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ARTYKUŁ ORYGINALNY / *ORIGINAL ARTICLE*

Incidence, treatment, in-hospital mortality and one-year outcomes of acute myocardial infarction in Poland in 2009–2012 — nationwide AMI-PL database

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Abstract

Background and aim: Nationwide data on acute myocardial infarction (AMI) are available for some Western but not for Central and Eastern European countries. We performed a study on nationwide data of all Polish AMI patients in 2009–2012 to assess incidence, quality of care, and cardiovascular events during 1 year following AMI.

Methods: The database of the only public, obligatory health insurer in Poland (National Health Fund) together with data from the Central Statistical Office were used. AMI cases were selected based on primary diagnosis ICD-10 codes I21-I22. For years 2009–2012, index hospitalisations (n = 311,813) in a given year and death records were analysed. Additionally, data on hospitalisations, procedures and deaths during 1 year follow-up were obtained for 2009.

Results: Age-adjusted incidence of AMI in Poland in 2009 was 196 cases per 100,000 population (176 per 100,000 were hospitalised), with a decreasing trend over time. The incidence was 2.5 times higher in men than in women. The median age was 63 years in men and 74 years in women. The proportion of ST elevation myocardial infarction (STEMI) decreased from 59% to 48% in 2012, and the proportion of patients receiving invasive treatment increased from 72% to 81%. Age-adjusted case fatality rate was equal in women and men. In 2009, the number of patients with AMI was 75,054 (61% men, 39% women) and 83% of them were treated in cardiology units. Invasive strategy was used in 77% of patients with STEMI and 66% of those with non-STEMI, thrombolysis in 1% and coronary artery bypass grafting in 1.9% of patients. Invasive treatment was used less frequently in women and the elderly patients. When all hospitals where a patient was treated until the final discharge were taken into account, in-hospital mortality was 10.5%. The lowest in-hospital mortality was noted among patients treated invasively (6.3%). The total number of readmissions within 1 year following AMI was 84,718, of which 61.9% were due to cardiovascular causes. The most common causes were stable coronary artery disease (27%), heart failure (7.9%), recurrent infarction (7.0%), and unstable angina (6.8%). Within 1 year after AMI, only 22% of patients participated in a cardiac rehabilitation programme. Total 1-year mortality was 19.4% (invasive treatment 12.3%, non-invasive treatment 38.0%).

Conclusions: Standards of care and early outcomes in AMI in Poland are similar to Western countries. The major cause of higher mortality due to AMI in the Polish population is a high incidence of AMI, indicating a need for intensification of primary prevention programmes. Secondary prevention is also underused, especially in the field of cardiac rehabilitation.

Key words: myocardial infarction, population-based study, epidemiology, morbidity, mortality, prevention

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INTRODUCTION

Cardiovascular (CV) diseases remain the major cause of mortality in Poland and most European countries [1]. In Poland, they account for one fourth of all deaths in the working-age population and become the most common cause of death in those above 64 years of age [2]. Despite significant advances in the diagnosis and treatment of CV disease in the last two decades, CV mortality rates, and in particular premature mortality (< 65 years of age) rates continue to be excessively high in Poland compared to other European Community countries [2]. The major CV disease is ischaemic heart disease including acute myocardial infarction (AMI), followed by cerebrovascular disease [2].

Government agencies, including the National Institute of Public Health — National Institute of Hygiene, monitor the state of health of the Polish population and periodically report basic epidemiological data including life expectancy, mortality rates, and hospital admissions. This information, however, does not allow comprehensive evaluation of early and long-term outcomes in AMI patients. A useful tool in this regard is the Polish Acute Coronary Syndrome Registry (PL-ACS) which has been established as a part of the National Cardiovascular Disease Prevention and Treatment Program POLCARD, edition 2003–2005 [3]. This registry has been operated for 10 years by the Silesian Centre for Heart Diseases, Zabrze, Poland [4]. Its findings showed a significant improvement in early and long-term outcomes in AMI patients in Poland [5, 6]. However, this registry includes only a subset of AMI patients, with underrepresentation of those treated in non-cardiology units, and thus is does not allow determination of nationwide medical, epidemiological, and economic indices related to AMI treatment. A similar situation exists in most European countries. Comprehensive evaluations of treatment outcomes based on all AMI patients have been reported only in Germany [7], and partial data are also available from Denmark [8], England [9, 10], the Netherlands [11], and Norway [12]. Registries that include all hospitalised AMI patients have also been established in England and Wales and in Sweden [13–16].

The authors of these epidemiological studies, in particular the German experts, highlighted significant differences between findings based on evaluation of all AMIs compared to an incomplete picture provided by clinical registries run in selected centres and randomised trials which are often based on highly selected patient populations. Thus, the aim of the AMI-PL project was to create a database including all AMI patients in Poland in 2009–2012 and to evaluate incidence, treatment, early and long-term outcomes, and costs at the national and voivodship level. To the best of our knowledge, it is the first analysis of this kind in a European country with a high CV risk and moderate income per capita.

METHODS

The major healthcare payer in Poland is the National Health Fund (NFZ), a public agency financed by an obligatory healthcare superannuation paid by all country inhabitants. In case of medical procedures related to AMI treatment, NFZ is practically the single payer that signs contracts with public and private healthcare providers. Effective July 1, 2008, NFZ introduced a diagnosis-related group (DRG)-based system for inpatient services, under this system, all admissions are categorised within DRGs based on the severity of cardiac disease, presence of concomitant conditions, and the treatment used, allowing cost reimbursement but also providing unified nationwide electronic data on disease incidence and healthcare delivery.

According to the classification of acute coronary syndromes (ACS), this category includes ST segment elevation myocardial infarction (STEMI), non-ST segment elevation myocardial infarction (NSTEMI), and unstable angina. Only AMIs (STEMI and NSTEMI) are the subject of the present evaluation [17].

Nationwide AMI-PL database 2009–2012

A database including all AMIs in Poland in 2009–2012 was created by combining 4 datasets. This compilation of data from various sources for each AMI patient was possible thanks to a unique personal identification number (PESEL) assigned to each citizen after birth.

The first dataset included information on deaths due to AMI in Poland in 2009–2012, collected in the nationwide mortality database operated by the Central Statistical Office (GUS) and provided annually, with some necessary limitations, for research purposes to the Department-Centre of Monitoring and Analyses of Population Health at the National Institute of Public Health — National Institute of Hygiene. In addition, age-standardised AMI mortality rates (for the ICD-10 codes I21-I22) in selected countries in 1999–2011 were calculated based on the World Health Organisation (WHO) Mortality Database (WHO Headquarters), allowing international comparisons of the mortality rate trends established for Poland.

The second dataset was created based on information reported to NFZ. It included all individual hospital admissions due to AMI in 2009–2012 (n = 311,813), without information on post-discharge events.

The third dataset included all individual hospital admissions due to AMI in 2009 (n = 75,054) reported to NFZ, along with information on all healthcare services including in-hospital treatment, outpatient treatment, rehabilitation, and reimbursed drug therapy in 2009 and 3 subsequent years (2010–2012), and patient deaths until the end of 2012. Index hospitalisations included both the initial admission due to AMI and subsequent patient transfers to other hospitals regardless of the cause and the primary diagnosis. Information on mor-

tality included all deaths along with their dates, regardless of the place and cause of death.

Within the second and the third datasets, the analysed AMI cases were limited to the ICD-10 codes I21-I22, regardless of the hospital unit but excluding admissions limited to a rehabilitation unit. If the time delay between hospital discharge and subsequent admission due to AMI was ≤ 1 day, both admissions were considered due to the same AMI.

The fourth dataset included information provided by the Social Security Institution (ZUS) that collects data on disability, disability benefits, and sick leaves. The present study reports the results of the analysis of the first, second, and third dataset on treatment and medical events during 1 year after AMI.

Epidemiological indices

To estimate the number of subjects with AMI during a given year, we combined information from datasets including patients admitted due to AMI and subjects who died due to AMI. This allowed estimating the number of out-of-hospital deaths due to AMI (as stated in the death certificate) if a subject was not hospitalised previously (within 1 year) due to AMI or died in hospital due to AMI but was previously admitted due to some other reason. We assumed that the number of such patients added to the number of subjects admitted due to AMI allows estimation of the total number of patients with incident AMIs during a given year (hospitalisation or death). Using this database, we were able to calculate crude and sex- and age-adjusted nationwide AMI incidence rates in Poland. Hospital admission rates were also calculated using the database of all patients admitted due to AMI.

Age adjustment was performed using the direct method, using the European age structure adopted by the WHO Regional Office for Europe as the reference age structure for both men and women. In addition, for selected subgroups we calculated crude and adjusted in-hospital case-fatality rates among patients admitted due to AMI in 2009–2012. For the purpose of this analysis, the reference age structure was defined as the age structure of all patients admitted due to AMI in 2009–2012. The IBM SPSS Statistica 19 package was used for data processing and calculations.

Long-term medical events

Using information on subsequent hospitalisations and deaths that were reported to NFZ, we estimated the proportions of patients who were readmitted due to selected reasons or died within 1 year after AMI. Kaplan-Meier curves were used to analyse these long-term data. To estimate the effect of selected variables on the rate of invasive treatment and in-hospital mortality, we used multivariate logistic regression analysis and calculated respective odds ratios with 95% confidence intervals (CI). To evaluate the effect of selected variables on 1-year mortality after hospital discharge, we used multivariate Cox proportional hazard model, reporting the results as relative risk with 95% CI. $P < 0.05$ was considered statistically significant. Calculations were performed using the Statistica PL 10 package (Statsoft, USA).

RESULTS

Incidence, hospital admissions, and in-hospital mortality due to AMI in Poland in 2009–2012

The number of patients with AMI (the total of those hospitalised due to AMI and those who died due to AMI out of hospital) in 2009–2012 was about 85–90,000 per year, yielding the incidence of 224 to 235 per 100,000 per year.

