

# Analysis of Costs of Diabetes in Poland in 2012 and 2013

Paweł Moćko, Paweł Kawalec, Krzysztof Malinowski

Institute of Public Health, Faculty of Health Sciences, Jagiellonian University Medical College, Cracow, Poland

*Address for correspondence:* Paweł Kawalec, Instytut Zdrowia Publicznego, Grzegórzecka 20, 31-531 Kraków, pawel.kawalec@uj.edu.pl

## Abstract

Diabetes mellitus is now recognized as a societal disease that significantly burden health care systems in highly developed as well as developing countries and constitutes a serious problem of public health world-wide. The aim of this study was to estimate the value of reimbursement of diabetes-related drugs in 2012 and 2013 and to analyze indirect costs generated by diabetes in Poland in 2012. It was revealed that reimbursement of glucose test strips, antidiabetic drugs and insulins covered by the National Health Fund was as high as 1.3 billion PLN in 2012 and 1.5 billion PLN in 2013 and the dominant cost drivers were glucose test strips (49% of costs in 2012 and 52% of costs in 2013) and insulins (40% and 38% of total reimbursement costs due to diabetes, respectively). Total indirect costs of diabetes type 1 and type 2 in 2012 were as high as 59 million PLN and 66.5 million PLN and absenteeism due to sick leave was a main cost driver (61% in diabetes type 1 and 95% in diabetes type 2, respectively). In summary, costs associated with diabetes constitute a serious burden for the National Health Fund as well as for the Social Insurance Institution in Poland.

**Key words:** type 1 diabetes, type 2 diabetes, the disease costs, indirect costs, direct costs

**Słowa kluczowe:** cukrzyca typu 1, cukrzyca typu 2, koszty choroby, koszty pośrednie, koszty bezpośrednie



Ministerstwo Nauki  
i Szkolnictwa Wyższego

Przygotowanie i edycja angielskich wersji publikacji finansowane w ramach umowy 914/P-DUN/2016 ze środków Ministra Nauki i Szkolnictwa Wyższego przeznaczonych na działalność upowszechniającą naukę.

## Introduction

Diabetes mellitus belongs to a group of metabolic diseases characterized by hyperglycemia caused by disorders in insulin secretion or by its effects. Currently, diabetes mellitus is regarded as a societal disease which puts a significant strain on the health care system in the developed as well as the developing countries and constitutes a serious problem for public health world-wide [1]. According to data for 2014 provided by the International Diabetes Federation – IDF, the number of persons with diabetes worldwide amounted to around 387 million [2]. In Poland, it is estimated that the number of person with diabetes in 2013 was about two million, with the diabetes type 1 morbidity rate for Poland of 0.3% (incidence of 10.2/100 thousand of cases per year), while the prevalence of diabetes type 2 oscillates between 1.6–4.7% (incidence of about 200/100 thousand cases per year) [1]. As a result of its considerable incidence, the morbidity and economic consequences, diabetes mellitus has become the subject of many epidemiologic studies and cost analyses of the disease and

it also creates a significant problem for public health in its broad context.

Within the framework of cost analysis connected with different diseases, we can identify the following cost groups: direct costs, indirect costs and intangible costs. Direct costs can be split into medical costs (expenses relating to the purchase of medical equipment, medication, salaries of medical staff, diagnostics and hospital stay) and non-medical costs (e.g. connected with third-party care provided to patients, the cost of transportation of patients, adjusting patients' accommodation to their needs or special diets) [3]. By indirect costs we understand the value of lost production resulting from absenteeism, disability (disability benefits) and premature deaths of people of working age, which generates specific productivity losses [3].

One particularly significant aspect associated with the measurement of indirect costs is the implementation of an appropriate method of assessment of the costs of lost production (valuation of lost time). The main methods assessing the cost of the lost production comprise the following: friction cost method – FCM, human capital

approach – HCA and health state valuation; the least frequently used approach in practice [3].

Human capital approach is the most popular and the most frequently used method assessing indirect costs. As a result of the disease prevalence, the capital at the disposal of a unit cannot be used to the full. The consequence of such an approach is that indirect costs occur as long as the human capital potential is limited [4]. Indirect costs are estimated by the HCA method as the product of the length of a disease (i.e. the time when human capital is not utilized) and productivity of an employee per unit of time (productivity of human capital) to the effect that the estimated value corresponds with theoretical, potential loss of productivity. A pure, classical HCA method assumes the lack of system unemployment and full maximum work efficiency when no health problems take place. In friction cost method, on the other hand, costs associated with a disease are analyzed from the point of view of a company (the assessment concerns the real loss of productivity), and in the FCM approach it is requested that the assessment of the long-term effect of an employee's sickness should take into account the circumstances which could diminish the real loss of productivity (an employee could be substituted by e.g. a new staff member) [3, 4].

In case an employee is forced to discontinue work, then indirect cost is equal to the volume of production which is lost because of an employees' sick absence (the so-called absenteeism). The loss of productivity connected with the presenteeism takes place when an employee decides to undertake professional activities despite his/her bad health condition and then their efficiency falls down due to illness [4].

