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ACUTE CORONARY SYNDROME TREATMENT COST ESTIMATION IN SELECTED HEALTH CARE UNITS IN POLAND – PILOT SURVEY RESULTS

SUMMARY

Background: The circulatory system diseases are one of biggest health problems which still pose a fundamental cause of mortality in developed countries. Among those illnesses important place takes myocardial ischemia. Aim: The main purpose of this article is to evaluate hospitalization costs of a patient with acute coronary syndrome in health care units conducting diagnostic and surgery (coronarography and PTCA) as well as in health centres, where patients are treated exclusively pharmacologically. Methods: There has been prepared and used author's individual questionnaire enabling estimation of both fixed and variable treatment costs per patient. In economic analysis there have been used micro-costing principle, defining every element of used supplies and calculating unit cost. Results: The analysis has shown that fixed costs of one hospitalized patient in a clinic equipped in hemodynamics laboratory are only 33% of all costs. In hospitals which did not carry out surgeries, variable costs (e.g. medicines) were respectively lower, whereas fixed costs were up to 72% of total treatment costs. A great impact on level of costs had two risk factors: smoking tobacco and hypercholesterolemia. Conclusions: Increasing number of carried out angioplasty, raises total treatment costs of acute coronary syndrome. Over half of all hospitalization costs of one patient with myocardial ischemia in hospitals not equipped in hemodynamics laboratories determines for fixed costs.

KEYWORDS

acute coronary syndrome, coronary vessel angioplasty, treatment costs, stent

1. Introduction

The cardiovascular system disease is a serious health problem which, with regard to its dissemination and costs being in the centre of attention, has intensified medical research in developed countries.

Shortening of life span by 27% as a result of cardiovascular system diseases, where almost half of it (13%) refers to myocardial ischemia disease. The myocardial ischemia disease is the most frequent cause of hospitalization in relation to cardiovascular system diseases. Figures show that almost one million adults living in Poland are diagnosed with it. One of the most serious forms of cardiovascular system disease is myocardial infarction. Annually approximately 100 000 Polish adults are diagnosed, and almost 40% of those cases are fatal (1). Myocardial ischemia diseases also cause sudden cardiac death, often to people who had no earlier symptoms of the illness. In Poland mortality caused by cardiovascular system diseases is very high and proves to bad health state of the society. The most important causes of this situation are: lipid disorders, hypertension, obesity, high level of homocysteine as well as diabetes.

Myocardial infarction has various definitions depending on its clinical, pathomorphological and biochemical features. The death of heart muscle cells is caused by long-lasting ischaemia, whose typical signs are changes in section ST and T wave, as well as myocardial necrosis with typical changes of the shape in QRS complex. In most cases, acute coronary syndrome is caused by a decrease in coronary blood flow. In case of transmural myocardial infarction (with elevation of ST section) it most often emerges as a result of clot appearing at atheromatous lamina, which, in the past, did not cause critical narrowing of vascular lumen, ischaemia nor collateral circulation. (2) Myocardial infarction (without persisting elevation of ST section) is mainly caused by a clot that does not obliterate vascular lumen emerging on instable atheromatous lamina. In case of acute coronary syndrome, with regard to therapy and costs, its essential part is individual risk factor. The most essential are biochemical and physiological features, which can be modified, such as: hypercholesterolaemia, hypertriglyceridaemia, low level of HDL, high arterial blood pressure, obesity, diabetes, and high concentration of homocysteine as well as thrombogene factors. Moreover, arteriosclerosis favours risk factors connected to lifestyle, namely: smoking tobacco, excessive consumption of alcohol as well as low physical activity. In Europe, economic impact of cardiovascular system diseases is connected with both medical costs as well as indirect costs, mostly paid by the society.

2. Materials and methods

Research carried out at the turn of the year 2007 and 2008, during 6 months period, had prospective and multimember cost study character, to which were qualified 176 patients diagnosed with acute coronary syndrome. The choice of four units to conduct the research was made according to three hospital reference levels: clinic – highly specialized teaching hospitals - (2 units), regional (1 unit) and county (2 units). The study was carried out in two Polish regions, of Łódź and Lublin.