Figure 1 shows the estimated total number of patients with AMI in 2012 in relation to gender and age. This estimate included 1) patients admitted due to AMI (88.2%), 2) patients admitted due to other reasons but died in the hospital due to AMI (5.2%), and 3) patients who died out of hospital due to AMI but were not hospitalised for this reason during that year (6.6%). The median patient age was 63 years in men and 74 years in women. Men were 62% of patients with AMI.

The incidence of AMI among men in 2012 was 297.7 per 100,000 and was 76% higher compared to the estimate in women (169.1 per 100,000). Figure 2 shows mean annual AMI incidence in 2009–2012 in relation to gender and age. These results shown a strong relationship of increased AMI incidence to age in both genders. When adjusted for age differences, AMI incidence in men was 2.5-fold (149%) higher compared to women.

Figures 3–5 show findings from the analysis of all patients admitted due to AMI, including the number of patients admitted due to AMI in 2012 (79,500) in relation to gender and age, and unadjusted and gender- and age-adjusted admission rates in 2009–2012. Table 1 shows AMI incidence and admission rates adjusted to the reference European population.

In 2009, STEMI occurred more frequently (59% of all AMI cases) than NSTEMI. In the following years, the proportion of STEMI decreased, and it comprised less than half (48%) of all AMI cases in 2012.

During 324,300 hospitalisations due to AMI in 2009–2012, the total of 27,500 patients (8.5%) died. In-hospital mortality due to AMI was strongly related to age (Fig. 6) and decreased in the subsequent years in all age groups. Age-adjusted case fatality rate was essentially the same in both genders (Fig. 7).

The mean duration of hospital stay due to AMI was about 6 days. Older patients were hospitalised for about 2–3 days longer than younger patients, and the length of hospital stay decreased slightly in 2011–2012 compared to 2009–2010 (Fig. 8).

Management of AMI in 2009

More detailed analyses of the management of AMI were performed for 2009, based on data availability and the ability to evaluate long-term outcomes. The number of patients admitted due to AMI in 2009 was 75,054 (including 61% men and

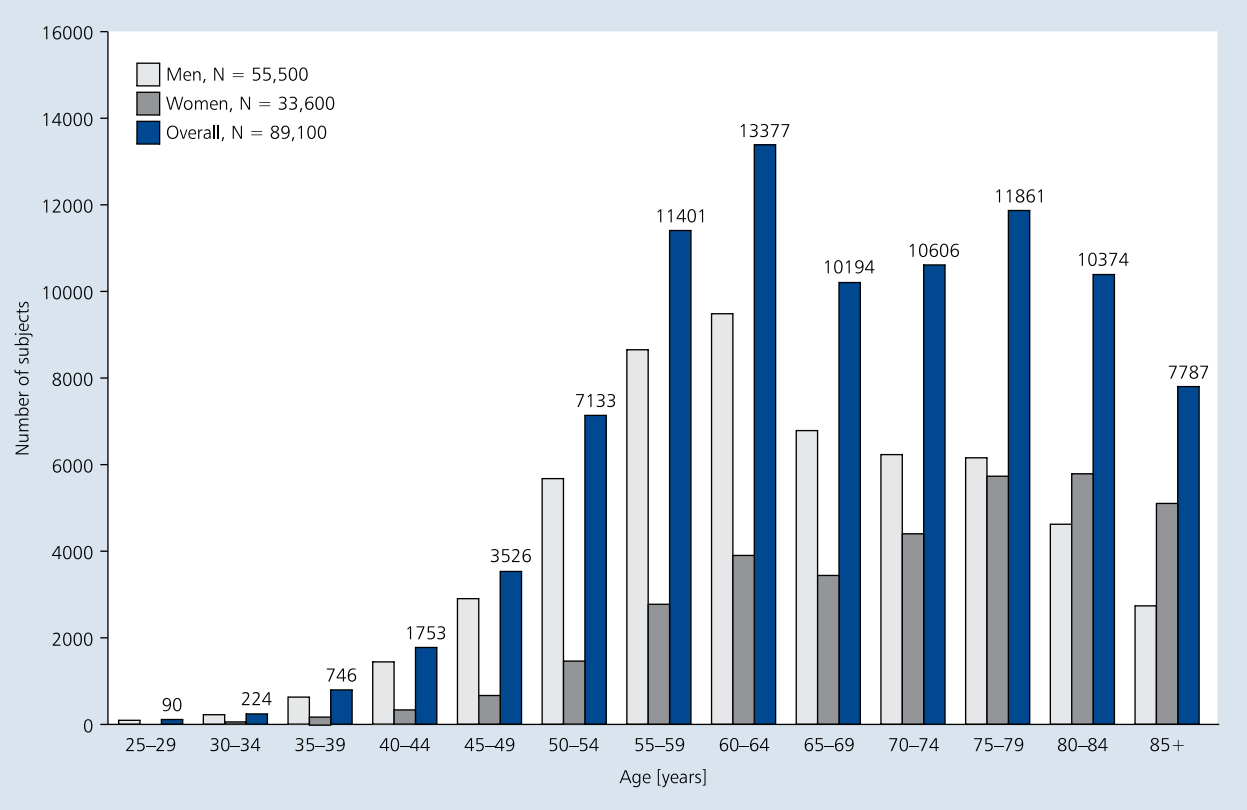

Figure 1. Estimated number of incident myocardial infarctions in Poland in 2012 in relation to gender and age

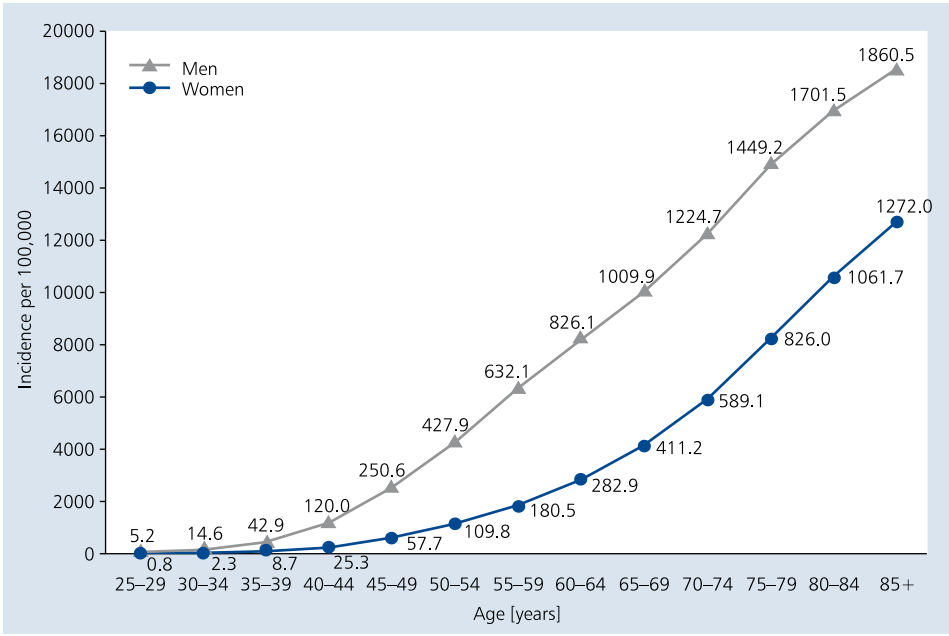

Figure 2. Mean annual myocardial infarction incidence rates in Poland in 2009–2012 in relation to gender and age

39% women), with 83% of them treated in cardiology wards and 3.4% requiring admission to an intensive care unit. Invasive treatment was used in 77% of STEMI patients and 66% of NSTEMI patients (Fig. 9). The proportion of AMI patients treated with percutaneous coronary intervention (PCI) was 59% and showed a strong relationship to age (Fig. 10). Invasive

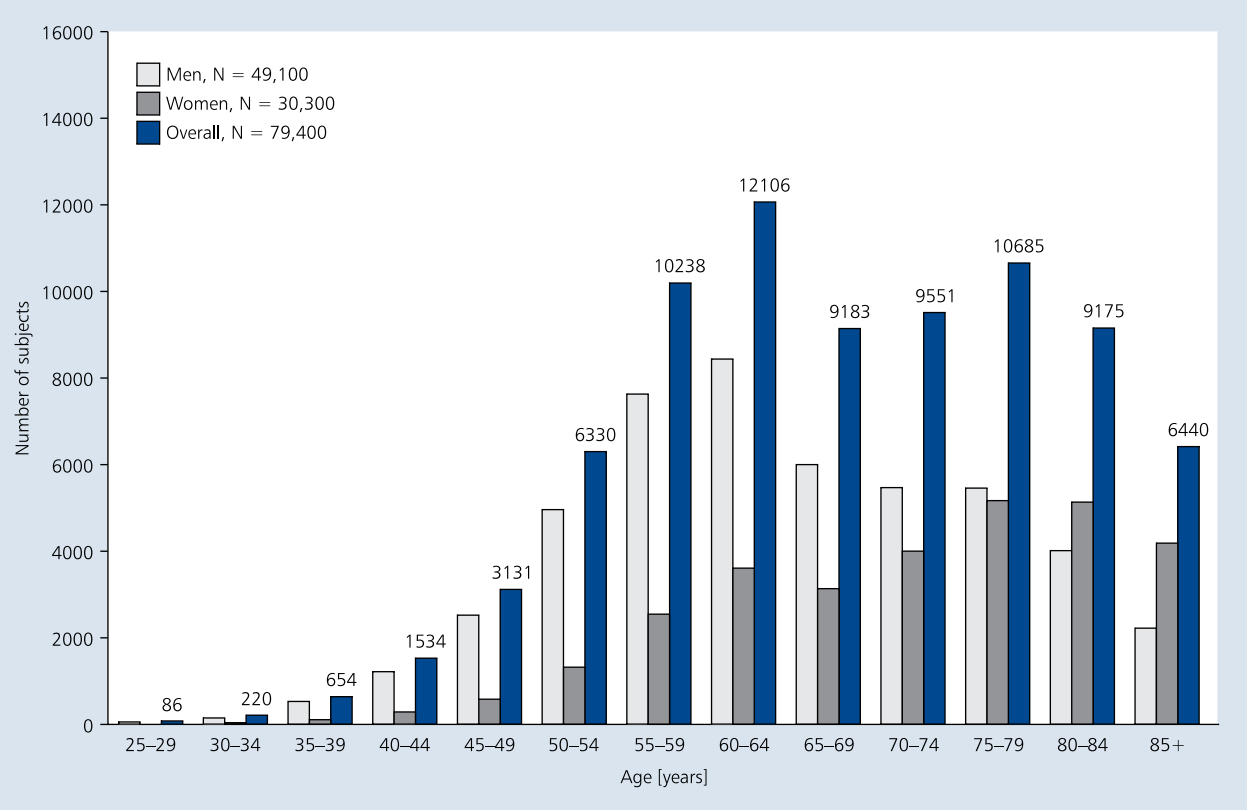

Figure 3. Number of subjects admitted due to myocardial infarction in 2012 in relation to gender and age