One very important element in the analysis of costs of disease is the choice of an appropriate point of view from which the assessment of the cost of disease is made (i.e. the perspective). The perspective of a patient takes into account solely costs incurred directly by the patient himself omitting the costs incurred by the public payer (e.g. the National Health Fund). In turn, the perspective of a public payer takes into account the costs of reimbursement from public funds omitting the costs incurred by the patient; there is also the perspective of a payer taking into account both the costs of the public payer and a patient. The social perspective reflects the broadest presentation of costs of the disease, which comprises all kinds of costs associated with an illness and its treatment, regardless of their source; hence it requires the consideration of not only economic consequences connected with the process of treatment and complications, but also it requires the consideration of indirect costs connected with the loss of productivity of a sick employee in the analysis [5].

Cost of illness studies make it possible to measure and identify costs of a particular disease entity. The studies also allow to assess the burden imposed on a given society by an illness occurring in a given population [6]. This type of analysis comprises all sorts of costs which are connected, among others, with prevention, diagnostics and the course of treatment but they omit in their calculations health effects obtained from medical technologies

data. At present, we can distinguish two main types of cost of disease analyses, which are dependent on the accepted analytical method: incidence-based cost of disease and prevalence-based cost of disease analysis [6–8].

The prevalence-based method assesses costs connected with a given disease entity within a year. This method is characterized by a simpler, analytical approach; therefore it is used much more often.

It is based on adding direct and indirect costs associated with a given disease entity which were incurred in a given year in a group of patients with the analyzed disease. In turn, the prevalence-based method assesses costs associated with a given disease entity within the whole life-span of people who were diagnosed with the analyzed disease entity in a given period of time. In this method, patients are divided into groups on the basis of prevalence which will be under observation from the beginning of an illness till the patient's death in order to make an assessment of the total costs of the disease for each of these patients [6].

## Diabetes mellitus treatment costs

### 1. Diabetes mellitus treatment costs world-wide

Diabetes mellitus is a disease which constitutes a huge epidemiological problem which translates into more and more serious economic consequences for individual societies [9], [10]. According to International Diabetes Federation (IDF) report of 2013, it is estimated that the cost of diabetes treatment amounted to 548 billion USD and constituted around 11% of the total costs incurred by healthcare world-wide (healthcare provided by healthcare institutions as well as individual care organized by patients themselves) [10]. The available research results also indicate that costs generated by diabetes are not evenly distributed in particular age groups and that the majority of costs (76%) are connected with diabetes treatment in adult population (50–79 years of age) [10]. Additional costs connected with undiagnosed diabetes complications are assessed from the perspective of a payer and amount to 18 billion USD per year (2864 USD per capita in the USA) [11].

The analysis of expenses covering diabetes treatment per person with diabetes, depending on the economic situation of a country, implies that in countries of low and medium income only 20% of financial means is connected with diabetes treatment (on average 356 USD per person with diabetes, 545 USD PPP<sup>1</sup> – Purchasing Power Parity per person with diabetes). In turn, in countries of high income, the cost of diabetes per capita is estimated at 5621 USD [10]. In 2013, the total cost of diabetes treatment in Europe remained at the level of around 147 billion USD [10]. It is assumed that one fourth of the expenses is allocated to monitoring the level of glucose in patients' blood, the next 25% is allocated to the treatment of diabetes complications, and the remaining 50% make up the sum of the remaining direct costs connected with doctors' and nurses' consultations, costs of hospitalization, medical equipment, medication as well

**Table I.** The total cost of diabetes treatment in the chosen countries in 2013.

Country	Prevalence coefficient of diabetes for a country (%)	Number of the population (aged 20–79) [thous.]	Number of person with diabetes [thous.]	Average cost covering diabetes treatment (USD)	Total cost of diabetes treatment (USD)	(USD)
Croatia	6.97	3,220.08	224.49	1,378	309,347,220	96.06
Denmark	8.58	4,041.69	346.73	7,272	2,521,420,560	623.85
Russia	10.03	108,928.97	10,924.11	899	9,820,774,890	90.15
Finland	8.85	3,946.2	349.14	4,547	1,587,539,580	402.29
France	7.50	45,009.94	3,374.7	5,406	18,243,628,200	405.32
Greece	7.01	8,336.17	584.6	2,453	1,434,023,800	172.02
Ireland	6.47	3,209.3	207.49	5,598	1,161,529,020	361.92
Germany	11.95	63,281.33	7,559.78	4,718	35,667,042,040	563.62
<b>Poland</b>	<b>6.50</b>	<b>28,907.31</b>	<b>1,879.69</b>	<b>1,037</b>	<b>1,949,238,530</b>	<b>67.43</b>
Czech Republic	9.23	8,190.15	755.7	1,610	1,216,677,000	148.55
Slovak Republic	10.16	4,159.07	422.64	1,621	685,099,440	164.72
Sweden	6.36	6,892.52	438.63	5,806	2,546,685,780	369.48
United Kingdom	6.57	45,307.03	2,974.95	3,994	11,881,950,300	262.25
Italy	7.95	45,637.2	3,626.04	3,501	12,694,766,040	278.16
Mexico	11.77	74,137.43	8,723.42	834	7,275,332,280	98.13
USA	10.90	223,937.51	24,401.77	9,800	239,137,346,000	1067.87
China	9.62	1,023,050.42	98,407.38	333	32,769,657,540	32.03
Indonesia	5.55	154,061.95	8,554.17	143	1,223 246 310	7.93
Japan	7.56	95,304.38	7,203.78	4,054	29,204,124,120	306.43
Brazil	9.04	131,959.75	11,933.58	1,477	17,625,897,660	133.57
Egypt	15.56	48,276.39	7,510.6	176	1,321,865,600	27.38
India	8.56	760,429.73	65,076.36	84	5,466,414,240	7.18
Total	–	–	–	–	–	151

Source: Own elaboration based on International Diabetes Federation, *Diabetes Atlas Update 2013 6<sup>th</sup> Edition*, Brussels, Belgium, 2013, <http://www.idf.org/diabetesatlas/download-book>; accessed: 2.07.2014 [10].

as indirect costs (the loss of productivity or efficiency at work and absenteeism) [9].