Among treated patients, 56 were women and 120 were men, aged 31 to 96. To calculate the costs, three identical questionnaires were created and subsequently used in all units. The questionnaires included all diagnostic, procedures as well as preparations made at every stage of hospital treatment. Two questionnaires were related to variable costs, the first one regarding health care centres that do not carry out invasive surgery, and the second for hospitals conducting coronarography and primary coronary angioplasty with implant of stent and balloon. The third questionnaire on fixed costs, identical for all units, contained information related to costs of workers' salaries (including Workers Fund fee, National Insurance and pension contributions, accident insurance) as well as other remaining fixed costs (e.g. water and sewage, energy, fuel, maintenance, taxes, payments, insurance, kitchen, laundry, transportation also within the department, sterilization, administration, depreciation, dissecting-room, extra services and other[1])

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1 In category „Other" were included costs of service, cleaning detergents, underwear/clothes, maintaining materials and office supplies.

per one patient, including average time needed to complete the therapy, which was 7.02 days (as for hospitals without hemodynamics laboratory it was 7.7 days, whereas for cardiac wards of clinical hospital, the average was 6.35 days). The total cost of workers' salary was calculated according to annual department's payments, number of medical staff, number of patients treated on each ward during one year and number of days spent in hospital by one patient, required to complete the therapy. To calculate the remaining fixed costs, we included the total cost of each ward, the number of patients on hospital wards treated while studies were carried out and the time needed to finish the hospitalisation, related to medical procedure.

Variable costs of hospitalization questionnaire consisted of several parts:

» *proceeding at casualty (concerning diagnostic and treatment),*

» *proceeding on hospital ward (concerning diagnostic and treatment as well as time after classifying for fibrinolystic/thrombolistic treatment and after stating hyperglycemia,*

» *proceeding on hospital ward (surgical treatment).*

On the first page of each questionnaire there was an ID-tag and name of the hospital, patient's PESEL number (personal electronic number for identification of Polish citizens), the name of the hospital ward where the patient was treated, date of birth, gender, as well as information about the place from where the patient has been taken to hospital. The questionnaire included individual risk factors connected to cardiovascular system diseases, such as: smoking tobacco, diabetes type 1 and 2, hypercholesterolaemia, obesity, metabolic syndrome, hypertension. The part regarding pharmacological treatment included information about applied medicines, total dose, method and period of time when the medicine was taken, total cost of used amount of medicine as well as the number of medical consultations. For economic analysis the micro-costing principle was applied, where every individual element of used supplies was defined and then unit cost was calculated. In the part related to surgical treatment the calculations were done in a similar

way: variable costs included costs of coronarography (therein: materials consumption, type of used materials, company which produced them, unit and total cost of used materials) and coronal angioplasty with implant of stent and balloon (therein: the pharmacotherapy before and after the surgery, material consumption).

3. Results

After analysing the materials collected during the research, the results show that average treatment cost for one patient with acute coronary syndrome in a hospital equipped with hemodynamics laboratory amounts to 1 868 €, where 66% (1 239 €) are variable costs and 33% (636€) are fixed costs. In hospitals which did not carry out transcutaneous invasive surgery the costs were respectively lower, i.e. on average 385€ per patient, where 26% (103€) were variable costs and the remaining 72% (282€) were fixed costs. Among fixed costs, the largest expenses of each health care unit were costs categorized as other (27% of all fixed costs) which were: municipal services, purchase of medical equipment and materials for diagnostic, clothes/underwear, cleaning detergents, "Health and Safety at Work" as well as costs of the workers' salaries with taxes and other fees, which amounted to 25% of all fixed costs (Chart 2).

In hospitals equipped with hemodynamics laboratory, carrying out transcutaneous invasive surgery, the highest costs were connected with necessity for implant of stent surgery (535€) as well as the pharmacotherapy before and after the surgery (248€).

Analysing the influence of individual risk factors on treatment costs, in case of acute coronary syndrome it has been noticed that women patients being smokers made no considerable difference in expenses of hospitalization. On the other hand, when male patients were smokers, this had a significant influence on treatment costs. Respectively these costs were: 610€ per one smoking male patient and 465 € per one non-smoking. In case of hypercholesterolaemia, the costs of treatment in the group with high risk factor as well as without were

approximately the same.

The largest economic difference was among hospitalized women with diabetes type 2. Treatment costs for women with diabetes type 2 were considerably higher (874€) than the treatment of acute coronary syndrome in the group of women without that risk factor.