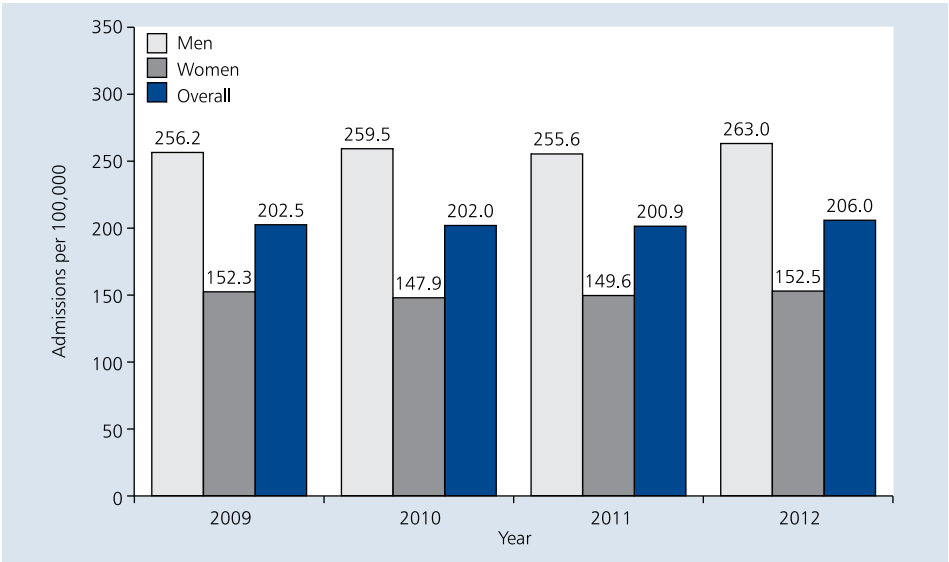

Figure 4. Admission rates due to myocardial infarction in Poland in 2009–2012 in relation to gender

treatment was significantly less frequently used in women, elderly patients and those initially admitted to non-cardiology wards (Fig. 11). Thrombolysis was used in a very small (1%) subset of patients. Coronary artery bypass grafting (CABG) was performed during the index hospitalisation in 1.9% of patients.

Early and long-term outcomes and medical events during one year after discharge in 2009 in relation to the place and type of treatment

We calculated in-hospital mortality, taking into account all hospitals where a patient was treated until the final discharge

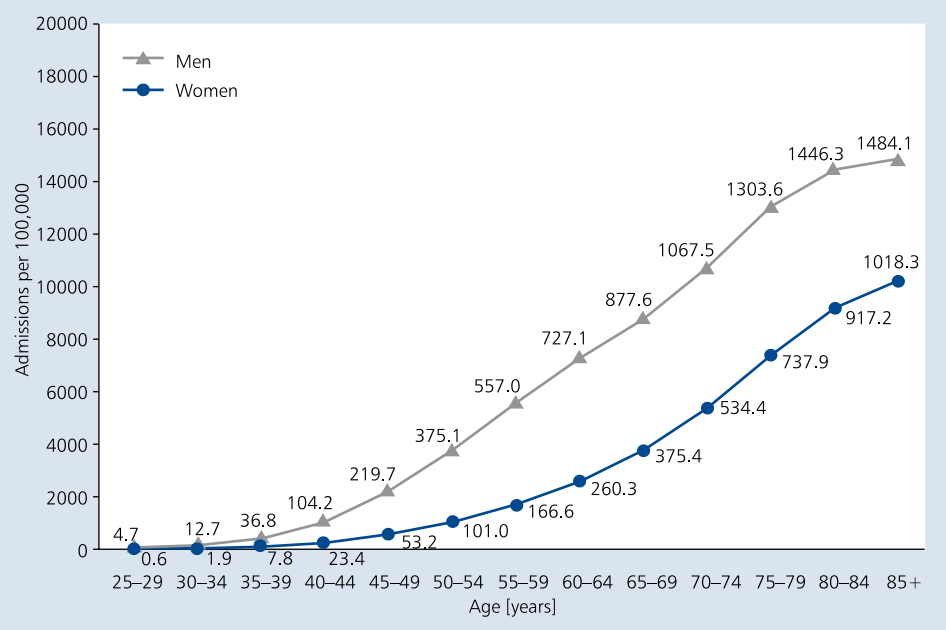

Figure 5. Mean annual admission rates due to myocardial infarction in Poland in 2009–2012 in relation to gender and age

Table 1. Myocardial infarction incidence and admission rates in Poland in 2009–2012 (per 100,000; adjusted for the reference European population age structure)

Year	2009	2010	2011	2012
Incidence of myocardial infarction				
Overall	195.7	190.9	183.4	183.5
Men	292.2	288.2	274.5	275.1
Women	119.4	113.3	110.6	109.9
Hospital admissions due to myocardial infarction				
Overall	176.2	173.0	168.6	169.6
Men	249.1	248.5	240.5	242.9
Women	104.8	100.9	99.9	99.8

home or death, regardless of the final diagnosis. Among all AMI patients admitted in 2009, in-hospital mortality was 10.5%. The lowest in-hospital mortality was noted among patients treated invasively (6.3%), regardless of age, gender, and the type of AMI (Fig. 12). Worse outcomes were noted in the elderly patients, STEMI patients, and those initially admitted to intensive care units or emergency departments (Fig. 13).

Figure 14 shows the proportions of patients readmitted due to various reasons within 1 year after the AMI. The total number of readmission for all reasons, including multiple admissions, was 84,718. The mean number of admissions per patient was 1.3, and 61.9% of hospitalisations were due to CV causes (ICD-10 codes I00-I99). During 1 year after AMI, 40% of patients (n = 26,550) were hospitalised at least once due to CV causes.

We did not find significant differences in 1-year readmission rates in relation to gender and the type of AMI, and only a slightly lower proportion of readmitted patients younger than 65 years compared to older ones (38% vs. 41%). Patients treated in cardiology wards were significantly less likely to be readmitted due to CV causes compared to patients treated in other units (38% vs. 46%).

The most common causes of readmission during 1 year after AMI included stable coronary artery disease (27%, or 17,812 patients), heart failure (7.9%, or 5,327 patients), recurrent AMI (7.0%, or 4,675 patients), unstable angina (6.8%, or 4,495 patients), atrial fibrillation (2.1%, or 1,158 patients), stroke (1.5%, or 1,005 patient), and cardiac arrest or life-threatening arrhythmia (1.0%, or 651 patients). During these hospitalisations, coronary angiography was performed in 15,666 (23%) patients,

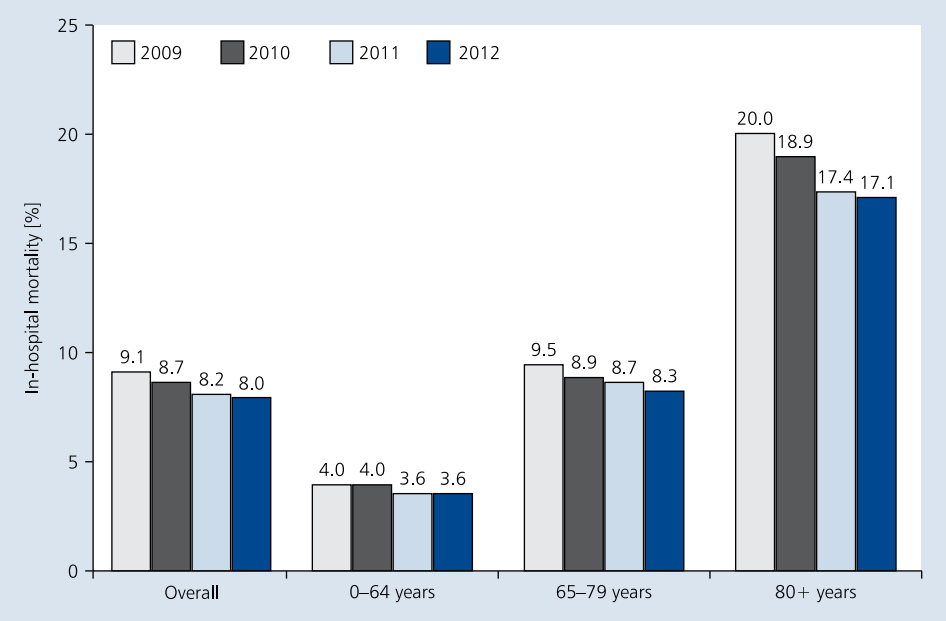

Figure 6. In-hospital mortality due to myocardial infarction among subjects hospitalized in Poland in 2009–2012 in relation to age

