

Received: 2014.06.04
Accepted: 2015.10.20
Published: 2016.04.13

Explaining the Decrease in Deaths from Cardiovascular Disease in Poland. The Top-Down Risk Assessment Approach, from Policy to Health Impact*

Spadek umieralności z powodu chorób układu krążenia w Polsce. Analiza w oparciu o model top-down

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Summary

Objective:	The purpose of this paper was to assess the relations between policy and health outcome
Setting:	The CVD mortality rate in Poland over the past two decades has decreased by about 40%. It was the highest decrease among Central and Eastern European countries and also exceptional on a global scale.
Design:	Key determinants which can account for these phenomena include CVD-related life style factors, better environmental indicators, and better access to medical technologies and to pharmacological treatment. Health policy played a vital role.
Methods:	The study was based on an extensive literature review, documentation analysis and questionnaire survey research. The top-down risk assessment approach model was implemented, which followed the logical pathway between the policy, health determinants, risk factors and health outcome.
Results:	Several national public health programs have been implemented since the beginning of the 1990s. The National Health Fund has constantly increased the expenditures on cardiology treatment. The number of invasive cardiology units has increased, as has the number of coronarography and angioplasty procedures in the same period.
Conclusions:	The significant mortality decrease can indicate to policy makers that it is necessary to prioritize policies to manage effective, innovative medical interventions. Topdown policy risk assessment is a useful methodological tool to present the full chain of interactions.
Keywords:	Cardiovascular diseases • Health care system • Innovation • Mortality • Policy

*This work was supported by the European Commission, 2nd Community Action Plan on Public Health Program via Directorate General for Health and Consumers (DG-SANCO) and Executive Agency for Health and Consumers (EAHC), through the grant agreement No 20081105, "Risk Assessment from Policy to Impact Dimension" (RAPID), 2009-2012.

Full-text PDF:	http://www.phmd.pl/fulltxt.php?ICID=1199304
Word count:	3290
Tables:	2
Figures:	5
References:	33

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INTRODUCTION AND OBJECTIVES

In Poland, as in other Central and Eastern European countries, the mortality rate has significantly improved over the past two decades. The main reason for this phenomenon is the decrease of CVD mortality, which is responsible for about 50% of deaths (in Western European countries it is less – approx. 40%). Cardiovascular deaths in Poland increased steadily through the 1960s, 1970s, 1980s and at the beginning of the 1990s. This unfavorable trend started to change just after the beginning of the democratic transformation and subsequently took first place as the fastest CVD decline in the world [1]. Since 1992, it has been constantly decreasing, and when compared to all Central European countries, Poland has achieved the greatest success in CVD mortality reduction. Among many key determinants which can be attributed to this phenomenon are CVD-related life style factors such as tobacco and alcohol consumption, diet, physical activity and better environmental indicators in the form of health system improvements such as better access to new medical technologies (intervention cardiology and cardiosurgery) and to pharmacological treatment. The improved medical rescue and rehabilitation systems have also contributed to this success. Health policy actions, especially health promotion and prevention programs, have played a vital role. Some research provides evidence that the decrease in CVD mortality in Poland was mostly achieved due to changes in key cardiovascular risk factors [1,33], whereas other research shows that the reduction in mortality mostly reflects the dynamic development in clinical treatment in the 1990s [11,20].

Several national health educational and preventive programs have been implemented over the past two decades. The National Health Fund (NHF), the public financier of health services, constantly increased the financial resources available to cardiology treatment between 1999 and 2006. A large number of modern centers for invasive cardiology were established during that period. Physicians started applying evidence-based pharmacotherapy. The purpose of this paper is to assess the relationship between policies and health outcome – the CVD mortality fall in Poland over the past twenty years.

MATERIALS AND METHODS

A top-down risk assessment model was implemented. This study was part of the European Commission public health research project RAPID [9]. The aim of the project was to develop and provide policy makers with a methodological guide for assessment of the complex impact structure of policies in relation to the health of the population [13]. The top-down policy risk assessment model aims to describe pathways from a policy through the health determinants and risk factors to the list of health effects. The work started with the selection of a policy-making process. Thereafter, wider determinants of health influenced by the policy and risk factors linked to these determinants were identified. As the final step, health outcomes related to selected risk factors were recognized. The aim of this approach is to emphasize that results of the policy might be related to many different health outcomes at the same time, bringing up the need to adopt inter-sectoral negotiations and also putting the health topic in the agenda of non-health sectors. The top-down risk assessment approach follows the logical structure that can be readily applied in the risk appraisal phase of health impact assessments of policies. A general scheme is presented in Fig. 1.

The data collecting process started with a questionnaire survey study in which all 16 regional branches of the NHF were involved. An extensive literature review and documentation analysis was based on the widely acknowledged scientific sources: Academic Search Complete, PubMed, Embase, Cinahl, WHO Library, Information Networks for Knowledge (WHOLIS), Eurostat, international and national reports and legislative documents.