The highest costs of basic treatment per one hospitalized patient refer to pharmacotherapy on hospital ward and diagnostic. The only risk factor which increases treatment costs for a patient with acute coronary syndrome in hospitals that are not equipped with hemodynamics laboratory is diabetes type 2 (chart 7).

Conclusions:

› *1.Annual increase in the number of invasive surgery, including coronarography and primary coronary vessel angioplasty (chart 3) systematically elevates treatment costs of patients with acute coronary syndrome in Poland*

› *2.The most essential are high fixed costs in hospitals that do not carry out transcutaneous*

surgery, because their costs account for 72% of total treatment costs

› *3.Detailed economic analysis provides the possibility to monitor and compare costs in different references' units and to use those data in pharmaco-economical analyses.*

References:

(1)Bednarkiewicz Z. (2004-05), Epidemiology of coronary syndrome, Polish Cardio logical Society, http://www.ptkardio.pl

(2)Crawford M.H (1997), Cardiology, Medical Publishing House, PZWL, Warsaw

Conflict of interest:
Non declared

Acknowledgements:

› *1) Warsaw University of Life Sciences, Department of Organization and Consumption Economics, Nowoursynowska 159 street, 02-776 Warsaw, Poland*

Chart 1. Acute Coronary Syndrome treatment costs' structure in individual hospital units in Poland per one hospitalised patient (in Euro)
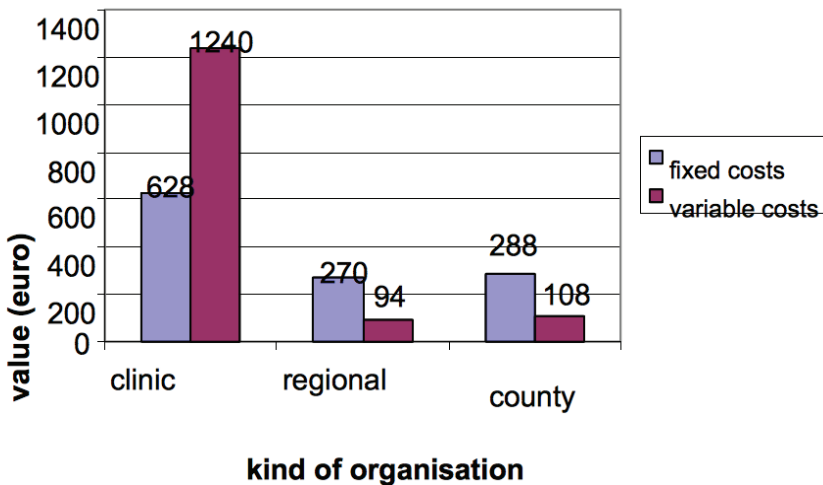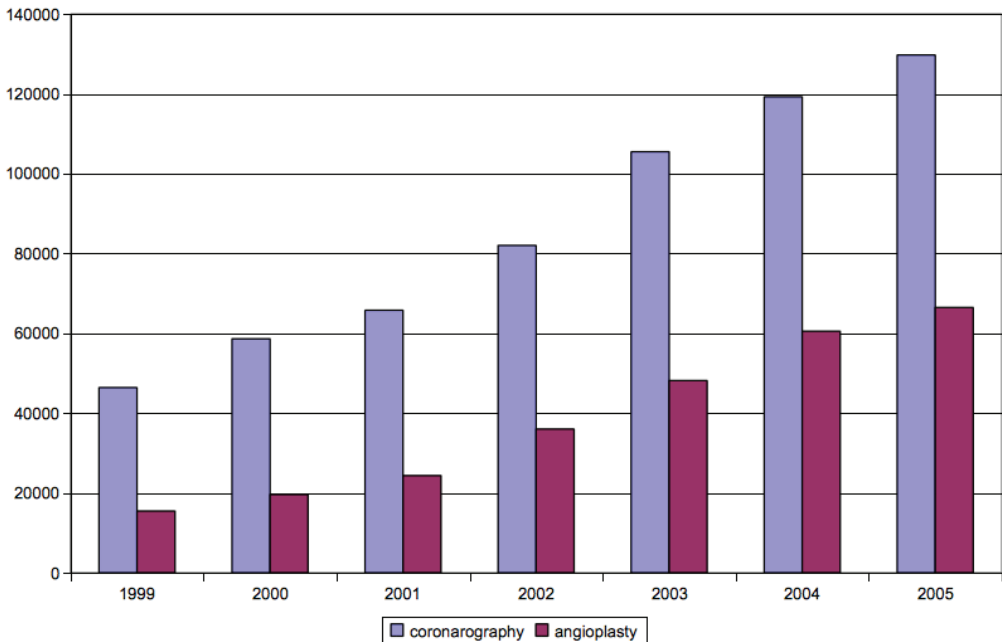

Source: Author's analysis.