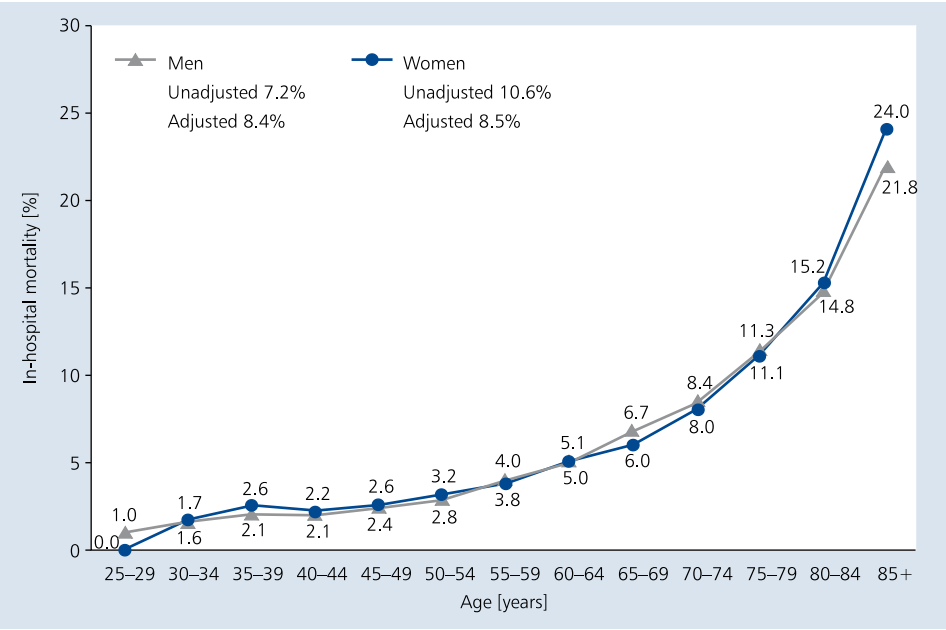

Figure 7. Mean annual in-hospital mortality due to myocardial infarction in Poland in 2009–2012 in relation to gender and age

PCI in 11,464 (17%) patients, CABG in 3,708 (5.5%) patients, cardiac pacemaker was implanted in 611 (0.9%) patients, and implantable cardioverter-defibrillator in 823 (1.2%) patients.

During 1 year after AMI, 14,758 (22%) patients were subjected to cardiac rehabilitation, mostly during the first 3 months after AMI (79% of them). Cardiac rehabilitation was undertaken significantly more frequently in younger patients (30% of all AMI patients below 65 years of age), men, and those treated invasively in cardiology wards (27% vs. 8% of those treated non-invasively). The mean number of primary care outpatient visits (with a cardiac diagnosis) during 1 year after AMI was 7.9. We were unable to provide a reliable estimation of the number of specialist outpatient visits, as no data regarding private outpatient cardiology consultations were available.

The total mortality at 1 year after admission due to AMI was 19.4% (including in-hospital mortality of 10.5% and mortality after discharge of 8.9%): 12.3% in patients who received

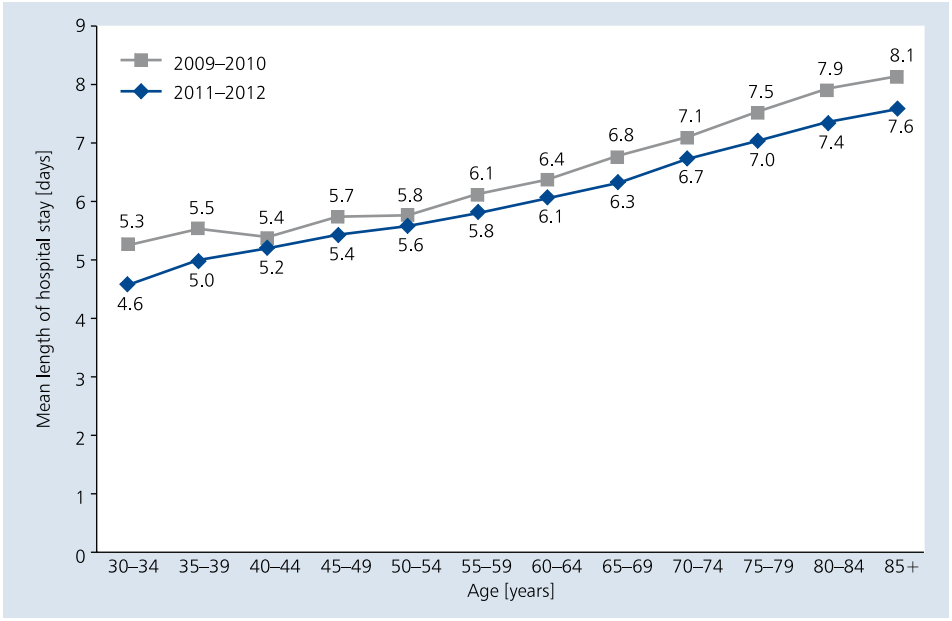

Figure 8. Mean length of hospital stay due to myocardial infarction in Poland in 2009–2012 in relation to age

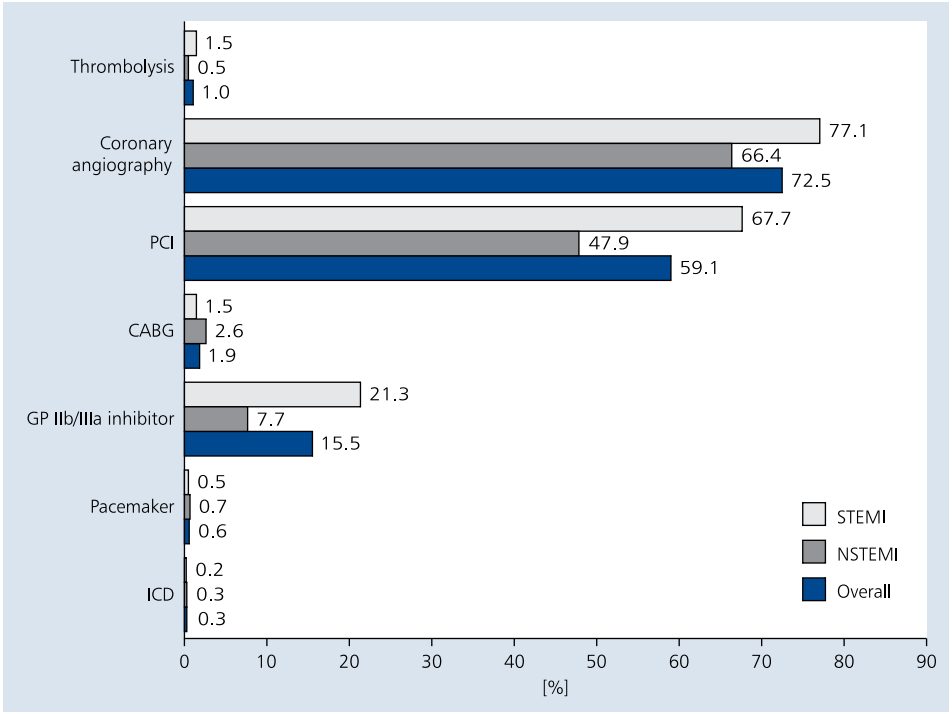

Figure 9. Management of myocardial infarction in Poland in 2009 — selected medical procedures during hospitalisations due to ST segment elevation myocardial infarction (STEMI) and non-ST segment elevation myocardial infarction (NSTEMI); PCI — percutaneous coronary intervention; CABG — coronary artery bypass grafting; GP IIb/IIIa — glycoprotein IIb/IIIa; ICD — implantable cardioverter-defibrillator

invasive therapy and 38.0% among those who received drug therapy only. The likelihood of dying was highest during the first month (1.8% in men and 2.6% in women) and decreased markedly in subsequent months.

In 2009, 1-year mortality after hospital discharge was 10.1% among all discharged AMI patients, 8.8% among men, and 12.2% among women. These are crude estimates without adjustment for age difference between men and women.

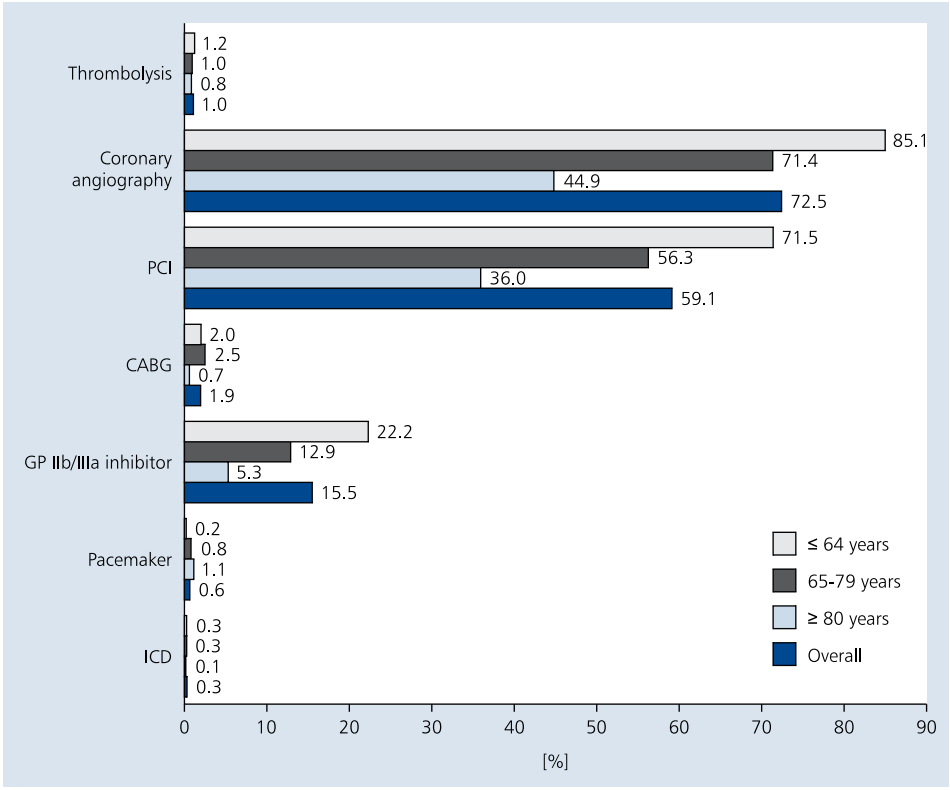

Figure 10. Management of myocardial infarction in Poland in 2009 — selected medical procedures during hospitalisation in relation to age; PCI — percutaneous coronary intervention; CABG — coronary artery bypass grafting; GP IIb/IIIa — glycoprotein IIb/IIIa; ICD — implantable cardioverter-defibrillator