The questioning of the 16 regional branches of the NHF was undertaken in February 2012 and concerned the number of coronary angioplasty and coronary angiography procedures and financial resources allocated to these interventions in each voivodeships in the years 2007-2011.

RESULTS

Screening of the policy

The low value of health indicators was the reason for the implementation of various health promotion pro-

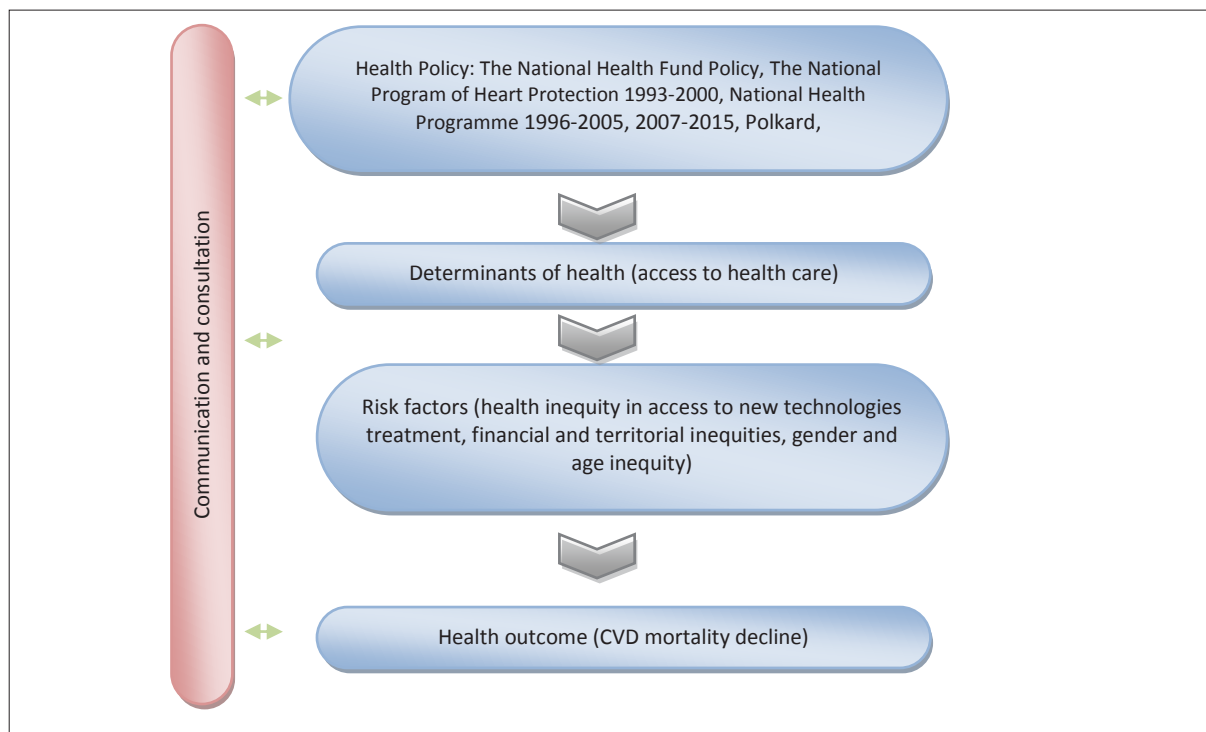


Fig. 1. Top-down health policy risk assessment model. Source: RAPID Project database

grams and a more active public health policy in CVD prevention and treatment in Poland at the beginning of the 1990s. Public health initiatives were aimed at both behavioral risk factors and the health care system. The National Program of Heart Protection 1993-2000 was the first to influence the development of interventional cardiology and contributed to the CVD mortality reduction, from 52% to 48% of all deaths in Poland [20]. The National Health Program 1996-2005, based on the WHO strategy "Health for All in 2000" also included CVD reduction targets. The expected key health effect was a 15% decrease in CVD mortality during the nine-year period. The first strategic goal of the second National Health Program 2007-2015 was to reduce CVD mortality, especially in the section of the population below the age of 65 and the stroke rate in the whole population. Early diagnoses and active care provided for the population segment with a high risk of CVD, stroke, cancer, and diabetes were the vital operational targets of this program. The National Program for Cardiovascular Diseases Treatment and Prophylaxis (POLKARD, 1st, 2nd and 3rd edition) was based on the European Union Council's recommendations. The main goal of the second edition of the POLKARD program was to maintain the positive trend in CVD mortality achieved in the period 1990-2004, and obtain a 3% decrease in CVD mortality every year in the period 2003-2012. The principal POLKARD targets for the Polish population were as follows: cholesterol level reduction below 5 mmol/l, blood tension level of population above 65 years old below 140/90 mmHg, reducing tobacco consumption by 1% per year, social access to health education and prevention activities (based on evidence-based medicine) with particular reference to

obesity, type 2 diabetes and heart inefficiency. There were also health programs implemented and financed directly by the NHF (e.g. the Program of CVD Prophylaxis 2004-2009).

