50 664 (32.9)
Community	39 778 (25.8)
Teaching	24 792 (16.1)
Other	38 874 (22.2)

Abbreviations: CABG, coronary artery bypass graft; SD, standard deviation; PCI, percutaneous coronary intervention

Table 2. Summary of the costs (in Euros) per patient

Type of cost	Median (IQR)	Mean
Hospitalization costs	2290.7 (2082.4–3205.7)	2699.5
Post-hospitalization costs	1113.6 (380.5–2490.4)	2302.7
Hospitalization and post-hospitalization costs	3804.7 (2674.1–5712.7)	5002.2
Post-hospitalization costs associated with cardiovascular causes	929.2 (217.3–2027.3)	1828.1
Hospitalization and posthospitalization costs associated with cardiovascular causes	3624.7 (2582.1–5258.5)	4536.8

Patients with missing cost values were excluded from the analysis

Abbreviations: IQR, interquartile range; other — see Table 1

Table 3. Summary of the costs by year of discharge from the hospital (in Euros)

Year of discharge from the hospital	Median (IQR)	Mean
Costs of hospitalization for acute myocardial infarction		
2017	2105.8 (1915.8–2659.8)	2336.4
2018	2290.7 (2082.4–2973.0)	2621.9
2019	2359.3 (2082.4–3310.4)	2791.0
2017–2019	2290.7 (2082.4–3205.7)	2699.5
Costs of the management in the post-discharge period		
2017	997.3 (280.9–2377.6)	2176.3
2018	1116.9 (399.1–2524.6)	2318.5
2019	1131.1 (387.3–2480.1)	2318.0
2017–2019	1113.6 (380.5–2490.4)	2302.7
Total costs		
2017	3450.7 (2407.8–5205.2)	4537.3
2018	3753.8 (2642.6–5681.9)	4975.7
2019	3944.9 (2794.8–5844.4)	5144.6
2017–2019	3804.7 (2674.1–5712.7)	5002.2

Patients with missing cost values were excluded from the analysis

Abbreviations: see Tables 1 and 2

cost was not statistically significant (r = –0.005; *P* = 0.12). Age remained not significantly related to the costs in multivariable analysis both when we used age as a continuous variable and when we constructed age categories (Table 4). The abovementioned relationships remained unchanged in multiple regression analysis using a Box-Cox transformation on dependent variables to correct cost data which had skewed distribution [10]. This allowed us to obtain a model that is better fitted to the data (R^2 = 0.2232) when compared to the model based on the original response variable (R^2 = 0.1316) (Figure 1).

The subgroup analysis of the postdischarge costs of medical care is presented in Table 5. The high cost of management was related to dialysis, chronic kidney disease, and HF in the history. Male sex was also related to significantly higher costs. The multivariable analysis confirmed that kidney disease, sex, history of HF, diabetes, atrial fibrillation, hypertension, chronic obstructive pulmonary disease, cancer, and stroke as well as invasive management in the acute phase of MI and type of department where the patient was hospitalized were independently related to management costs following discharge.

The management cost of patients hospitalized for acute MI was correlated with the number of comorbidities (Figure 2). Both, the total cost as well as the post-hospitalization cost correlated with the number of comorbidities (Spearman correlation r = 0.20; *P* <0.001 and r = 0.16; *P* <0.001).

DISCUSSION

To the best of our knowledge, this is the first study that captured and quantified the hospitalization and post-hospitalization costs related to MI in Poland. The number of hospital admissions and cost of hospitalization of acute MI patients put a substantial economic burden on the healthcare system. Our analysis focused on the country's National Health Fund data and demonstrated that more than 90% of total hospitalization and post-hospitalization expenditure was related to cardiovascular healthcare. Importantly, the mean post-hospitalization cost, €2302.7, incurred in the first year following discharge was only slightly lower compared to the mean cost of acute MI patient hospitalization (€2669.5). Our findings align with the annual costs reported in the Soroka Acute Myocardial Infraction II (SAMI II) retrospective study from a tertiary medical center. In that study, annual per-patient costs throughout the first year following MI (€5592) were significantly higher compared with the preceding year (€3120) [11]. Additionally, we observed that the mean per-person annual cost of hospitalization in Poland was comparable to that incurred in Sweden in relation to CVD patients [12].

Analyzing clinical data, our results showed that co-morbidities rather than age were cost predictors. Specifically, the co-morbidities identified as predictors of increased hospitalization cost in studies of MI patients were diabetes, hypertension, and chronic kidney disease as well as HF, atrial fibrillation, and stroke. These comorbidities may affect the course of coronary artery disease and, as a result, may increase therapy-related costs, which stresses the need for optimal and coordinated care in the first year following MI [13, 14].