It was possible to make an assessment of costs incurred by diabetes per capita per year thanks to the compilations of data on the number of patients with diabetes in 2013 (on the basis of a prevalence coefficient for a country), the average costs covering diabetes treatment for 2013 and through relating this data to the number of people aged between 20–79 (**Table I**). As data analysis carried out in the developed countries indicates (the USA, Denmark, Sweden and France), on average, a sum between 5406 USD (France) and 9800 USD (the USA) is allocated for the treatment of one person with diabetes, while in China these expenses reach merely 333 USD (Table I). Relating this data to the total number of the population in a given country, it can be observed that the highest social burden is noted in the USA (1 068 USD per capita), France (405 USD per capita) and Finland (402 USD per capita). It should be stressed that in Poland, on average 1037 USD is allocated for the treatment of one person with diabetes, with the estimated cost burden of 67 USD per inhabitant. The average burden per capita for all the analyzed countries amounts to 151 USD (per capita) (Table I).

## 2. Diabetes costs in Poland

Few studies conducted in recent years assess the real costs of diabetes treatment in Poland.

In the study on the burden on the Polish society caused by diabetes mellitus type 1 and diabetes mellitus type 2, the results are shown in the form of public expenses on health care among patients with diabetes and also in the form of a shortened life span caused by premature death and disability resulting from diabetes [12]. It is one of very few studies on the global scale which conducted an evaluation of the diabetes burden expressed in disability adjusted life years – DALY, based on the prospective epidemiological research. It has been calculated that in 1998 the direct costs of diabetes in Poland borne by the state budget reached 1937 million PLN, which made up 9.3% of all the public expenditure incurred on the health care at that time (and considering the purchasing power of the dollar, it was 1076 million USD PPP). It has also been determined that the total number of lost DALYs in the analyzed period amounted to 112 584 DALY, representing over 3% of all DALYs lost in 1998 due to all the diseases and afflictions in Poland [12]. In 1998, the average costs of treating a patient with diabetes mellitus

type 1 were 6.4 times higher than in case of patients with diabetes mellitus type 2–3 times higher than the average cost per capita in Poland [13]. Projections relating to diabetes costs would amount to 2.46 billion PLN in 2003, whereas the estimated cost of care for a patient with diabetes ranges between 4.9 and 6.8 billion PLN in 2002 [13]. In turn, projections for 2005 incline towards the 22% growth in costs of diabetes treatment, mainly because of the expected rise in the number of patients [13].

One of the studies dealing with the issue of diabetes costs in Poland is CODIP (Cost of Diabetes Type 2 in Poland) [14]. The aim of the study was to make an overall assessment of the total costs of diabetes type 2 treatment in Poland in 2002. The assumption and methodology of the study were similar to the assumptions of CODE-2 study, which makes it possible to compare international results obtained within the CODIP study. A retrospective, multi-centre study (20 centres) of the bottom-up type was conducted on a group of 303 patients with diabetes type 2 (average age 61). As Polish epidemiological data was limited, the authors of the study applied randomization without stratification in order to choose a test group. The aim of the CODIP study was to determine the structure of the total costs of diabetes type 2, the overview of current strategies of treatment and the evaluation of the impact of diabetes complications on costs. The estimated value of the resources used by health care and its costs were converted into a period of one year. In direct costs analysis three categories were presented: outpatients' costs, hospital and medication costs, Total direct costs connected with diabetes were assessed for around 2.6 billion PLN, which made up 8% of all the expenses on health care in 2002 in Poland. The greatest share in total diabetes costs are the costs of hospitalization and pharmacotherapy. According to the authors of the study, the purchase of insulin formulations made up about 2/3 of the costs of hypoglycemic agents and the average time of hospitalization resulting from complications amounted to 6.2 days. The average total direct cost per patient with diabetes type 2 in Poland in 2012 amounted to 2430 PLN (1185 EUR). The dominant cost drivers per patient are anti-diabetic drugs (46%) and hospitalization costs (30%) [14].

The evaluation of indirect costs of diabetes (using the human capital method) carried out additionally within the framework of CODIP study indicates that they amount to 6797 PLN (3316 EUR). The main component of indirect costs were costs associated with taking early retirement or disability pension (4382 PLN = 2137 EUR), which made up about 64% of the total indirect costs. Costs associated with the third party care were in the second position in the structure of indirect costs (34%) [14].