HEALTH DETERMINANTS

Access to health care

People's health is influenced and determined by social, economic, cultural and environmental factors, living and working conditions, as well as community and individual lifestyle factors [7]. Lalonde described human life and health as 50% related to lifestyle, 20% to genetics, 20% to environment and 10% to health care system activity [16]. The WHO highlighted that there are a few vital reasons for differences in health status between Western and Eastern European countries: firstly, key lifestyle factors (diet, smoking and physical activity); secondly, psychosocial factors (stress); and thirdly, access to and the quality of health care, which are also thought to play a role here [30]. The health system is one of the core determinants of health, and an unequal distribution of care is defined as a key social determinant of health [19]. In Poland, a constant increase in access to cardiology treatment during the last several decades has been observed. The first balloon angioplasty was performed in Poland in 1981, and it began to be performed as a common practice 2 years later. In 1985 the first hemodynamic procedures were performed in hemodynamic units in only two Polish cities. The number of 1000 angioplasties per year was achieved in 1989, and in 1997 this number reached 5000. During the period

1996-1998, the number of angioplasties and stents doubled, from 4986 to 10 846, with a 24% increase of coronarography procedures during the same period [11]. The next vital time for invasive cardiology in Poland was 1999, after the introduction of the Common Health Insurance Act, when the cardiology procedures became better financed by a new institution, the public financier of health services, first the Regional Healthcare Funds, then the NHF.

In 1999, there were 31 invasive cardiology centers in Poland, and the total number of coronarography procedures increased, in comparison to 1998, by 31.8% (rising to 44 964 procedures), and angioplasty procedures increased by 32.8% (rising to 14 422 procedures). In 2000, there were about 43 cardio-angiographic units in Poland, and a year later this number reached 52. In 2001, approximately 60 000 coronarography procedures and 23 000 angioplasty procedures were performed. In 2006, the number of hemodynamic and invasive cardiology units reached 86, and in 2011 there were 120 [8,11]. The increase in the number of procedures is presented in Fig. 2.

During the analysis of the period 2007-2011, the NHF regional branch offices reported a more complex situation when observing the differences between voivodeships. In some of them, the number of invasive cardiology procedures (coronarography) increased and in others it decreased (Table 1, Fig. 3).

RISK FACTORS

Health inequity in access to new treatment technologies

Healthcare authorities are obliged to guarantee that the policies and programs do not increase health inequality or even decrease it through better access to healthcare. The successful implementation of current best practice interventions concerning the main risk factors reducing CVD in social groups with both low and high economic status could reduce most of the inequalities in CVD mortality [15].

Financial aspects

Economic factors significantly influence CVD mortality and the burden of cardiovascular diseases [27]. Tremendous changes in both access to health care and expenditure on modern treatment of CVD have been observed in Poland. The latest research showed a significant increase in the number of households in Poland in the period between 2000 and 2011 which used public and private medical services – public: 38.6% in 2000, compared to 49.1% in 2011, private: 86.4% in 2000, compared to 91.5% in 2011 [6]. There was also a considerable increase in cardiovascular procedure financing in Poland. For example, in 2009 approximately 1.62% of the entire NHF budget was spent on myocardial infarction treatment, and the regional increase of expenditures varied from a few per-