Chart 2. Fixed treatment costs structure in individual hospital units in Poland per one hospitalised patient (in Euro)
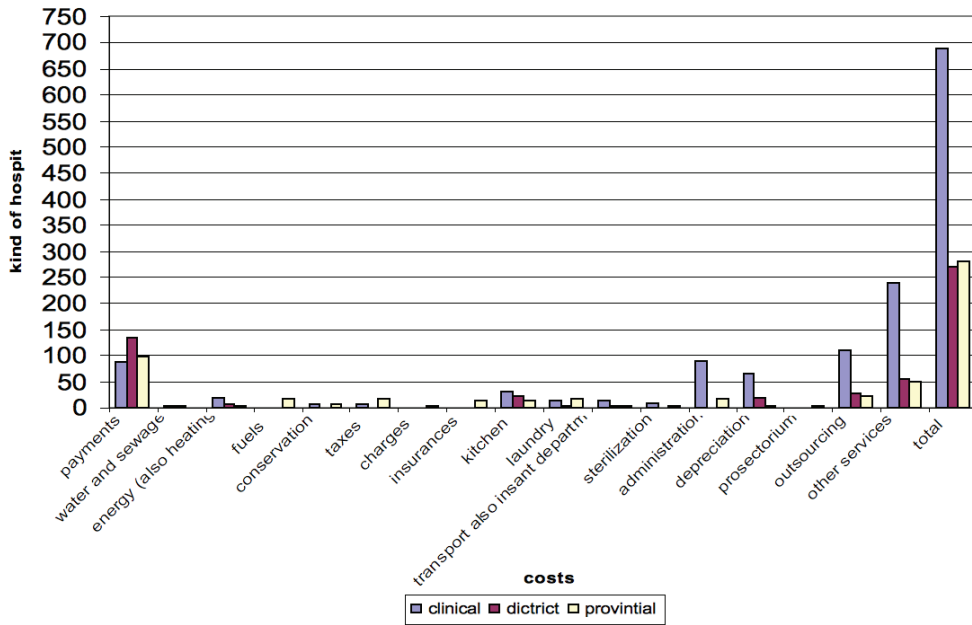
Source: Author's analysis.

Chart 3. Number of carried out coronarography and angioplasty in Poland in period of 1999-2005.
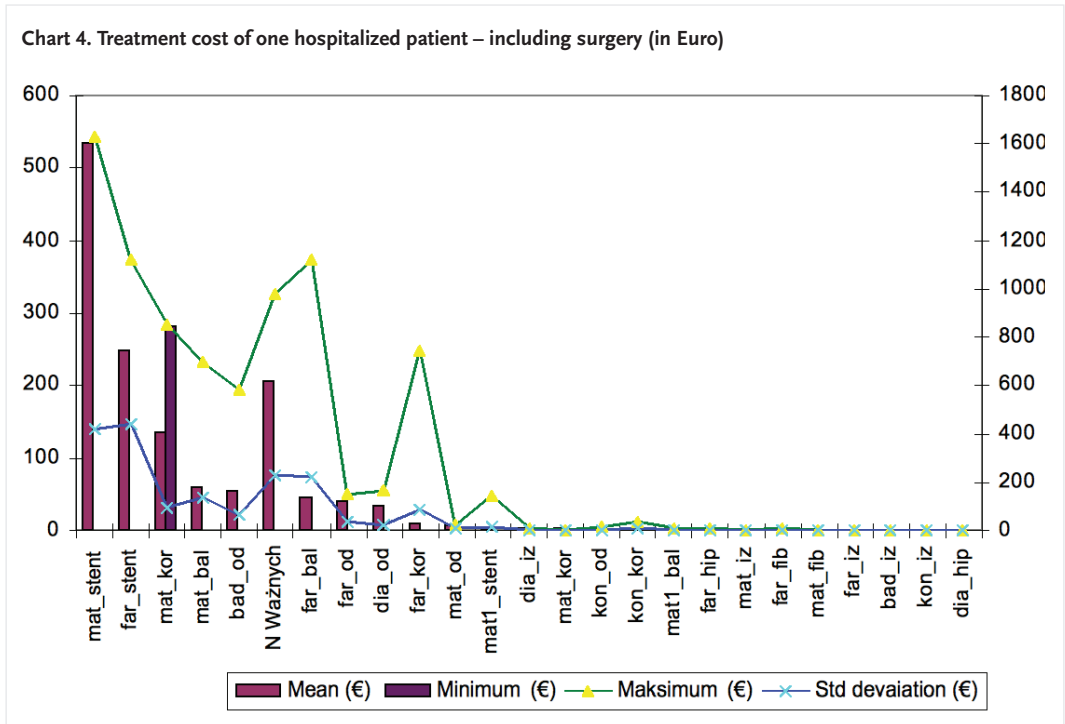