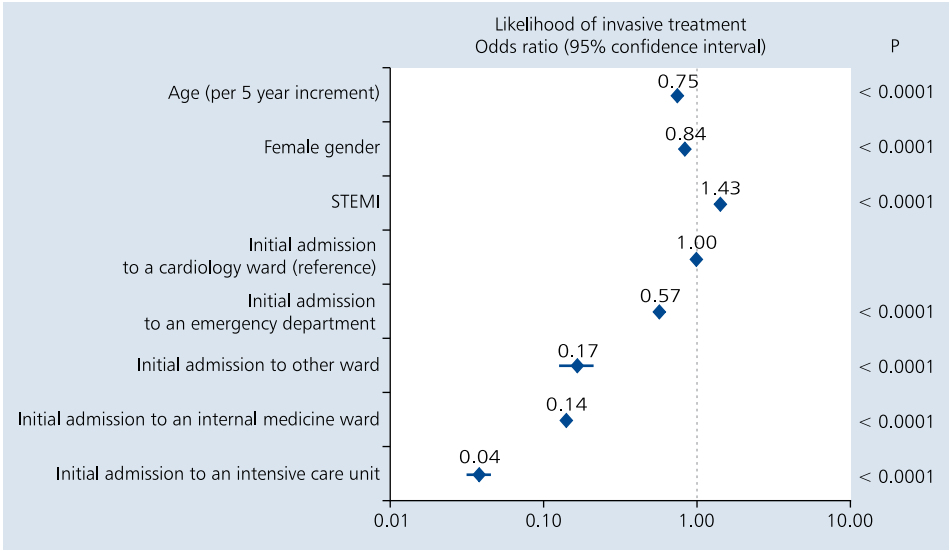

Figure 11. Likelihood of invasive treatment (multivariate analysis); STEMI — ST segment elevation myocardial infarction

One-year mortality after discharge was 6.5% in patients who received invasive therapy compared to 21.3% among those who received drug therapy only. These are also crude estimates that do not account between-group differences in the clinical characteristics of patients. Figure 15 shows 1-year mortality after discharge in relation to gender and age, and Figure 16 shows 1-year mortality after discharge in relation to the place and type of treatment. In Figure 15, mortality rates

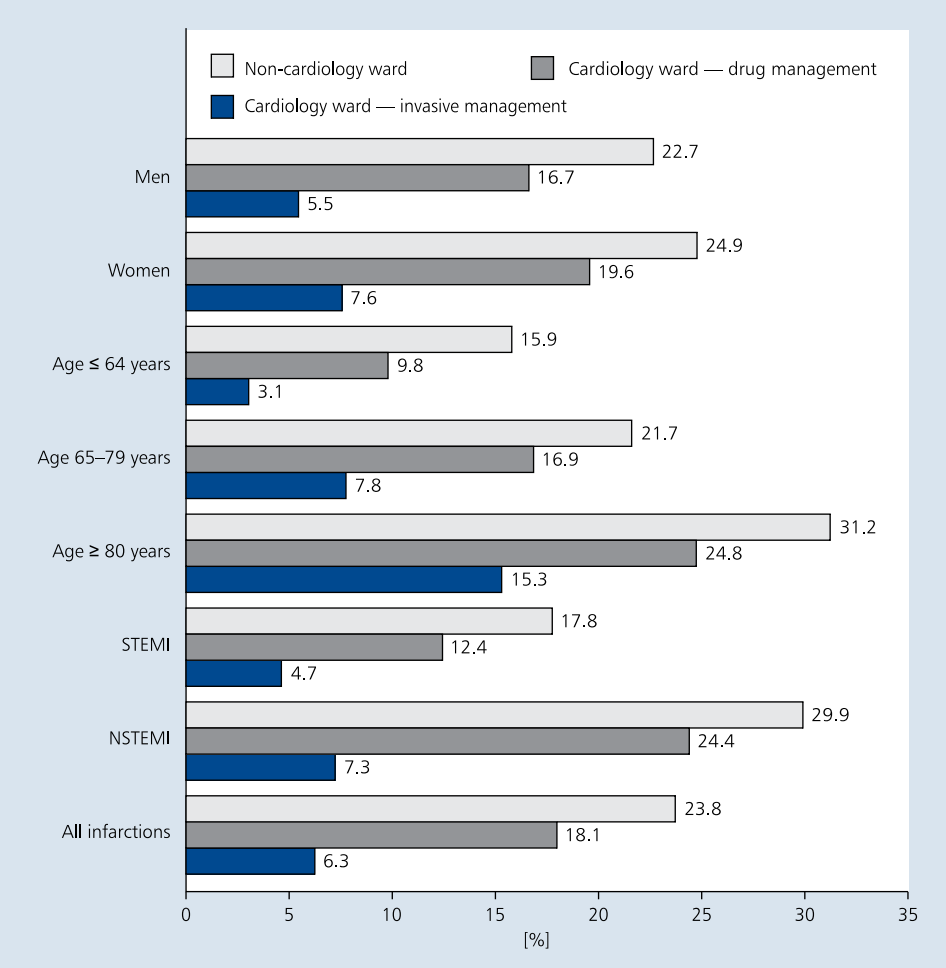

Figure 12. In-hospital mortality in myocardial infarction (including patient transfers between units regardless of the final diagnosis) in relation to gender, age, type of infarction, and place and type of treatment; NSTEMI — non-ST segment elevation myocardial infarction; STEMI — ST segment elevation myocardial infarction

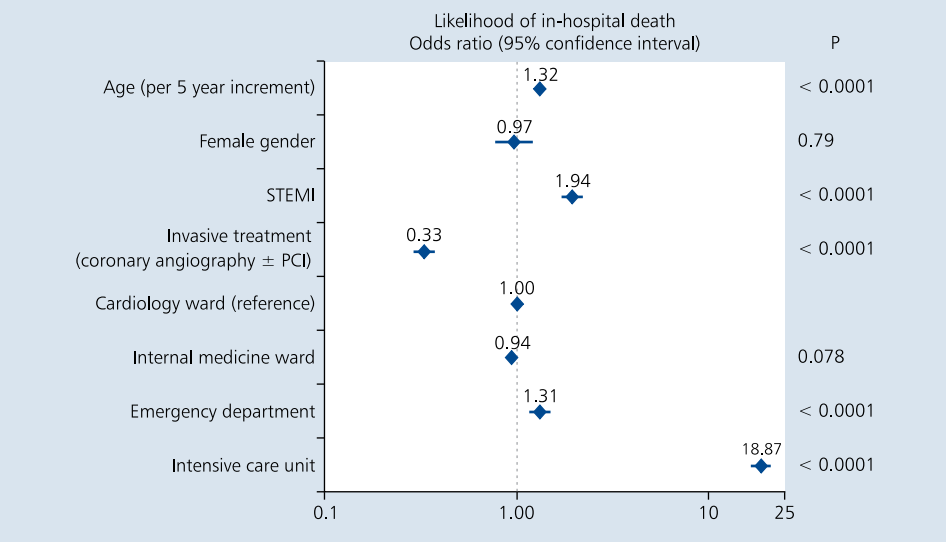

Figure 13. Likelihood of in-hospital death (multivariate analysis); PCI — percutaneous coronary intervention; STEMI — ST segment elevation myocardial infarction