Our results demonstrated that men are more likely than women to generate high management costs. CVDs are highly prevalent in men compared to women, which may explain the underuse of clinical procedures in women and overuse in men. Another explanation can be a higher complication rate in men and, therefore, higher costs of usually expensive procedures tackling complications [15]. On the other hand, women are more willing than men to

Table 4. Variables related to the total costs (in Euros) in univariable and multivariable analysis

Variable	Total cost			
	Univariate, median (IQR)	*P*-value	Mutivariable regression, β (95% CI)[a]	*P*-value
Age				
<50 years	3290.6 (2487.4–4539.8)	<0.001	Reference	
50–60 years	3724.3 (2746.5–5393.5)		–	–
60–70 years	3989.7 (2850.6–6085.6)		–	–
70–80 years	4072.3 (2770.3–6289.5)		–	–
≥80 years	3460.9 (2305–5151)		–	–
Sex				
Male	3969 (2846.1–6037.5)	<0.001	0.023 (0.022, 0.025)	<0.001
Female	3531 (2388.5–5204.9)		Reference	
Heart failure				
Yes	3998.8 (2562.2–6575.9)	<0.001	0.023 (0.021, 0.025)	<0.001
No	3766.7 (2698.6–5519.3)		Reference	
Hypertension				
Yes	3855.5 (2668.6–5849.6)	<0.001	–	–
No	3678.9 (2689.9–5300.6)		Reference	
Atrial fibrillation				
Yes	3850.9 (2501.6–6192.3)	0.241	0.007 (0.005, 0.010)	<0.001
No	3798.8 (2698.1–5650.7)		Reference	

→

Table 4 (cont.). Variables related to the total costs (in Euros) in univariable and multivariable analysis

Variable	Total cost			
	Univariate, median (IQR)	*P*-value	Mutivariable regression, β (95% CI)[a]	*P*-value
Diabetes				
Yes	4128.5 (2838–6440.6)	<0.001	0.020 (0.018, 0.021)	<0.001
No	3691.1 (2618.3–5410)		Reference	
History of myocardial infarction				
Yes	3641.9 (2443.6–5989.4)	<0.001	–0.013 (–0.017, –0.010)	<0.001
No	3813.4 (2695.2–5692.3)		Reference	
History of PCI				
Yes	3879 (2647.1–6384.1)	<0.001	0.009 (0.006, 0.012)	<0.001
No	3795.7 (2677.9–5638.1)		Reference	
History of CABG				
Yes	3666.3 (2448.1–6059.1)	0.198	–	–
No	3805.5 (2676.8–5709.7)		Reference	
History of stroke				
Yes	4124 (2681.2–6304.7)	<0.001	0.013 (0.008, 0.017)	<0.001
No	3796.4 (2673.8–5689.3)		Reference	
Chronic kidney disease				
Yes	4481.4 (2880–8240)	<0.001	0.025 (0.022, 0.028)	<0.001
No	3765.5 (2662.3–5569)		Reference	
History of dialysis				
Yes	17368.1 (9718.1–21201.8)	<0.001	0.280 (0.273, 0.287)	<0.001
No	3782.6 (2663.6–5629.7)		Reference	
Chronic obstructive pulmonary disease				
Yes	3955.7 (2712.6–6091.5)	<0.001	0.008 (0.006, 0.011)	<0.001
No	3786.5 (2670.4–5664)		Reference	
Cancer in the history				
Yes	3896.6 (2689.8–5959.6)	<0.001	0.010 (0.008, 0.012)	<0.001
No	3774.1 (2669.2–5629.8)		Reference	
Coronary angiography during the index hospitalization				
Yes	3877.5 (2798.6–5779.2)	<0.001	0.032 (0.029, 0.035)	<0.001
No	2700.2 (1453.3–4863.6)		Reference	
PCI during the index hospitalization				
Yes	3961.8 (3028.9–5520.1)	<0.001	0.113 (0.111, 0.115)	<0.001
No	2546.7 (1301.2–6653.1)		Reference	
CABG during the index hospitalization				
Yes	8071.4 (6883.5–10,144.4)	<0.001	0.252 (0.248, 0.256)	<0.001
No	3707.5 (2621.8–5356)		Reference	
Department of cardiology				
Yes	3791.4 (2702.8–5627.2)	0.045	–0.050 (–0.055, –0.046)	<0.001
No	3951.4 (2430.4–6412.4)		Reference	
Department of internal medicine				
Yes	3710.5 (2260.9–5824.5)	<0.001	–0.027 (–0.032, –0.022)	<0.001
No	3810.5 (2708.2–5701.7)		Reference	
Other department				
Yes	4725.7 (2933.7–7964.9)	<0.001	–	–
No	3785.7 (2668.9–5644.4)		Reference	
Teaching hospitals				
Yes	4284 (2913.6–6912)	<0.001	–	–
No	3732.1 (2622.9–5492.6)		Reference	
District hospitals				
Yes	3667.3 (2598.2–5495.5)	<0.001	–0.017 (–0.019, –0.015)	<0.001
No	3874.6 (2714.7–5817.9)		Reference	
Community hospitals				
Yes	3587.9 (2457–5388.3)	<0.001	–0.018 (–0.02, –0.016)	<0.001
No	3875.6 (2761.8–5816.5)		Reference	
Other hospitals				
Yes	3960.3 (2871.4–5578)	<0.001	0.009 (0.007, 0.010)	<0.001
No	3754.7 (2612.9–5765.9)		Reference	