Source: Author's analysis.

Table 1. Cost of surgical treatment including all components per one hospitalised patient (in Euro)
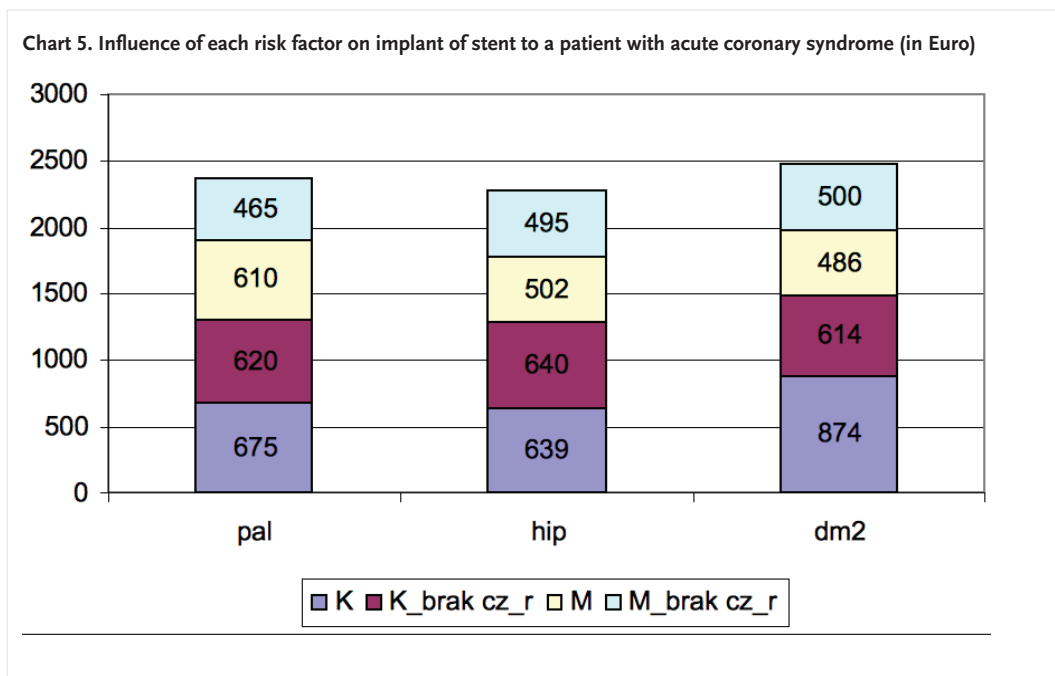
Figures

	Mean (€)	N	Minimum (€)	Maximum (€)	Std deviation (€)
mat_stent	535	75	0	1628	421
far_stent	248	75	0	1122	436
mat_kor	135	75	280,5	850	94
mat_bal	58	75	0	696	134
bad_od	54	75	0	583	65
N Ważnych (observation only)	206	75		976	230
far_bal	45	75	0	1121	221
far_od	41	75	0	149	32
dia_od	33	75	0	162	22
far_kor	10	75	0	747	86,00
mat_od	7	75	0	23,5	5
mat1_stent	3	75	0	145	17
dia_iz	2	75	0	4	2
mat_kor	1,5	75	0	2,7	1,5
kon_od	0,6	75	0	13	3
kon_kor	0,4	75	0	33	4
mat1_bal	0,2	75	0	6	0,7
far_hip	0,16	75	0	6	1
mat_iz	0,06	75	0	0,2	0,05
far_fib	0,05	75	0	4	0,5
mat_fib	0,03	75	0	2,6	0,3
far_iz	0	75	0	0	0
bad_iz	0	75	0	0	0
kon_iz	0	75	0	0	0
dia_hip	0	75	0	0	0