The comparison of the results of pharmacotherapeutic costs has shown that the patients taking part in the CODIP study were over twice more often treated with insulin than the patients participating in the CODE-2 study. In comparison with CODE-2, the cost of drugs in the CODIP study made up a substantial part of the total costs, which is probably connected with the relatively high prices of drugs in Poland. On the other hand, significantly lower expenses connected with hospitalization were observed in

the CODIP study when compared with CODE-2, which is probably due to the underestimation of costs. This situation may result from a huge debt of Polish hospitals; alternatively, it may be the outcome of too low values of unit costs. (i.e. day of hospitalization) [14].

Insulin pharmacotherapy makes up 30% of the total expenditure on diabetes type 2 treatment in Poland, and the cost of oral anti-diabetic drugs constitute 17% of medical costs and around 4.5% of the total costs. On the other hand, in case of diabetes type 1 treatment, the dominant role is played by the costs of insulin therapy (63%) where hospitalization is responsible for 22% of the cost. Insulin therapy has a significant share in the cost of diabetes type 2 treatment (46%), similarly as hospital treatment (26%). Globally, the cost of insulin therapy and the cost of hospitalization have the greatest share in the direct costs of diabetes treatment (50% and 25%, respectively). In the group of indirect costs, a significant role is played by the costs of lowered productivity due to early retirement or disability retirement (74%). It should be also noted, that the cost of sick leave in the overall indirect costs connected with diabetes makes up 11% [15].

It is worth mentioning the significance of very high costs generated by diabetes complications, which were not taken into account within the framework of the CODIP study. It is estimated that the cost of treatment of diabetes complications in Poland amounts to around 0.5 billion PLN which makes up about 25% of the total costs (2–2.6 billion PLN). Other sources [15] indicate that the cost of treatment of diabetes and its complications amount to around 6 billion PLN per year in Poland. Diabetes complications, type 2 in particular, are the drivers of additional costs of in-patients' and hospital care [15, 16]. It is worth mentioning, that in 2002 the dominant role in overall costs of complications treatment was played by the costs of in-patients' consultations (42%) and costs of hospitalization resulting from microangiopathic complications (38% and 21%, respectively). When it comes to the cost structure of microangiopathic complications, the highest costs are observed in connection with the treatment of kidney complications (54%) and ocular complications (37%), whereas in case of macroangiopathic complications, over 50% of the costs were related with the coronary heart disease [17]. Direct costs connected with diabetes complications amounted to 1.3 billion PLN in 2012, whereas indirect costs amounted to almost 1.7 billion PLN [18].

The findings of the research [18] on the costs of diabetes generated between 2004–2009 indicate that the costs of health benefits (encompassing basic health care and medication) in 2009 went up by 25% in case of diabetes type 1 and by 29% in case of diabetes type 2 in comparison with 2004. Additionally, it was shown that the costs of health benefits (encompassing hospitalization and specialist care) doubled in the researched period. In case of diabetes type 1, a considerable increase in costs was caused by an over 80% rise in the average benefit cost, which was mostly connected with the introduction of the reimbursement of insulin pumps and the pump equipment for children at that time. It can be assumed that the

rise in diabetes type 2 costs was connected with the rise in the prevalence of the disease, as the average cost of the benefit for 2009 was only 30% higher in comparison with 2004. Both in case of diabetes type 1 and type 2 the main source of additional costs were hospital services. In 2009 the average cost of health benefits provided to a patient with diabetes type 2 in Poland was 414 PLN, and those with diagnosed diabetes type 1 – 926 PLN [19].

Within the scope of the conducted research, a calculation of direct as well as indirect costs connected with diabetes in Poland was carried out. As no reliable studies of this kind referring to the most recent data are available, it was considered as appropriate to carry out this type of analysis (the exact data were presented in chapters 2.1 and 2.2).

### 2.1. The evaluation of direct costs in diabetes treatment in Poland from the perspective of the public payer (the National Health Fund)

On the basis of the data published by NFZ (the National Health Fund) concerning the amount of reimbursement and also information concerning the reimbursed formulations placed in announcements by the Health Minister, a detailed analysis of the reimbursement expenses was conducted in 2012 and 2013 [20, 21].

It is estimated that from January to December 2012 the value of the reimbursed drugs applied in the treatment of diabetes (including anti-diabetic drugs, insulin and glucose test strips) amounted to over 1.3 billion PLN, which made up 19% of the total reimbursement sum of around 6.9 billion PLN. In 2013, the amount of reimbursement of drugs for diabetes was even higher

and it amounted to 1.5 billion PLN, similarly as its share in the total amount of reimbursement, which was 21% for 2013 [20, 21].

The highest costs are generated by glucose test strips – about 49% (645 million PLN) in 2012 and 52% (793 million PLN) in 2013. A slightly lower share in total direct cost of diabetes belongs to insulin; 40% (518 million PLN) and 38% (583 million PLN), respectively. The lowest share in total direct costs of 11% (144 million PLN) and 10% (155 million PLN) respectively, belongs to anti-diabetic drugs (**Table II, Figure 1**).