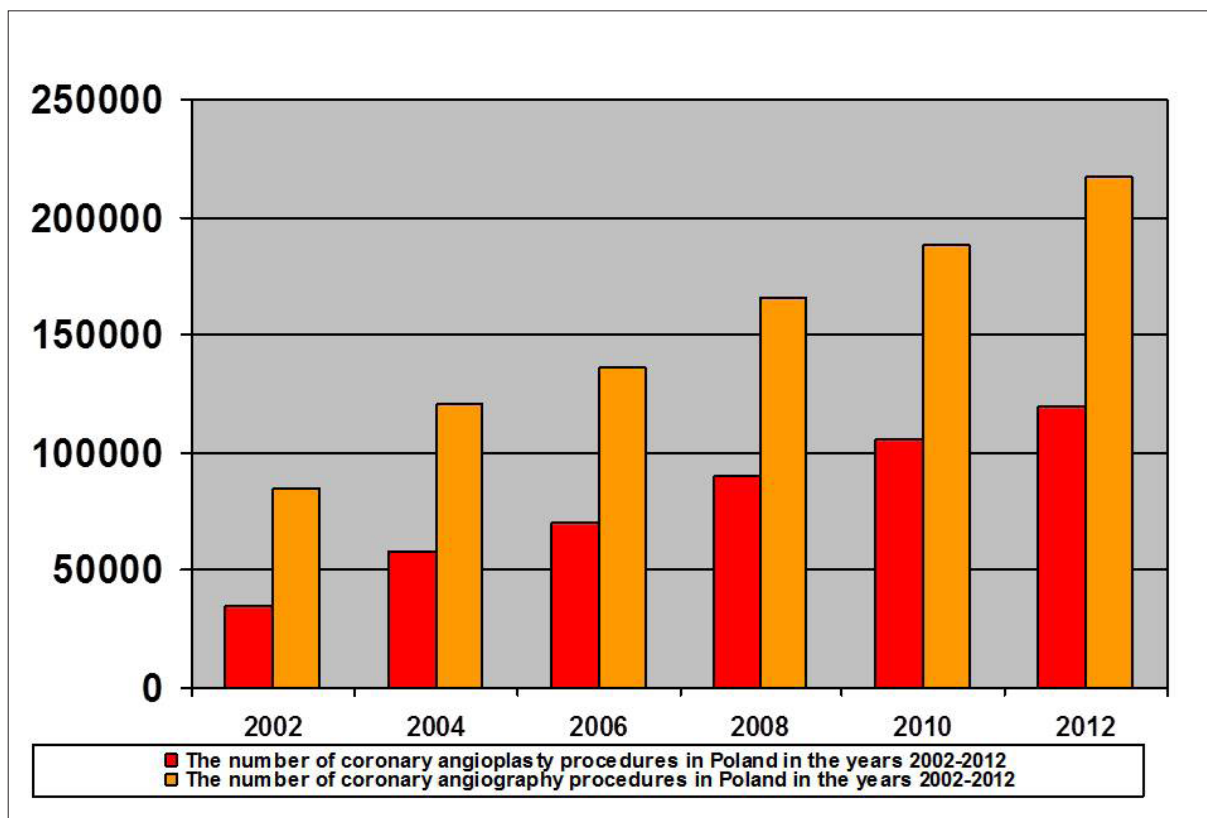


Fig. 2. The number of coronary angioplasty and coronary angiography procedures in Poland in the years 2002-2012. Source: Kardiologia Polska, 2013

Table 1. Number and cost of coronarography for selected voivodeships in Poland, (Source: RAPID project, NHF data)

National Health Fund Regional Branch Offices	Years	Number of procedures	Total expenditures (PLN)
Pomorski	2007	6654	5.482.49*
	2008	7609	6.142.52
	2009	8796	7.179.05
	2010	9156	7.308.89
	2011	12260	8.011.30
Zachodniopomorski	2007	3109	2.480.800
	2008	3042	3.659.328
	2009	2448	3.993.504
	2010	3028	4.941.696
	2011	3082	5.029.824
Warmińsko-Mazurski	2007	2762	15.771.252.80**
	2008	4275	27.042.782.12
	2009	4479	30.093.060.03
	2010	4398	30.493.039.32
	2011	4916	32.139.407.74
Lubelski	2007	4207	3.366.400
	2008	4576	5.489.648
	2009	2913	4.754.016
	2010	2634	4.298.688
	2011	3457	5.641.824
Podkarpacki	2007	5615	
	2008	6929	
	2009	7965	
	2010	8068	
	2011	8146	
Podlaski	2007-06.2008	5510	4.529.455
	07.2008-12.2011	4607	7.402.444
Dolnośląski	2007	5506	4.838.680
	2008	4592	5.344.938
	2009	2561	3.682.223
	2010	2339	3.817.248
	2011	2671	4.359.072
Łódzki	2007	3165	2.531.200
	2008	2672	3.172.065
	2009	1702	2.722.797
	2010	1943	3.163.060
	2011	1952	3.185.664
Świętokrzyski	01.2007-12.2011	27021	
Lubuski	2007-06.2008	3732	3.202.880
	07.2008-12.2008	1101	1.684.131.84
	2009	1749	1.602.950.40
	2010	1995	3.128.599.68
	2011	1773	2.828.256

*cost of coronarography

** cost of hospital treatment, including coronarography

cent to 40%, when compared to 2008 [18]. Although the access to invasive cardiology units in Poland is comparable with the EU average, some restrictions concerning financial limitations and access to diagnostic treatment units have been observed over the past few years [11].

Important information concerns the planning policy; in all regional NHF branches the number of cardiology procedures and their prices were estimated based on data about the number carried out in previous years.