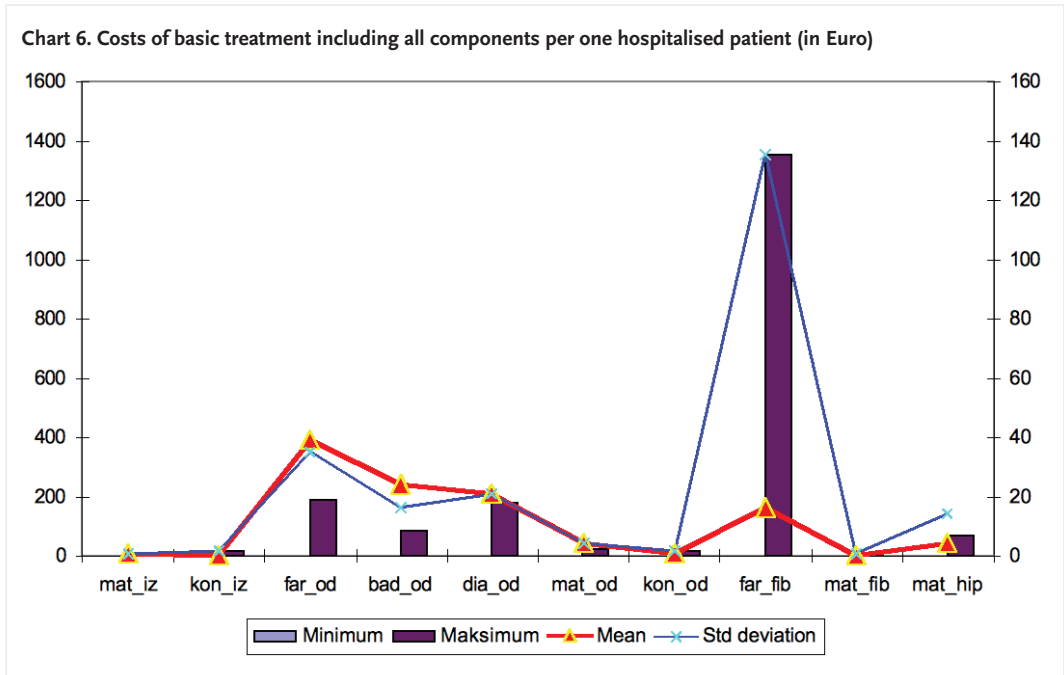**Chart 4. Treatment cost of one hospitalized patient – including surgery (in Euro)**

GLOSS:

mat_stent: materials used during angioplasty with implant of stent, **far_stent**: pharmacotherapy before and after the surgery (the implant of stent), **mat_kor**: materials used during coronarography, **mat_bal**: materials used during coronary vessel angioplasty with the implant of balloon, **bad_od**: laboratory analysis in hospital, **far_bal**: pharmacotherapy before and after the surgery (implent of stent), **far_od**: pharmacotherapy on hospital ward, **dia_od**: diagnostics on hospital ward, **far_kor**: pharmacotherapy used over coronarography, **mat_od**: materials used on hospital ward, **mat1_stent**: materials used during angioplasty with the implant of stent, **dia_iz**: diagnostic at casualty, **mat_kor**: materials used during coronarography examination, **kon_od**: medical consultations carried on hospital ward, **kon_kor**: medical consultations during coronarography, **mat1_bal**: materials used during balloon's angioplasty, **far_hip**: pharmacotherapy used in case of hyperglycemia, **mat_iz**: materials used at casualty, **far_fib**: pharmacotherapy used during fibrinolysis, **mat_fib**: materials used during fibrinolysis, **far_iz**: pharmacotherapy at casualty, **bad_iz**: laboratory analysis at casualty, **kon_iz**: specialistic medical consultations at casualty, **dia_hip**: diagnostics made in case of hyperglycemia.