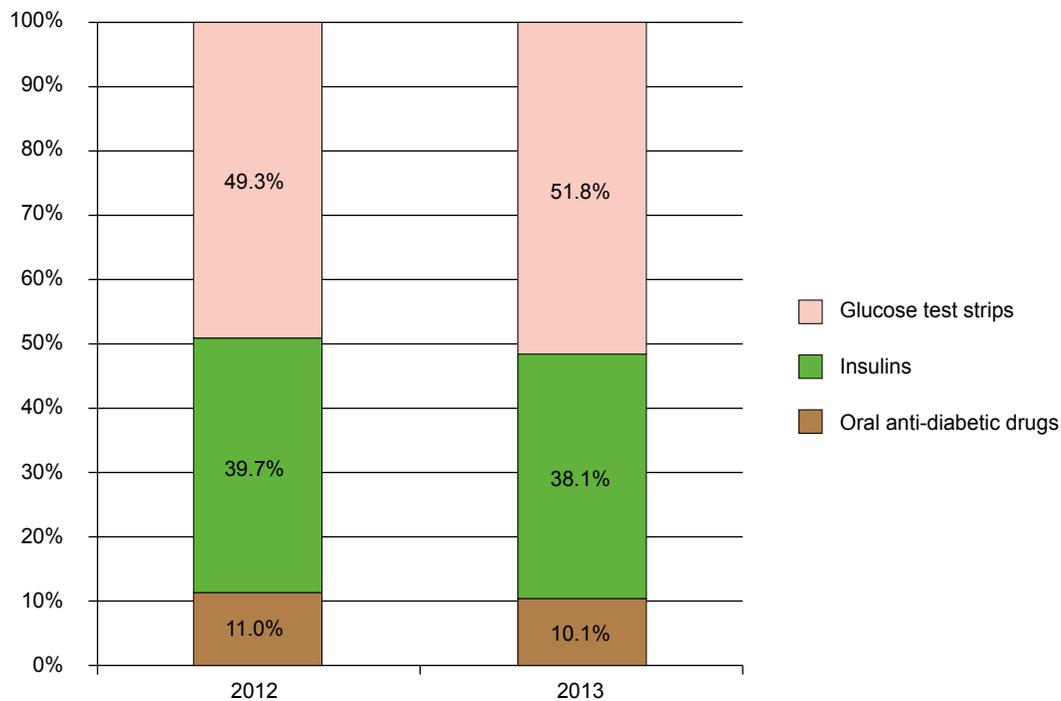
While conducting a detailed analysis of the individual cost categories, it should be emphasized that in 2012 and 2013 the National Health Fund allocated over 518 million PLN and 583 million PLN respectively for the reimbursement of insulin, where about 60–62% was the cost of human insulin (323 million PLN and 353 million PLN respectively), while the remaining 38–40% consisted of insulin analogues (195 million PLN and 231 million PLN, respectively). The highest reimbursement costs among human insulins are incurred by the public payer with reference to a mixture of human insulins (65–66% of the reimbursement costs of human insulin), whereas in case of insulin analogues the highest costs are generated by mixtures of insulin analogues (47–52% of the reimbursement cost of insulin analogues) (**Figure 2**). In a group of oral anti-diabetic drugs, substantial costs are generated by biguanides (49–54% of the amount of reimbursement of oral anti-diabetic drugs), and then sulfonylurea derivatives (40–44% of the reimbursement amount) (**Figure 3**) [20, 21].

According to the National Health Fund (pol. NFZ) data, in the compilation of the top 25 substances whose

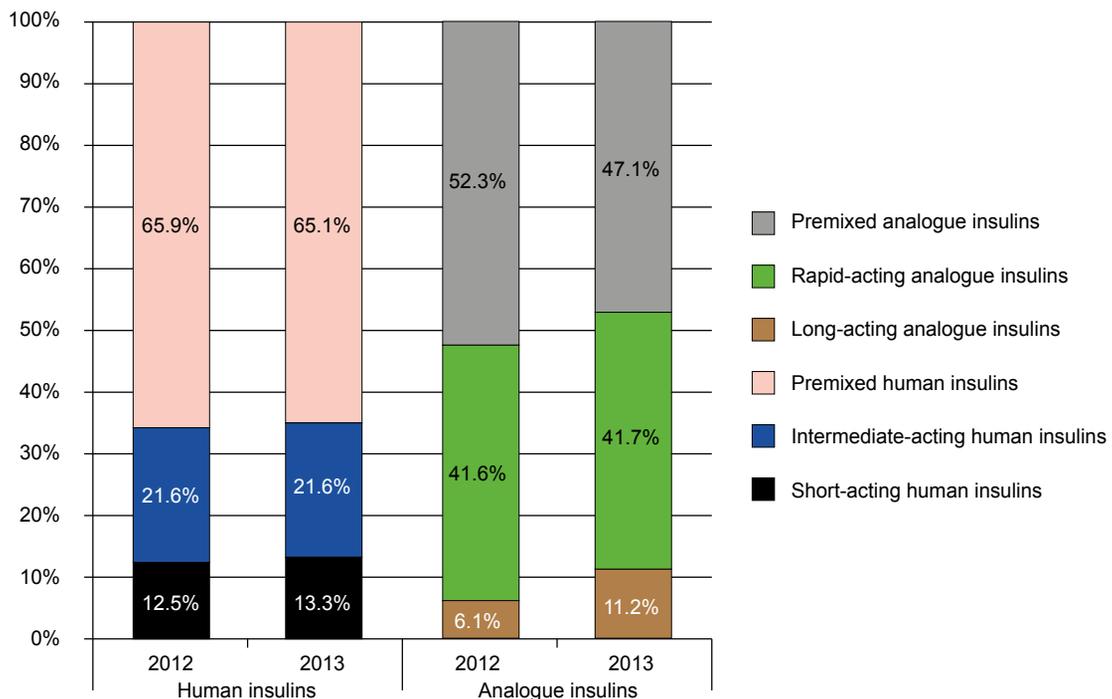
**Table II.** The value of the reimbursed drugs applied in diabetes treatment in 2012 and 2013