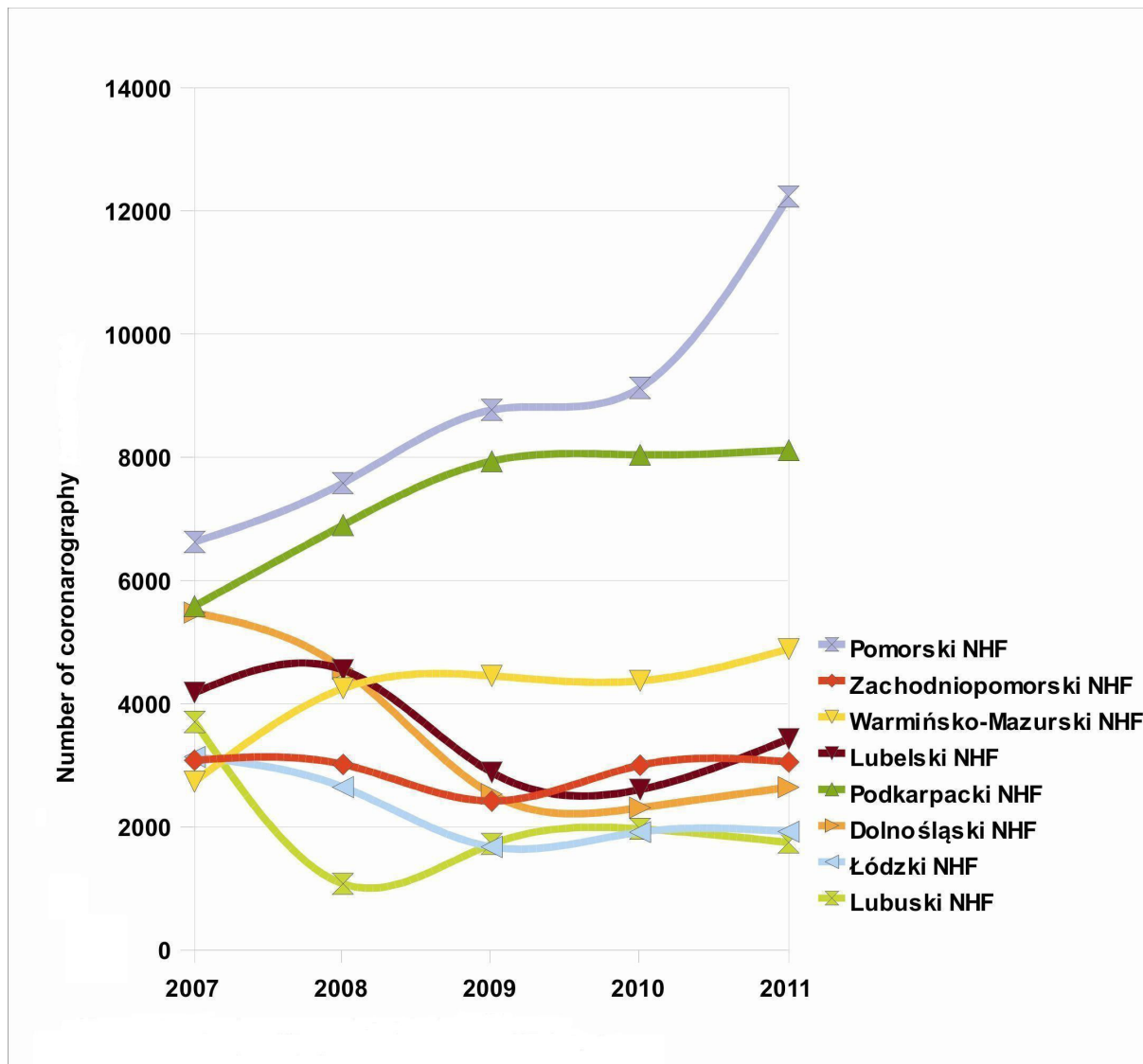


Fig.3. Numer of coronarography in selected voivodships in period 2007-2011 Source: RAPID Project database

Territorial inequity in access to new treatment technologies

Although the number of invasive cardiology units is considered to be reaching the recommended level, there are some differences concerning territorial access [21]. In 2006, the number of Polish hemodynamic and invasive cardiology units was estimated at the level of 1 unit per 447.7 thousand inhabitants, and it fulfilled the guidelines of the European Society of Cardiology, which indicated the necessity of providing access to 1 unit per 500 thousand inhabitants. The total number of 127 invasive cardiology units exceeds the level of Western countries: Luxembourg, Belgium or France. Since 2011 invasive cardiology units have been operating in all 16 voivodships. The number of Polish invasive cardiology specialists reached the level of 602 in 2007, compared to 300 in 2000 [11]. The number of operating specialists was estimated at the level of 441 in 2011, and