Chart 5. Influence of each risk factor on implant of stent to a patient with acute coronary syndrome (in Euro)

GLOSS:

K: average treatment costs of a woman with specific risk factor, **K_brak cz_r**: average treatment costs of a woman without specific risk factor, **M**: average treatment costs of a man with specific risk factor, **M_brak cz_r**: average treatment costs of a man without specific risk factor, **pal**: smoking tobacco, **hip**: hypercholesterolaemia,
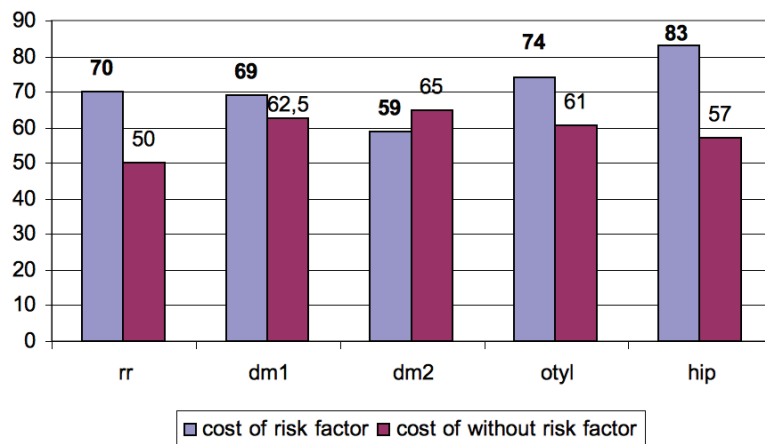
Chart 6. Costs of basic treatment including all components per one hospitalised patient (in Euro)

GLOSS:

mat_iz: materials used at casualty, **kon_iz**: medical consultations at casualty, **far_od**: pharmacological treatment on hospital ward, **bad_od**: laboratory analysis on hospital ward, **dia_od**: diagnostic made on hospital ward, **mat_od**: materials used on hospital ward, **kon_od**: medical consultations on hospital ward, **far_fib**: pharmacotherapy used during fibrinolysis, **mat_fib**: materials used during fibrinolysis, **mat_hip**: materials used in case of hyperglycemia.
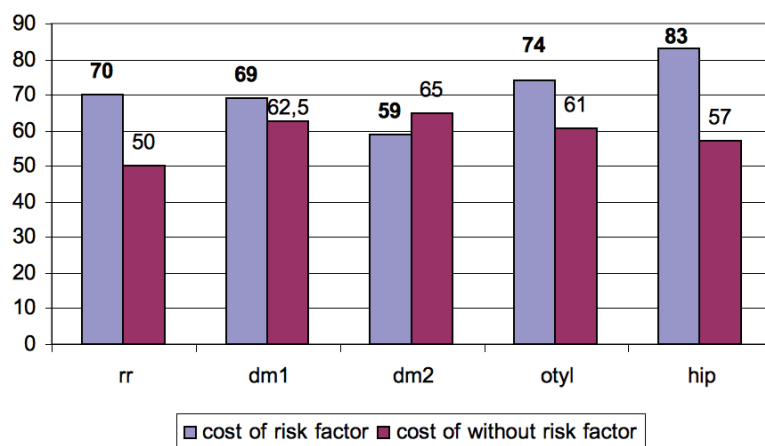
Chart 7. Influence of each risk factor on patients' treatment costs on hospital ward in hospitals that do not carry out surgery (in Euro)
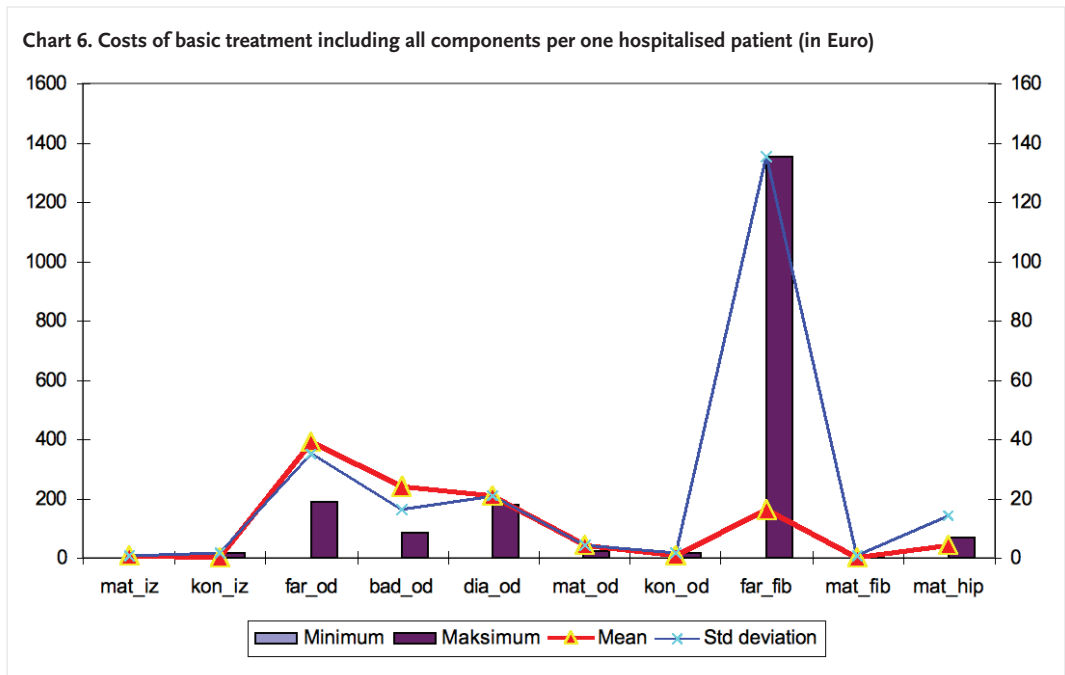