[a]Estimated coefficient in the model based on variables selected using the Bayesian Information Criterion (BIC)

Abbreviations: see Table 1

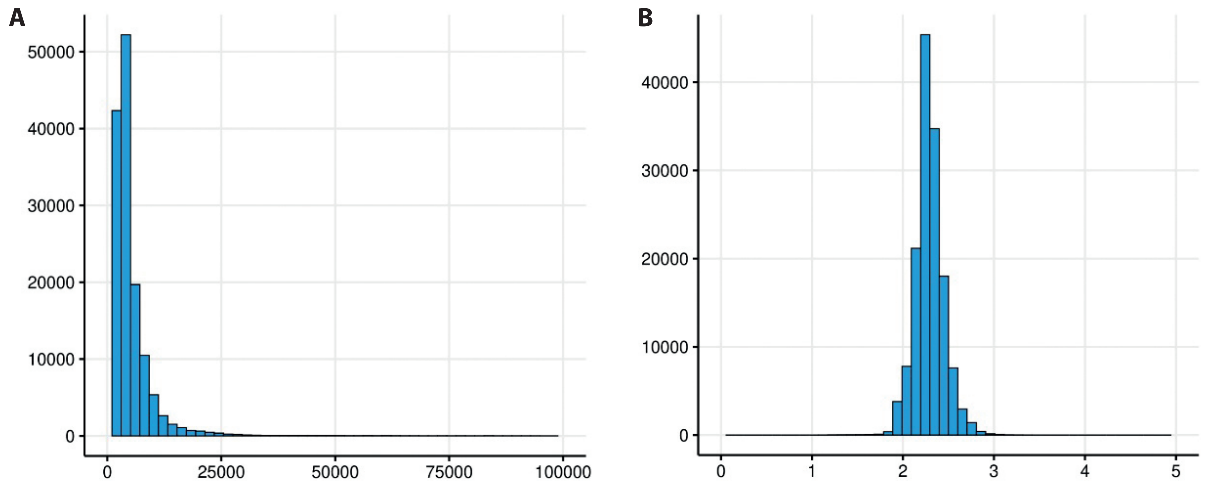

Figure 1. Distribution of the total cost (**A**) and distribution of the total cost after Box-Cox transformation (**B**). The optimal value of parameter λ = 0.1 in Box-Cox transformation

Table 5. Subgroup analysis of the costs (in Euros) of management in the post-discharge period