No.	Category	The reimbursement costs (PLN) in 2012	The reimbursement costs (PLN) in 2013
<b>1.</b>	<b>Anti-diabetic drugs</b>	<b>143,749,543</b>	<b>155,312,792</b>
1.2	Sulfonylureas	62,609,577	61,912,963
1.2	Biguanides	69,729,083	83,145,399
1.3	Alpha-glucosidase inhibitors	11,410,883	10,254,430
<b>2.</b>	<b>Insulins</b>	<b>518,472,407</b>	<b>583,709,379</b>
2.1	Human insulins	323,214,782	352,999,147
2.1.1	Short-acting human insulins	40,475,551	46,822,755
2.1.2	Intermediate-acting human insulins	69,843,724	76,410,157
2.1.3	Premixed human insulins	212,895,508	229,766,235
2.2	Analogue insulins	195,257,625	230,710,231
2.2.1	Long-acting analogue insulins	11,895,070	25,753,189
2.2.2	Rapid-acting analogue insulins	81,189,738	96,166,952
2.2.3	Premixed analogue insulins	102,172,817	108,790,091
<b>3.</b>	<b>Glucose test strips</b>	<b>645,254,221</b>	<b>792,809,381</b>
–	<b>Total</b>	<b>1,307,476,171</b>	<b>1,531,831,551</b>

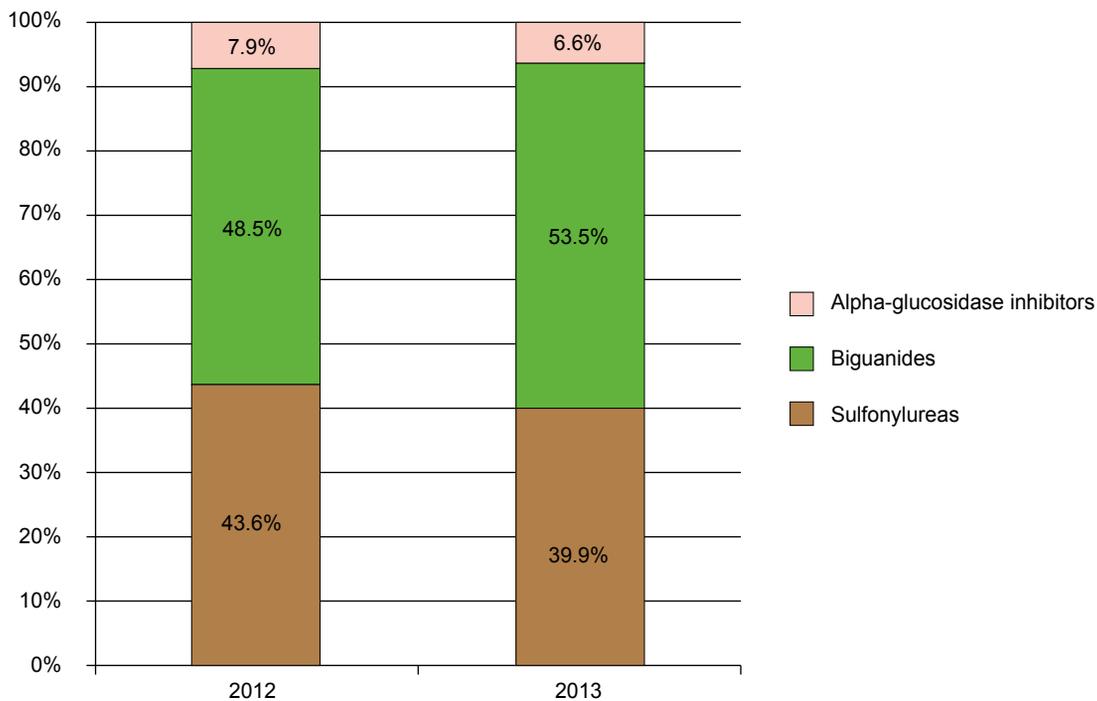
Source: Own elaboration based on Komunikaty Departamentu Gospodarki Lekami (DGL). Wartość refundacji cen leków według kodów EAN narastająco od początku roku do grudnia 2012 roku [20]; Obwieszczenie Ministra Zdrowia w sprawie wykazu refundowanych leków, środków spożywczych specjalnego przeznaczenia żywieniowego oraz wyrobów medycznych z okresu 2012 roku [21].

**Figure 1.** The structure of the reimbursement costs dedicated to diabetes treatment in 2012 and 2013

Source: Own elaboration on the basis of the National Health Fund data: Komunikaty Departamentu Gospodarki Lekami (DGL). Wartość refundacji cen leków według kodów EAN narastająco od początku roku do grudnia 2012 roku [20]; Obwieszczenie Ministra Zdrowia w sprawie wykazu refundowanych leków, środków spożywczych specjalnego przeznaczenia żywieniowego oraz wyrobów medycznych z okresu 2012 roku [21].