GLOSS:

To valuate the costs, into account were taken costs of pharmacological treatment, diagnostic and materials used on the hospital ward. **rr**: arterial hypertension, **dm1**: diabetes type 1, **dm2**: diabetes type 2, **otyl**: abdominal obesity, **hip**: hypercholesterolaemia

Chart 8. Risk factors appearing in different groups of patients treated in hospitals that do not carry out surgery.
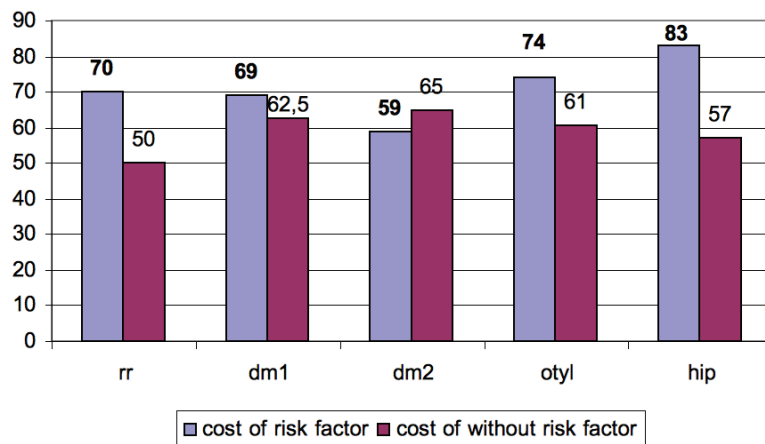

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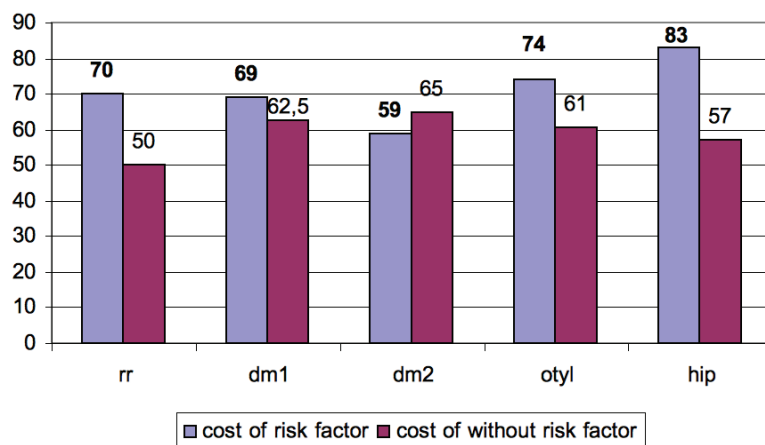
Chart 7. Influence of each risk factor on patients' treatment costs on hospital ward in hospitals that do not carry out surgery (in Euro)

GLOSS:

To valuate the costs, into account were taken costs of pharmacological treatment, diagnostic and materials used on the hospital ward. **rr**: arterial hypertension, **dm1**: diabetes type 1, **dm2**: diabetes type 2, **otyl**: abdominal obesity, **hip**: hypercholesterolaemia

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