Variable	Post-hospitalization cost			
	Univariate, median (IQR)	*P*-value	Multivariable regression, β (95% CI)[a]	*P*-value
Age				
<50 years	780.7 (245.8–1532.7)	<0.001	Reference	
50–60 years	1024.5 (382.7–2143.5)		–	–
60–70 years	1154.3 (431.2–2618.9)		–	–
70–80 years	1250 (446.3–2887.5)		–	–
≥80 years	1072.8 (241.1–2420.8)		–	–
Sex				
Males	1147 (422.1–2620.6)	<0.001	0.040 (0.036, 0.043)	<0.001
Female	1049.2 (292.4–2272)		Reference	
Heart failure				
Yes	1432.3 (521.4–3569.6)	<0.001	0.039 (0.035, 0.044)	<0.001
No	1054.9 (352.6–2249.7)		Reference	
Hypertension				
Yes	1160.6 (401–2634.2)	<0.001	0.014 (0.01, 0.018)	<0.001
No	974 (331.5–2049.2)		Reference	
Atrial fibrillation				
Yes	1357.9 (480.4–3276.2)	<0.001	0.019 (0.014, 0.024)	<0.001
No	1093.2 (369.2–2388.7)		Reference	
Diabetes				
Yes	1297 (485.2–3064.5)	<0.001	0.037 (0.033, 0.040)	<0.001
No	1036.7 (341–2252)		Reference	
History of myocardial infarction				
Yes	1256.6 (381.7–3272.3)	<0.001	−0.022 (−0.03, −0.015)	<0.001
No	1103.5 (380.3–2444.3)		Reference	
History of PCI				
Yes	1339.7 (440.1–3460)	<0.001	0.021 (0.014, 0.027)	<0.001
No	1095.1 (373.1–2390)		Reference	
History of CABG				
Yes	1234.8 (332.7–3534.1)	<0.001	–	–
No	1112.5 (380.9–2482.3)		Reference	
History of stroke				
Yes	1460 (525.6–3307)	<0.001	0.022 (0.013, 0.031)	<0.001
No	1103.4 (376.7–2463)		Reference	
Chronic kidney disease				
Yes	1835.3 (736.2–5122.1)	<0.001	0.052 (0.045, 0.058)	<0.001
No	1079.8 (359.1–2345)		Reference	

Table 5 (cont.). Subgroup analysis of the costs (in Euros) of management in the post-discharge period

Variable	Post-hospitalization cost			
	Univariate, median (IQR)	*P*-value	Multivariable regression, β (95% CI)[a]	*P*-value
History of dialysis				
Yes	14695.1 (6500.3–17999.5)	<0.001	0.437 (0.421, 0.453)	<0.001
No	1103.4 (372.7–2425.4)		Reference	
Chronic obstructive pulmonary disease				
Yes	1302.1 (514.9–2995)	<0.001	0.025 (0.020, 0.030)	<0.001
No	1095.7 (365.4–2429.4)		Reference	
History of cancer				
Yes	1246.1 (472.8–2859.2)	<0.001	0.040 (0.036, 0.043)	<0.001
No	1073.2 (346.3–2367.2)		Reference	
Coroangiography during the index hospitalization				
Yes	1109.1 (380.2–2457.2)	<0.001	–0.014 (–0.02, –0.008)	<0.001
No	1168.2 (382.3–2829.4)		Reference	
PCI during the index hospitalization				
Yes	1149.6 (445.9–2434.1)	<0.001	0.041 (0.036, 0.045)	<0.001
No	944.1 (202.2–2760.8)		Reference	
CABG during the index hospitalization				
Yes	1013.6 (519.4–1719)	<0.001	–	–
No	1119.9 (375.6–2526.2)		Reference	
Department of cardiology				
Yes	1103 (376.1–2421.3)	<0.001	–0.044 (–0.053, –0.035)	<0.001
No	1254.9 (424.5–3071.2)		Reference	
Department of internal medicine				
Yes	1199.8 (410.4–2913)	<0.001	–0.022 (–0.033, –0.011)	<0.001
No	1104.3 (378.4–2454.5)		Reference	
Other department				
Yes	1413.5 (471–3620.3)	<0.001	–	–
No	1104.5 (378.1–2460.6)		Reference	
Teaching hospitals				
Yes	1116.6 (433.6–2606)	<0.001	–	–
No	1112.7 (365.2–2469.4)		Reference	
District hospitals				
Yes	1103.4 (374.7–2463.4)	0.003	–0.015 (–0.020, –0.011)	<0.001
No	1117.9 (383.3–2502.6)		Reference	
Community hospitals				
Yes	1136.7 (315–2580.6)	0.768	–0.019 (–0.023, –0.014)	<0.001
No	1105.5 (402.6–2456.2)		Reference	
Other hospitals				
Yes	1103.4 (408.4–2354.7)	0.098	–	–
No	1116.7 (373.1–2533.4)		Reference	

[a]Estimated coefficient in the model based on variables selected using the Bayesian Information Criterion (BIC)

Abbreviations: see Table 1

adapt their lifestyle and adhere to medications to avoid surgery [16].

The likelihood of incurring high management costs was associated with a number of co-morbidities. Similarly, a multi-country analysis of costs related to CVD in patients with atrial fibrillation reported that co-morbidities, such as diabetes and stroke, were identified as predictors of costs in the Polish population [17]. Pre-existing HF was related to significantly higher costs in our analysis. This finding is in line with other analyses showing high costs of management of HF patients [18].