**Figure 2.** The structure of reimbursement costs for human insulin and insulin analogues in 2012 and 2013

Source: Own elaboration on the basis of the National Health Fund data: Komunikaty Departamentu Gospodarki Lekami (DGL). Wartość refundacji cen leków według kodów EAN narastająco od początku roku do grudnia 2012 roku [20]; Obwieszczenie Ministra Zdrowia w sprawie wykazu refundowanych leków, środków spożywczych specjalnego przeznaczenia żywieniowego oraz wyrobów medycznych z okresu 2012 roku [21].

**Figure 3.** The structure of reimbursement costs for anti-diabetic drugs in 2012 and 2013

Source: Own elaboration on the basis of the National Health Fund data: *Komunikaty Departamentu Gospodarki Lekami (DGL). Wartość refundacji cen leków według kodów EAN narastająco od początku roku do grudnia 2012 roku [20]; Obwieszczenie Ministra Zdrowia w sprawie wykazu refundowanych leków, środków spożywczych specjalnego przeznaczenia żywieniowego oraz wyrobów medycznych z okresu 2012 roku [21].*

reimbursement is the most costly (about 40% of the overall reimbursement amount), insulin is in the third position (5.26% of the overall reimbursement amount).

When analyzing the direct cost of diabetes treatment, attention should be paid to the issue of undiagnosed diabetes, which is undoubtedly a serious social and health problem. It is estimated that 609.02 thousand of people aged 20–79 in Poland do not realize that they are affected by diabetes [10]. The analysis of type MZ-11 reports, which are directly passed to the head office of the National Health Fund from regional branches has shown that the detection rate of diabetes is steadily increasing and so is the number of patients diagnosed with diabetes. Diabetes detection rate growth will be translated into increasing expenditure for its treatment in the following years as well as the decrease in the expenditure for complications treatment (because of its early detection).

## 2.2. The evaluation of indirect costs of diabetes in Poland

So far research on indirect costs connected with diabetes in the Polish conditions has been conducted on the basis of the National Health Fund and Social Insurance (pol. ZUS) data so far. It should be stressed, that because of the implementation of the system solutions, the number of granted disability pensions is falling down every year. The number of decisions on incapacity for work due to diabetes has also fallen down in case of diabetes [18]. On the basis of the report by Leon Koźminski Academy, (ALK) in Warsaw [19] it has been observed that between

2004–2009 the decrease rate for decisions on incapacity for work among people with diabetes is lower than for the whole population. In the analyzed years, on the other hand, the rise in the number of the granted rehabilitation services and sickness benefits has been observed. The ALK report indicates that indirect costs make up almost 50% of the cost of diabetes.

On the basis of the data provided by the Social Insurance, the Department of Statistics and Actuarial Projections, in numbers of [22]:

- sick absences in 2012 due to illness of people insured in ZUS in the order of disease entity;
- first-time medical decisions by Social Insurance certifying physicians issued in 2012 qualifying for rehabilitation services by gender and disease entity (the value used to define short-term disability);
- first-time medical decisions by ZUS certifying physicians issued in 2012 qualifying for rehabilitation services with the simultaneous need for remedial rehabilitation by gender, the projected period of disability for work and disease entity (the value used to determine short-term disability);
- first-time and renewed medical decisions establishing complete inability to work issued by ZUS certifying physicians to people applying for a social assistance pension, by gender and disease entity (the value used to determine long-term disability, i.e. pensions),

indirect costs of insulin-dependent diabetes (type 1) and insulin-independent diabetes (type 2) were assessed in Poland in 2012.

**Table III.** The cost of sickness absence and short and long-term disability to work for patients with diabetes type 1 and 2

Parameter	Category	Costs in 2012	
		Diabetes type 1	Diabetes type 2
Sickness absence	Number of sick leaves	20,368	39,753
	Number of years	871	1,522
	GDP value <sup>a</sup>	36,065,620	62,992,625
	Cost per 1 sick leave <sup>b</sup>	1,771 PLN	1,585 PLN
Short-term disability to work	Number of permissions for rehabilitation benefits	380 <sup>c</sup>	173 <sup>c</sup>
	Average length of rehabilitation benefit [months]	5	5
	Number of years <sup>d</sup>	158	72
	GDP value <sup>a</sup>	6,554,683	2,980,656
	Cost per 1 short-term benefit <sup>e</sup>	17,249 PLN	17,249 PLN
Long-term disability to work (disability pension)	Number of decisions of total disability to work	396	15
	GDP value <sup>a</sup>	16,393 608	620,970
	Cost per one decision <sup>f</sup>	41,398 PLN	41,398 PLN

<sup>a</sup> calculated as number of years multiplied by GDB per capita (41 398 PLN); <sup>b</sup> calculated as quotient of GDP value and number of sick leaves; <sup>c</sup> including 5 and 2 permissions for rehabilitation benefit with simultaneous need of therapeutic rehabilitation in case of diabetes type 1 and 2, respectively; <sup>d</sup> calculated as number of permissions for rehabilitation benefits multiplied by an average length of benefit in years; <sup>e</sup> calculated as quotient of GDP value and number of permissions; <sup>f</sup> calculated as quotient of GDP value and number of citizens (GDP per capita).