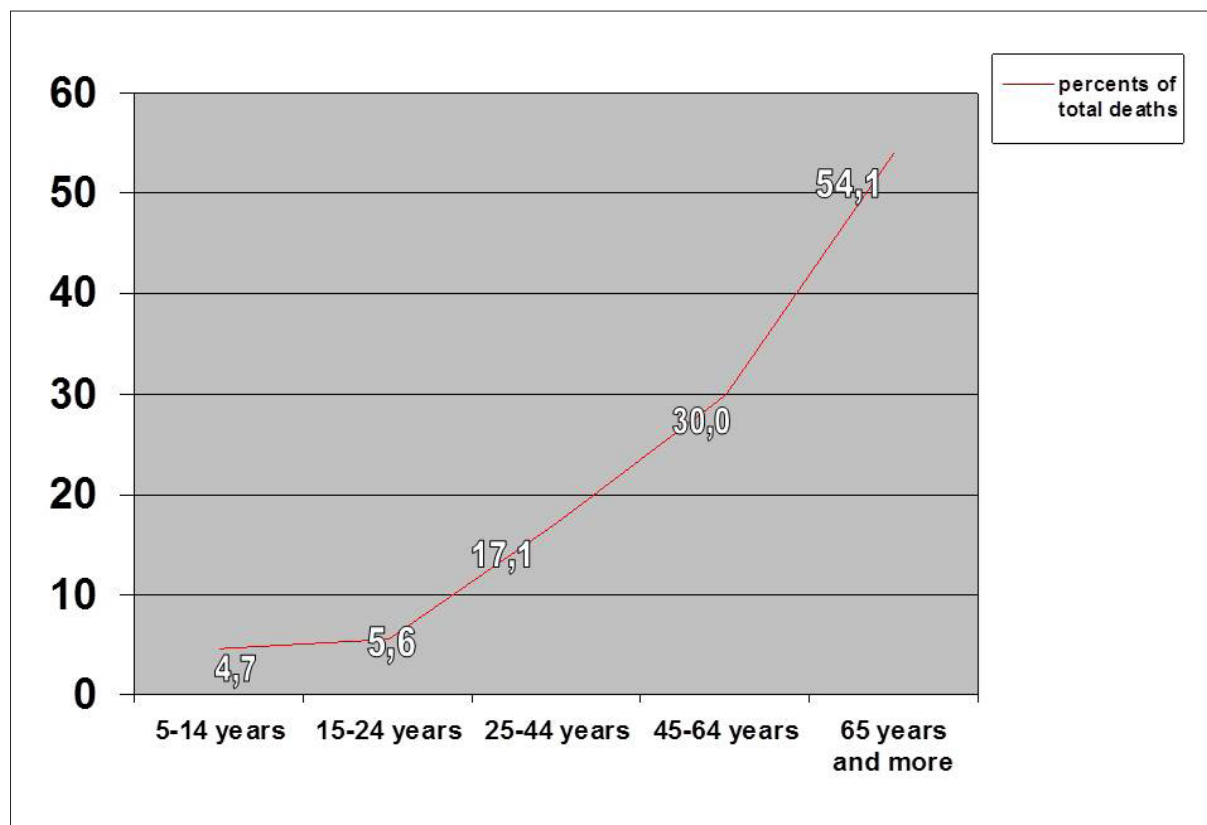
the average waiting time for coronarography and angioplasty procedures is to 2-4 weeks [21]. The great diversities in the number of invasive cardiology units (per 1 million inhabitants) between provinces are not being reduced; the most units are in Świętokrzyskie Voivodeship, the least in Zachodniopomorskie [8]. It is most important that the distance to each invasive cardiology center does not exceed 50 kilometers [22].

Gender and age inequity

Health inequality may disadvantage men and women in different ways in terms of mortality from cardiovascular diseases [31]. Although a significant reduction in hospital mortality due to myocardial infarction for both genders has been observed in the last decade, the female hospital mortality indicator has improved more significantly [23]. The distribution of CVD burden of disease

Table 2. CVD deaths for 100 000 inhabitants in Poland, males and females, in selected age groups (Source: Central Statistical Office in Poland)

Years	0-44 years		45-59 years		60 years and more	
	Men	Women	Men	Women	Men	Women
1990	44.0	14.3	537.3	167.6	3555.1	2863.9
2000	24.6	7.8	376.2	112.3	2665.4	2249.5
2005	20.4	6.3	321.5	90.8	2252.5	1946.6
2009	20.5	5.9	305.3	83.9	2110.5	1762.7

**Fig. 4.** Percentage of total cardiovascular deaths by age in Poland, 2010. Source: Wojtyniak et al., 2012

varies greatly due to age and gender [24]. The risk of dying from ischemic diseases increases with age, and it is almost 25 times higher among people aged 65 years or more than those considered as young; furthermore, this risk is 90% higher among males than females [29]. There are some territorial and gender differences concerning cardiovascular morbidity and mortality indicators in reference to the Polish population.