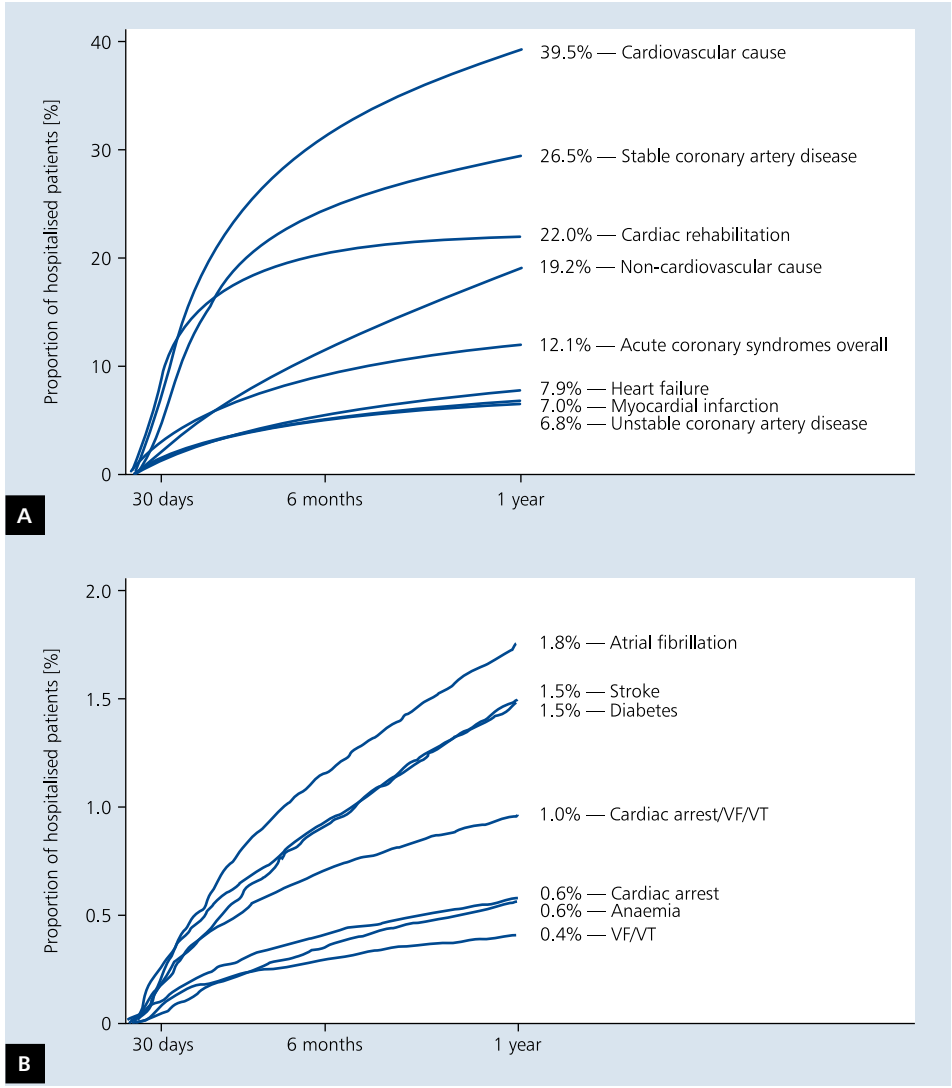

Figure 14. Hospital admissions within 1 year after myocardial infarction (including cardiac rehabilitation); VF — ventricular fibrillation; VT — ventricular tachycardia

are higher in women than in men at all evaluated time points, i.e. after 1 and 12 months but as indicated above, this was related to more advanced age among women compared to men. When adjusted for age, one year mortality was slightly but significantly higher in men (Fig. 17).

DISCUSSION

A major advantage of our database of all AMIs in Poland (AMI-PL) is the fact that it was based on a large and complete dataset of unselected records that included both hospitalised patients and those who died due to AMI but were not hospitalised. Thus, the data regarding therapy, readmissions and deaths summarise current everyday clinical practice in Poland and its outcomes. Analysis of the AMI-PL database allowed verification of previous partial data regarding AMI incidence, treatment, and outcomes.

Our analyses and comparisons between Poland and other European Community (EC) countries, e.g. England, Denmark and Germany, when adjusted for such factors as different age structures of the compared populations, showed markedly higher incidence and admission rates in our country [7–9]. Comparison of Polish and English data shows that AMI incidence (a total of all hospitalisations and deaths due to AMI without hospitalisation) in men in Poland (288 per 100,000) is about two thirds higher compared to England (174 per 100,000), and incidence in women is about 50% higher (113 per 100,000 in Poland vs. 74 per 100,000 in England).

Morbidity may be roughly estimated based on a population-wide analysis of all admissions due to AMI (excluding out-of-hospital deaths due to AMI). Such data were reported by Danish and German authors. These findings indicate that

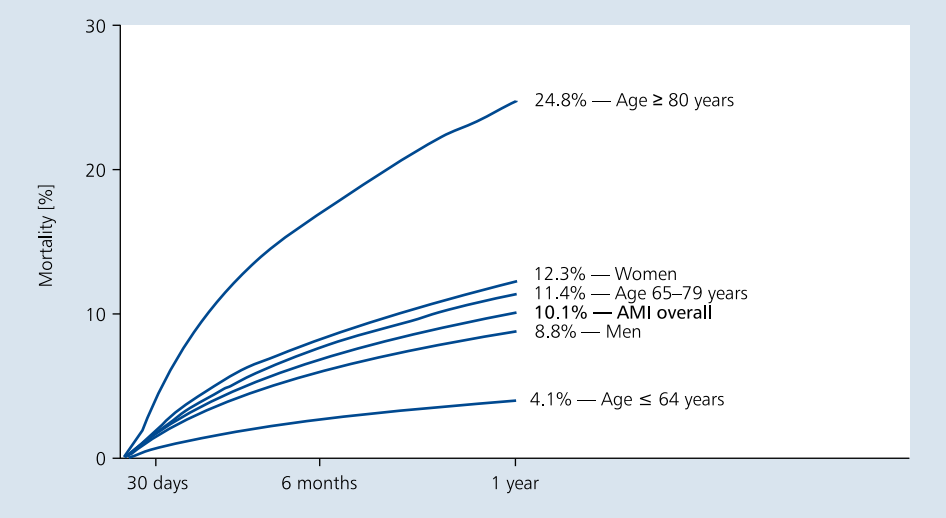

Figure 15. One-year mortality following hospital discharge in patients with myocardial infarction in Poland in 2009 in relation to gender and age; AMI — acute myocardial infarction

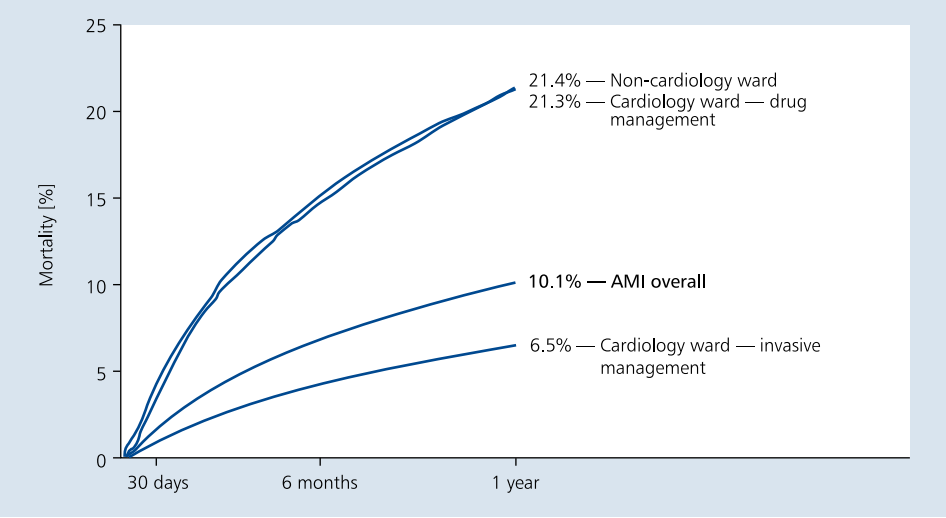

Figure 16. One-year mortality following hospital discharge in patients with myocardial infarction in Poland in 2009 in relation to the place and type of treatment; AMI — acute myocardial infarction

admission rates in Denmark are about one fourth lower compared to our country (256 per 100,000 among men in Poland in 2009 compared to 187 per 100,000 in Denmark in 2004–2008; and 152 per 100,000 compared to 116 per 100,000 among women in Poland and Denmark, respectively), and admission rates in Germany are about 10% lower. Certainly, it would be of benefit to initiate close scientific collaboration between countries that undertook such detailed analyses regarding clinical epidemiology of AMI. Such collaboration should include standardised creation of comparable databases followed by their joint analysis which would allow precise international comparisons and evaluation of factors determining AMI incidence and mortality.

Based on epidemiological indices, Poland is considered a high CV risk country by the European Society of Cardiology [18]. As indicated by representative nationwide NATPOL 2002 and WOBASZ studies performed in the previous decade, and the 2011 NATPOL study [19, 20], the prevalence of CV risk factors in Poland continues to be high, and their control is suboptimal. The most recent studies under the EC-funded EuroHeart 2 project [21] indicate that the potential for modern primary prevention in such countries as Poland is the most important factor for the reduction of morbidity and costs of cardiac care. With current trends regarding morbidity and aging in the population, resulting in expected doubling of healthcare costs within 20 years, lack of active and effective

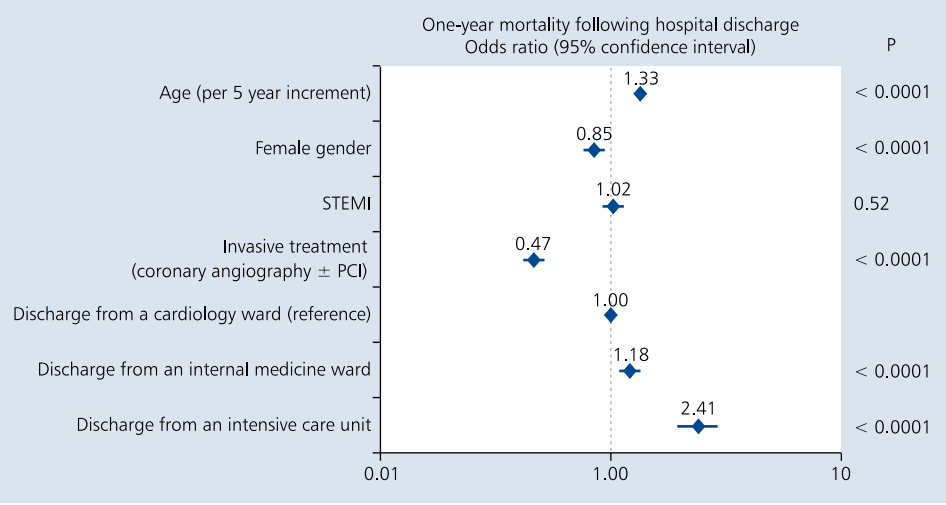

Figure 17. Relative risk of dying within 1 year following hospital discharge (multivariate analysis); PCI — percutaneous coronary intervention; STEMI — ST segment elevation myocardial infarction

healthcare policy in this area may render impossible to sustain the current level of healthcare system in Poland.