Since the economic burden of acute MI is high, efforts to provide effective public health activities and effective medical management could result in significant health-related cost savings and increased productivity. It applies also to MI-related complications and post-acute MI hospitalization which can be substantially lowered with effective treatment coordination and prevention.

Limitations

Although our study focused on Polish residents, our findings remain relevant to other healthcare systems. However, the present analysis has some limitations. First, the design of the present study precludes any claims on cause-and-effect relations. Indeed, we can only confirm statistical associations between the analyzed variables and cost management, rather than a causal relationship. Second, we were not able to estimate the indirect costs of MI nor the

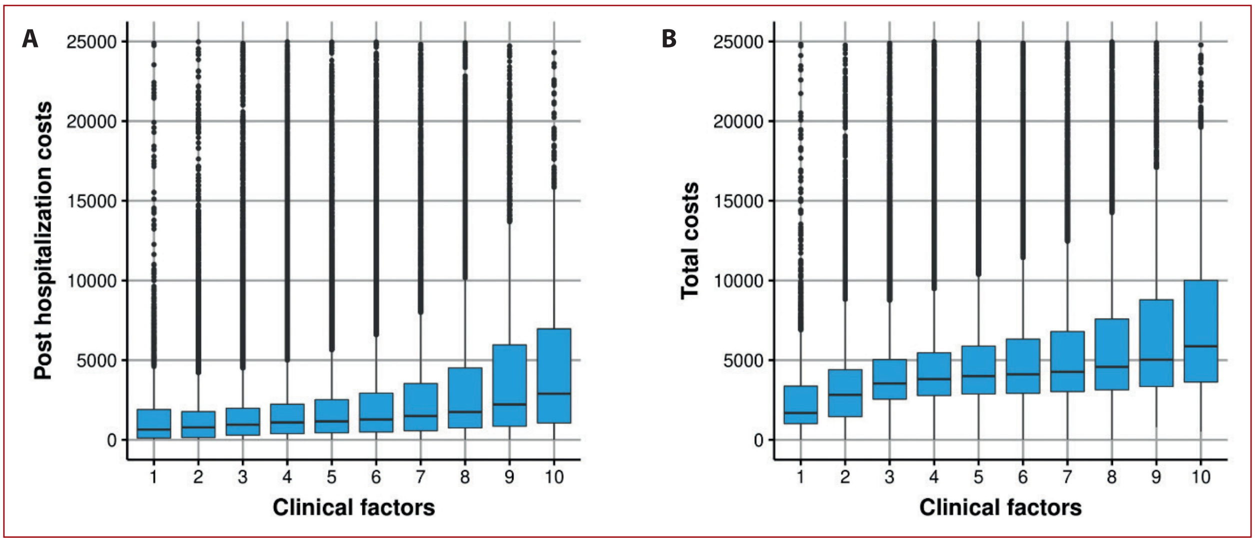

Figure 2. Total costs (**A**) and post-hospitalization costs (**B**) calculated in Euros in relation to several clinical factors (male sex, hypertension, diabetes, atrial fibrillation, heart failure, cancer in the history, stroke in the history, myocardial infarction in the history, chronic kidney disease in the history, chronic obstructive pulmonary disease, history of percutaneous coronary intervention, percutaneous coronary intervention during the index hospitalization, invasive management during the index hospitalization, previous dialysis, history of coronary artery bypass grafting, coronary artery bypass grafting) present simultaneously in the patient

socio-economic status of patients due to lack of available data. Moreover, we have no data on lifestyle habits of the analyzed patients. The inclusion of such additional information would possibly allow for a more effective analysis of the impact of the considered variables on costs. Third, we could not analyze costs of drugs utilized in the post-discharge period. Therefore, the presented cost estimates should be seen as understated. Finally, the results are based on the robustness of the public databases that generally suffer from reporting bias resulting from the specificity of financing claims. On the other hand, a major advantage of the present study is the analysis of a large, nationwide database including all patients hospitalized for MI between October 1, 2017 and December 31, 2019 in Poland. Thus, the data regarding used resources provide an overview of current everyday practice.

CONCLUSIONS

Male sex, HF, atrial fibrillation, diabetes, kidney disease, chronic obstructive pulmonary disease, and history of stroke as well as hospitalization in departments other than cardiology or internal disease are independently related to the cost of management of MI patients. Age was not independently related to the cost of management of MI patients.

Article information

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