The gender-specific mortality rate, i.e. ICD-10 classification of cases of acute coronary syndromes I21-I22, was: 80.3 deaths per 100 000 men in 2005 and 78.0 deaths per 100 000 men in 2006, compared to 45.6 deaths per 100 000 women in 2005 and 44.2 deaths per 100 000 of women in 2006.

Territorial differences were also observed: 61.2 deaths (per 100 000 inhabitants) in towns and cities compared

to 59.5 deaths (per 100 000 inhabitants) in rural areas. The hospitalization indicator (per 100 000 inhabitants) showed that in 2006 there were 208.0 patients hospitalized due to the acute coronary syndrome (I21-I22) (269.1 men and 150.8 women), 220.8 inhabitants of towns and cities (294.1 men and 154.5 women) and 186.6 inhabitants of rural areas (230.0 men and 143.8 women).

Health outcome

Recent research has demonstrated that effective health services can significantly influence health outcomes; some of them provide evidence that improved access to effective health care, combined with other factors, reduced mortality in many European countries in the 1980s and 1990s [19]. In this study the health outcome is the CVD mortality rate.

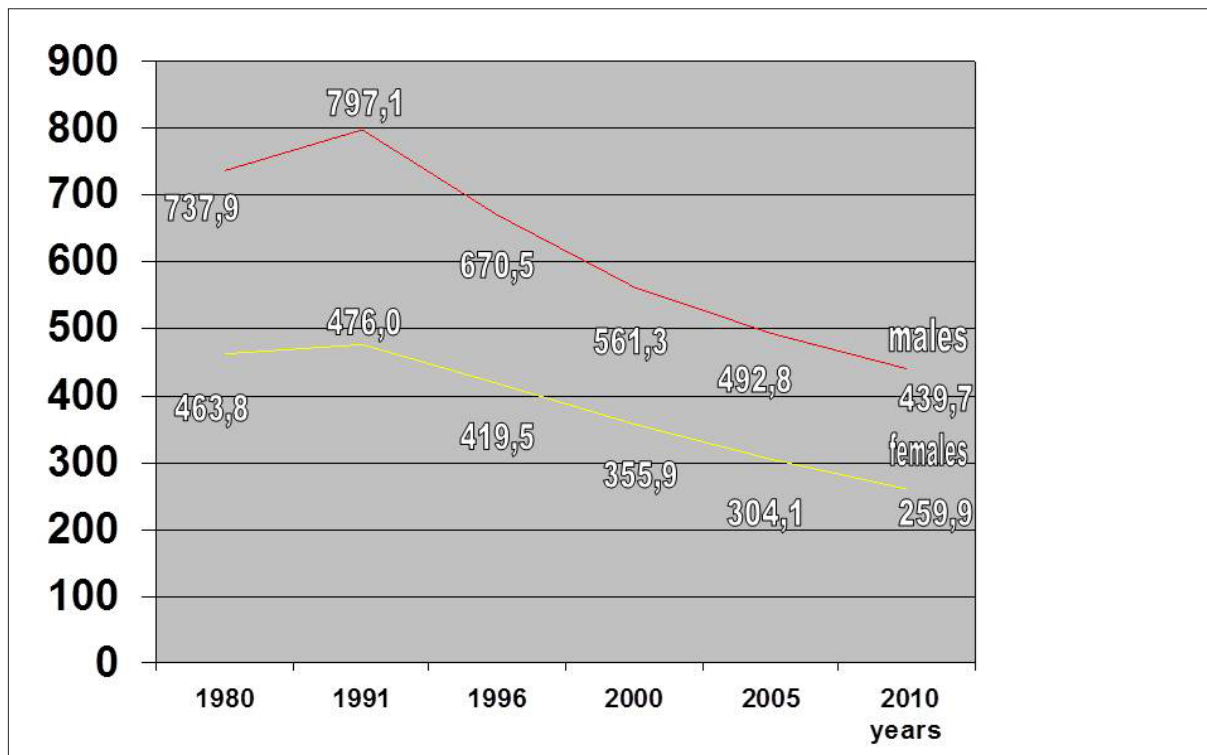


Fig. 5. Cardiovascular deaths of males and females in selected years 1980-2010 (death rates per 100 000). Source: Central Statistical Office of Poland, 2012

The CVD mortality rate in Poland over the past two decades has decreased by about 40%. It was the highest decrease among Central and Eastern European countries and also exceptional on a global scale. The improvements in life expectancy in Poland in the same period were mainly attributed to the decrease in cardiovascular mortality, more than 50% for men and more than 60% for women [26]. Since 1992, CVD mortality in Poland has been decreasing constantly, and in 1990 CVD deaths contributed to 52% of all deaths, in 2000 to 46%, and in 2010 to 44%. There were differences between men and women. During the period 1990-2010 the number of deaths decreased in men from 57% to 52% of all deaths and in women from 48% to 41% of all deaths. This phenomenon is also reflected in the CVD death rate for men and women (Fig. 5).