Until now, no nationwide analyses were performed in Poland to evaluate in-hospital mortality, or the number of deaths among all patients hospitalised due to AMI. The reported rates (3% to 6%), similarly to most other European registries, were obtained in patient groups or centres that were not representative for the whole population [4, 5, 6, 22, 23]. Comprehensive evaluation of AMI therapy at the national level requires precise determination of the number of patients treated invasively and those treated without an access to invasive therapy, and the number of in-hospital deaths in both these groups. A difficulty in such analyses is the fact that patients are often transferred to other units or hospitals to continue therapy or to treat other complications and concomitant conditions. Thus, to evaluate the actual quality of care based on mortality indices, deaths should be counted not only in those units where the patient was admitted initially, but also considering the whole treatment process in subsequent hospital units when continued after the initial admission due to AMI, regardless of the later diagnoses. This problem affects about 10% of patients. Of note, in-hospital mortality in AMI in Germany in 2009, when evaluated using a similar approach, was comparable to that in Poland (10.8%) [7], while 30-day mortality after hospital admission in Poland was similar to that in England and slightly lower compared to Denmark [8, 9]. One-year likelihood of dying after hospital discharge in Poland is about 10%, slightly higher than in England and similar to Denmark. Considering findings discussed above, it may be concluded that a higher mortality due to AMI in Poland compared to England and Denmark results from differences in AMI incidence which is much higher in our country, with similar quality of AMI treatment.

The unadjusted risk of early and late mortality among AMI patients receiving invasive therapy is much lower compared to patients who receive medical treatment only. It would be worth to extend these analyses with the assessment of possible differences of demographic and clinical characteristics between these patient groups.

Current healthcare policy trends in our country, resulting in a wider implementation of invasive procedures, are consistent with AMI treatment guidelines [24, 25]. Both in-hospital mortality in cardiology units of 6% and the proportion of patients receiving invasive therapy (72% in 2009 and as much as 81% in 2012) may be considered major successes of Polish cardiology in Europe. For comparison, a lower proportion of patients received invasive therapy was noted in Germany in 2009 (62%). Our findings also indicate that the development of invasive cardiology services undoubtedly contributed to a reduction of indirect costs. This issue has been discussed in the "Report on AMI in Poland" and will be reported in detail in a separate publication. Due to a low actual retirement age in Poland (56 years among women and 61 years among men), the Ministry of Health, the Ministry of Work and Social Policy, and ZUS have a large potential for further reduction of indirect costs and increased proportion of patients returning to work when considering primary and secondary prevention in the working age population.

Significant improvements and savings regarding the excessive number of readmissions, particularly during the first 6–12 months following AMI, may be afforded by an improved access to specialist outpatient cardiac care and rehabilitation, along with its better integration with primary care [26]. Comprehensive cardiac rehabilitation is undertaken following AMI in only 22% of patients in Poland. This proportion is highly unsatisfactory, as cardiac rehabilitation should be provided to a large majority of patients. Considering the fact that the duration of hospital stay is only several days, comprehensive psychological intervention is not possible during this short

period of time but this opportunity should be nevertheless well used for reduction of anxiety, better patient understanding of self-management, and motivating the patient to introduce healthy lifestyle changes. The rehabilitation period should be devoted not only to physical training but most importantly, to increasing patient awareness of the need for lifestyle changes. Thus, effective rehabilitation should comprise input from cardiologists, dieticians, physical therapists, and psychologists.

In summary, optimal healthcare policy requires systematic monitoring of the clinical epidemiology and treatment of AMI at least at the level that provides information that is similarly detailed to that reported in the present paper, and the "Report on AMI in Poland", prepared for healthcare policy makers based on the AMI-PL database and available at the National Institute of Public Health — National Institute of Hygiene website (http://www.pzh.gov.pl). The authors of the present paper and the above mentioned report believe that such actions will allow reduction of some healthcare costs and directing these savings to further development and innovations in the area of cardiac care.

Limitations of the study

Analyses based on the NFZ reporting system use data primarily intended for reimbursing medical procedures. It seems that in case of some diseases, this information may be prone to errors regarding diagnoses and procedures. We believe, however, that reporting such a precisely defined diagnosis as AMI is relatively "resistant" to the effect of non-medical factors, e.g. changes in reimbursement. Causes of out-of-hospital deaths reported in death certificates may also be subject to errors. They have been discussed in detail in the above mentioned "Report on AMI in Poland" available at the National Institute of Public Health — National Institute of Hygiene website. In addition, distinguishing between first and subsequent AMIs was not possible in the AMI-PL database, as we had no access to information from before 2009. Categorisation of AMIs into STEMI and NSTEMI was based on ICD-10 codes and was not verified in any other way.

CONCLUSIONS

Higher mortality due to AMI in Poland compared to other European countries results mostly from higher AMI incidence, as with advances in cardiac care that occurred in the recent years, AMI treatment and its outcomes have become similar to those in more affluent Western European countries. This indicates a need to intensify primary prevention efforts. The potential of improvement related to secondary prevention, particularly in the area of cardiac rehabilitation, has also been underused.

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References

1. Nichols M, Townsend N, Luengo-Fernandez R et al. European Cardiovascular Disease Statistics 2012. European Heart Network, Brussels, European Society of Cardiology, Antipolis, Sophia 2012.
2. Wojtyniak B, Goryński P, Moskalewicz B. Sytuacja zdrowotna ludności Polski i jej uwarunkowania. Narodowy Instytut Zdrowia Publicznego — Państwowy Zakład Higieny, Warszawa 2012.
3. Narodowy Program Profilaktyki i Leczenia Chorób Układu Sercowo-Naczyniowego POLKARD 2003–2005. Via Medica, Gdańsk 2003.
4. Poloński L, Gąsior M, Gierlotka M et al. Polish Registry of Acute Coronary Syndromes (PL-ACS). Characteristics, treatments and outcomes of patients with acute coronary syndromes in Poland. Kardiol Pol, 2007; 65: 861–872.
5. Poloński L, Gąsior M, Gierlotka M et al. What has changed in the treatment of ST-segment elevation myocardial infarction in Poland in 2003–2009? Data from the Polish Registry of Acute Coronary Syndromes (PL-ACS). Kardiol Pol, 2011; 69: 1109–1118.
6. Gierlotka M, Gąsior M, Wilczek K et al. Temporal trends in the treatment and outcomes of patients with Non-ST-Segment elevation myocardial infarction in Poland from 2004–2010 (From the PL-ACS Registry). Am J Cardiol, 2012; 109: 779–786.
7. Freisinger E, Fuerstenberg T, Malyar NM et al. German nationwide data on current trends and management of acute myocardial infarction: discrepancies between trials and real-life. Eur Heart J, 2014; 35: 979–988.

8. Schmidt M, Jacobsen JB, Lash TL et al. 25 years trends in first hospitalization for acute myocardial infarction, subsequent short and long term mortality, and the prognostic impact of sex and comorbidity: a Danish nationwide cohort study. BMJ, 2012; 344: e356.
9. Smolina K, Wright FL, Rayner M, Goldacre MJ: Incidence and 30-day case fatality for acute myocardial infarction in England in 2010: national-linked database study. Eur J Public Health, 2012; 22: 848–853.
10. Smolina K, Wright FL, Rayner M, Goldacre MJ. Long-term survival and recurrence after acute myocardial infarction in England, 2004 to 2010. Circ Cardiovasc Qual Outcomes, 2012; 5: 532–540.
11. Koopman C, Bots ML, van Oeffelen AA et al. Population trends and inequalities in incidence and short-term outcome of acute myocardial infarction between 1998 and 2007. Int J Cardiol, 2013; 168: 993–998.
12. Sulo G, Vollset SE, Nygård O et al. Trends in acute myocardial infarction event rates and risk of recurrences after an incident event in Norway 1994 to 2009 (from a Cardiovascular Disease in Norway Project). Am J Cardiol, 2014; 113: 1777–1781.
13. Herrett E, Smeeth L, Walker L, Weston C; MINAP Academic Group. The Myocardial Ischaemia National Audit Project (MINAP). Heart, 2010; 96: 1264–1267.
14. Jernberg T, Johanson P, Held C et al. SWEDEHEART/RIKS-HIA. Association between adoption of evidence-based treatment and survival for patients with ST-elevation myocardial infarction. JAMA, 2011; 305: 1677–1684.
15. Chung SC, Gedeborg R, Nicholas O et al. Acute myocardial infarction: a comparison of short-term survival in national outcome registries in Sweden and the UK. Lancet, 2014; 383: 1305–1312.
16. McNamaraemail RL, Chung SC, Jernberg T et al. International comparisons of the management of patients with non-ST segment elevation acute myocardial infarction in the United Kingdom, Sweden, and the United States: The MINAP/NICOR, SWEDEHEART/RIKS-HIA, and ACTION Registry-GWTG/NCDR registries. Int J Cardiol, 2014; 175: 240–247.
17. Thygesen K, Alpert JS, Jaffe AS et al. Third universal definition of myocardial infarction. Eur Heart J, 2012; 33: 2551–2567.
18. Perk J, De Backer G, Gohlke H et al. European Guidelines on cardiovascular disease prevention in clinical practice (version 2012). The Fifth Joint Task Force of the European Society of Cardiology and Other Societies on Cardiovascular Disease Prevention in Clinical Practice. Eur Heart J, 2012; 33: 1635–1701.
19. Zdrojewski T, Rutkowski M, Bandosz P et al. Prevalence and control of cardiovascular risk factors in Poland. Assumptions and objectives of the NATPOL 2011 Survey. Kardiol Pol, 2013; 71: 381–392.
20. Bandosz P. Zmiany rozpowszechnienia klasycznych czynników ryzyka chorób układu krążenia w Polsce w latach 2002–2011. Rozprawa na stopień doktora nauk medycznych. Gdański Uniwersytet Medyczny, Gdańsk 2013.
21. Andersen K, Aspelund T, Bandosz P et al. CHD mortality projections to 2020, comparing different policy scenarios. EuroHeart II Work Package 6. London 2014. http://www.ehnheart.org/euroheart-ii/euroheart-ii-publications/publication/787-chd-mortality-projections-to-2020-comparing-different-policy-scenarios.html.
22. Schiele F, Hochadel M, Tubaro M et al. Reperfusion strategy in Europe: temporal trends in performance measures for reperfusion therapy in ST-elevation myocardial infarction. Eur Heart J, 2010; 31: 2614–2624.
23. Fox KA, Eagle KA, Gore JM et al.; GRACE and GRACE2 Investigators. The Global Registry of Acute Coronary Events, 1999 to 2009: GRACE. Heart, 2010; 96: 1095–1101.
24. Steg PG, James SK, Atar D et al. ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation: The Task Force on the management of ST-segment elevation acute myocardial infarction of the European Society of Cardiology (ESC). Eur Heart J, 2012; 33: 2569–2619.
25. Hamm CW, Bassand JP, Agewall S et al. ESC Committee for Practice Guidelines. ESC Guidelines for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation. Eur Heart J, 2011; 23: 2999–3054.
26. Jankowski P, Niewada M, Bochenek A et al. Optymalny model kompleksowej rehabilitacji i wtórnej prewencji. Kardiol Pol, 2013; 71: 995–1003.

Zapadalność, leczenie, śmiertelność szpitalna i rokowanie 1-roczne w zawale serca w Polsce w latach 2009–2012 — ogólnopolska baza danych AMI-PL

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Streszczenie

Wstęp: Standardy leczenia zawału serca (MI) opierają się na wynikach randomizowanych badań klinicznych i rejestrów, obejmujących wyselekcjonowane grupy chorych oraz ośrodki. Eksperci podkreślają, że dane te mogą się istotnie różnić od rzeczywistych wyników terapii MI w skali całej populacji (państwa) z powodu niedostatecznej reprezentacji niektórych istotnych podgrup chorych. Dlatego autorzy artykułu podjęli prace nad utworzeniem ogólnopolskiej bazy danych MI (AMI-PL), która po raz pierwszy w Polsce podsumowuje rzeczywisty stan epidemiologii klinicznej i leczenia MI. Takie kompletne i kompleksowe analizy wskaźników epidemiologicznych na podstawie populacji całego kraju pochodzą jak dotąd tylko z kilku państw Europy Zachodniej.

Cel: Celem projektu AMI-PL było utworzenie bazy danych obejmującej wszystkich chorych z MI w Polsce w latach 2009–2012 oraz analiza współczynników zapadalności, sposobów leczenia, rokowania wczesnego i odległego w skali całego kraju. Przedmiotem oddzielnych publikacji będą analizy na poziomie wojewódzkim oraz analizy ekonomiczne.

Metody: Bazę danych AMI-PL, obejmującą wszystkich chorych z MI w Polsce w latach 2009–2012, utworzono, łącząc dane o umieralności mieszkańców Polski Głównego Urzędu Statystycznego i dane systemu sprawozdawczości Narodowego Funduszu Zdrowia (NFZ), obejmującego wszystkie osoby hospitalizowane z powodu MI (n = 311 813). Ponadto zbiór osób hospitalizowanych z MI w 2009 r. (n = 75 054) uzupełniono o świadczenia medyczne w ciągu 1 roku po wypisie, obejmujące leczenie stacjonarne, ambulatoryjne, rehabilitację oraz leki refundowane. Jako hospitalizację z powodu MI przyjęto nieprzerwany pobyt włącznie z przekazaniami do kolejnych szpitali. Liczbę osób, które zmarły z powodu MI poza szpitalem, oszacowano na podstawie analizy kart zgonu. Standaryzację współczynników względem wieku przeprowadzono metodą bezpośrednią. Jako standardową strukturę wieku przyjęto strukturę europejską Światowej Organizacji Zdrowia. Do porównania z innymi krajami użyto *WHO Mortality Database* i standaryzacji ze względu na wiek.

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Wyniki: *Zawał serca w latach 2009–2012.* Liczba pacjentów hospitalizowanych z powodu MI i osób, które zmarły z tej przyczyny poza szpitalem bez uprzedniej hospitalizacji w danym roku, wynosiła 85–90 tys. rocznie (224 do 235 zachorowań na 100 tys. na rok). Średni wiek tych osób wyniósł 63 lata wśród mężczyzn i 74 lata wśród kobiet. Mężczyźni stanowili 62%. W 2012 r. częstość wystąpienia MI u mężczyzn wynosiła 297,7/100 tys./rok, a u kobiet 169,1/100 tys./rok. U obu płci zaobserwowano silny wzrost zachorowalności z wiekiem. Po wyeliminowaniu różnic w strukturze wieku częstość wystąpienia MI u mężczyzn była wyższa (2,5-krotnie) niż u kobiet. W 2009 r. przeważał MI z uniesieniem odcinka ST (STEMI) — 59% chorych. W kolejnych latach odsetek STEMI zmniejszał się i w 2012 r. wyniósł 48%. Podczas 324,3 tys. hospitalizacji z powodu MI w latach 2009–2012 zmarło 27,5 tys. (8,5%) osób. Śmiertelność szpitalna istotnie rosła wraz z wiekiem. Standaryzowana względem wieku śmiertelność mężczyzn i kobiet była praktycznie taka sama. Średni czas hospitalizacji osób z MI wyniósł 6 dni. Porównania między Polską a Anglią i Danią, z usunięciem wpływu różnic w strukturze wieku, wskazały na zdecydowanie wyższe wskaźniki zachorowań na 100 tys. mężczyzn (Polska 288 *vs*. Anglia 174) i kobiet (113 *vs*. 74) oraz hospitalizacji na 100 tys. mężczyzn (Polska 256 *vs*. Dania 187) i kobiet (152 *vs*. 116) w naszym kraju. W porównaniu z Niemcami nie było tak niekorzystnych różnic. *Zawał serca w 2009 r. i rokowanie po wypisie.* W 2009 r. liczba chorych hospitalizowanych z powodu MI wyniosła 75 054 (61% mężczyzn, 39% kobiet). Na oddziałach kardiologii leczono 83% pacjentów, a na OIOM — 3,4%. Strategię inwazyjną zastosowano u 77% chorych ze STEMI oraz u 66% z NSTEMI. Odsetek leczonych za pomocą angioplastyki wieńcowej (PCI) wyniósł 59%. Istotnie rzadziej terapii inwazyjnej poddawano kobiety, chorych starszych i pacjentów, którzy nie byli przyjmowani bezpośrednio na oddział kardiologii. Trombolizę zastosowano u 1% chorych, a pomostowanie aortalno-wieńcowe (CABG) wykonano u 1,9% osób. Śmiertelność szpitalna, obejmująca wszystkie szpitale, w których był leczony pacjent do momentu ostatecznego wypisu do domu lub zgonu, wyniosła 10,5%. Najniższą śmiertelność stwierdzono wśród chorych leczonych inwazyjnie — 6,3%, niezależnie od wieku, płci i typu MI. Łączna liczba rehospitalizacji w ciągu 1 roku od MI wyniosła 84 718, w tym 61,9% stanowiły hospitalizacje z przyczyn sercowo-naczyniowych. Najczęstsze przyczyny stanowiły: stabilna choroba wieńcowa (27%), niewydolność serca (7,9%), ponowny MI (7,0%) i niestabilna choroba wieńcowa (6,8%). Podczas tych hospitalizacji u 23% pacjentów wykonano koronarografię, u 17% — PCI, u 5,5% — CABG, u 0,9% wszczepiono stymulator serca, a u 1,2% implantowano kardiowerter-defibrylator. W okresie 1 roku od MI rehabilitacji poddano 22% chorych. Średnia liczba porad na rok z rozpoznaniem kardiologicznym w ramach POZ wyniosła 7,9. Łączna śmiertelność obliczona po roku od początku hospitalizacji z powodu MI wyniosła 19,4% (10,5% szpitalna i 8,9% po wypisie); u chorych, u których stosowano procedury inwazyjne — 12,3%, u pacjentów po leczeniu zachowawczym — 38,0%. Wśród osób po MI wypisanych w 2009 r. do domu w ciągu roku zmarło 10,1% (8,8% mężczyzn i 12,2% kobiet; 6,5% leczonych inwazyjnie i 21,3% leczonych tylko zachowawczo).

Wnioski: Właściwa ocena polityki zdrowotnej wymaga regularnego monitorowania epidemiologii klinicznej i terapii MI w skali całego kraju. Wyższa niż w innych krajach europejskich umieralność mieszkańców Polski z powodu MI jest spowodowana przede wszystkim większą zachorowalnością, gdyż sposób leczenia i rokowanie w MI, dzięki rozwojowi kardiologii w ostatnich latach, nie odbiegają od poziomu osiąganego przez bogatsze kraje europejskie. Wskazuje to na konieczność intensyfikacji działań w zakresie profilaktyki pierwotnej. Niewykorzystane są również możliwości poprawy stanu zdrowia wynikające z prewencji wtórnej, zwłaszcza w zakresie rehabilitacji kardiologicznej.

Słowa kluczowe: zawał serca, badanie populacyjne, epidemiologia, zachorowalność, śmiertelność, prewencja

Kardiol Pol 2015; 73, 3: 142–158