The decrease in CVD deaths applies to mainly the middle-age population, and at the present time CVD is the leading cause of death among people aged over 65.

Several studies confirm that the decrease in CVD mortality has been achieved due to changes in key cardiovascular risk factors and the dynamic development in the field of clinical cardiology and evidence-based medical and pharmacological treatment, but it is hard to assess the exact impact of the above-mentioned factors. Some experts estimate that 54% of the coronary mortality decline is associated with changes in risk factors and 37% is related to better medical treatment [1].

DISCUSSION

The study confirms the worldwide perception of a link between the effectiveness of health care systems and health indicators [30]. The main role of the health care system is the improvement of the health status of the population, which is confirmed by the key documents on health policies, including the European Commission Health Strategy. The efficiency of the health care system can be estimated on the basis of services it provides and the way they are financed. Although a fair distribution of finances and other resources is the main value of an efficient health care system, it is obvious that today's health systems need to evolve in order to respond to the European population's requirements and needs. The core tool is the development and implementation of new and more effective medical technologies [28].

The tremendous CVD mortality fall in Poland over the past two decades also provides proof of a strong association between innovative health care services and resulting better health. Although positive trends concerning lifestyle patterns have been observed, also the interventional cardiology units play an important role in reducing CVD mortality [32]. Since 1999, there has been a progressive increase in invasive cardiology procedures and an increase in the number of invasive cardiology units in Poland. The NHF policy has confirmed the WHO statement that providers have an important role in determining the uptake and use of health technologies [27], especially in the context that in the same period

Poland had the lowest public expenditure per capita on health among the EU countries [6].

Cardiovascular diseases are responsible for 49% of all deaths and for 30% of all premature deaths before the age of 65 in Europe, and although age-specific mortality rates have been reduced significantly during the last two decades, the prevalence of CVD is increasing due to an ageing population [17]. Some experts highlight that about two-thirds of the decline of cardiovascular diseases is associated with the reductions in vital risk factors, and one-third is related to modern medical treatment [19], while other findings confirm that improvements to treatment strategies and evidence-based pharmacological and interventional therapies played a vital role, responsible for 25% to 55% of the decreases in coronary heart disease mortality worldwide [3]. Modern hospital treatment also improves the quality of life and the health status of patients who have survived stroke or myocardial infarction [14]. The US studies concluded that about half of the reduction in coronary deaths between 1980 and 2000 could be attributable to reductions in major risk factors, and another half to improvements in the medical treatment of CVD [10]. It is also worth noting that the decrease in mortality from myocardial infarction has been achieved due to primary percutaneous coronary interventions [5]. In the Netherlands, the number of deaths from heart diseases dropped by 46% between 1978 and 1985 [2]. This progress was achieved due to effective treatment in coronary care units, post-infarction treatment and coronary bypass grafting. Canadian studies show that the decrease in coronary heart disease deaths during the last few decades was significant in the age group of 75-84 years (by 35% in the period 1994-2005). At the same time, 44% of the decline in deaths caused by heart diseases was associated with prevention campaigns: anti-tobacco policies, cholesterol level control and hypertension treatment [25].

CVD mortality has been decreasing significantly over the past four decades in most developed countries. Understanding the mechanisms responsible for the past trends in CVD mortality provides decision makers with knowledge concerning the associations between policy making and the health status of the general population and is crucial for future strategic planning and prioritization of health policies.

CONCLUSIONS

1. Top-down policy risk assessment seems to be a useful methodological tool to present the full chain of interactions between policy, health determinants, risk factors and health outcomes.
2. CVD mortality has decreased significantly in Poland over the past two decades and about 30-40% of the reduction is attributable to medical treatments using innovative technologies.
3. There are no significant financial inequalities in access to evidence-based cardiology treatment in Poland, while age and gender differences in CVD health indicators can be noted.
4. Over the past few years there have been differences between voivodeships in the frequency of coronarography and the expenditure.
5. The exceptional rate of CVD mortality decrease in Poland provides policy makers with evidence of a strong association between innovative health care services and better health outcomes, and it seems to be necessary to prioritize policies in order to manage effective, innovative medical interventions and reduce major risk factors.

Limitations of this study

The principle limitation of our study was the low response rate to the questionnaire – 62.5%. Only 10 NHF Regional Branch Offices sent detailed information, although all 16 responded. Another limitation is the fact that the collected data from the period before and after 1 July 2008 are difficult to compare. Until 30 June 2008, coronarography was a separate procedure, and since 1 July 2008, it has belonged to diagnosis-related groups (DRG), which causes difficulties in identifying the number of coronarographies, as each DRG includes several procedures. Therefore, since 1 July 2008, the data have indicated the number and cost of hospitalizations including coronarography.

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The authors have no potential conflicts of interest to declare.