Source: Own elaboration based on Zakład Ubezpieczeń Społecznych (ZUS) – Portal Statystyczny ZUS, <http://www.psz.zus.pl/>; accessed: 20.07.2014 [22].

In the calculations of indirect costs, additional information was used – gross value added (GVA) per employee in 2012, remuneration per employee in 2012 and gross domestic product (GDP) per capita in 2012. The information above was obtained from the Central Statistical Office ([www.stat.gov.pl](http://www.stat.gov.pl)). The **Table III** presents a breakdown of figures described above for diabetes type 1 and type 2 in 2012.

In 2012 one sickness absence of an employee with diabetes type 1 or 2 generated the average cost of productivity loss of 1771 PLN or 1585 PLN, respectively.

A short-term cost in the form of one entitlement to a rehabilitation service in 2012 amounted to 17 249 PLN, both in case of diabetes type 1 and 2. The cost is generated by patients who need rehabilitation and is the same, regardless the type of diabetes, because in both cases the average length of rehabilitation is the same (5 months) and thus the cost of productivity loss also remains the same [22]. In 2012 the highest unit costs were generated by decisions about permanent disability to work (disability pensions). The cost of one medical decision (one disability pension) in case of patients with diabetes type 1 and 2 amounted to 41 398 PLN [22].

The total indirect costs of diabetes type 1 and 2 in Poland in 2012 amounted to 59 013 912 PLN and 66 597 701 PLN, respectively. The greatest share in indirect costs in case of diabetes type 1 in Poland in 2012 belongs to sickness absence. A considerable share in indirect costs was also observed in case of medical decisions about long-term disability to work (disability pension). The entitlements to rehabilitation services issued to patients with diabetes type 1 in Poland in 2012 were responsible for over 11% of the total indirect costs

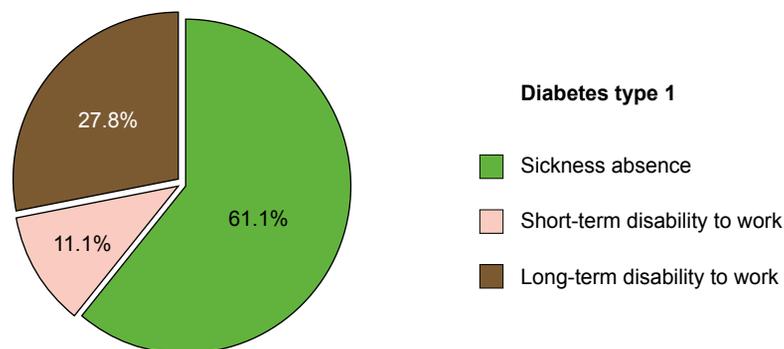
(**Figure 4**). The case of diabetes type 2 presents itself in a slightly different way. In 2012, very few decisions about long-term disability to work were issued to patients with diabetes type 2; thus the cost of these decisions amounted to just a little below 1% of the total indirect costs. A slightly higher number of people with diabetes type 2 received short-term services in the form of entitlement to rehabilitation services; however, their costs did not exceed a 5% share in total indirect costs. 95% of indirect costs of diabetes type 2 in Poland in 2012 were made up of the cost of sickness absence (**Figure 5**) [22].

## Summary

The conducted study overview concerned the evaluation of the total direct and indirect costs of diabetes treatment – in Poland and world-wide. Research findings indicate that the prevalence of this disease is associated with high costs burdening the societies in individual countries. It is estimated that the treatment of diabetes in 2013 absorbed 548 billion USD, which makes up about 11% of the total expenditure on health care all around the world [10].

Studies concentrating on costs of a disease, indirect cost in particular, currently constitute a serious challenge for decision-makers, e.g. in the health service or for specialists in public health. Studies concentrating on direct costs are simpler to conduct as gathering data is easy and popular; therefore a number of publications of this type about diabetes are available. On the other hand, indirect cost analysis is more difficult to carry out, mainly because of the lack of clear-cut, comprehensive data sources and because of difficulties with their measurement.

**Figure 4.** Individual categories of indirect costs of diabetes type 1 in Poland in 2012



Source: Own elaboration based on Zakład Ubezpieczeń Społecznych (ZUS) – Portal Statystyczny ZUS, <http://www.psz.zus.pl/>; accessed: 20.07.2014 [22].

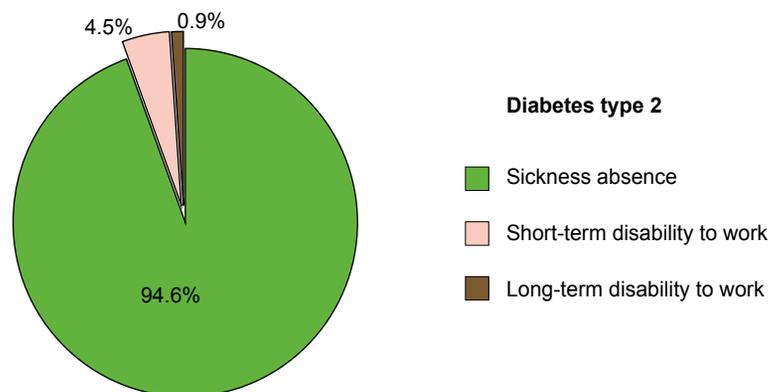
Therefore, there are no reliable publications dealing with indirect costs; indirect costs of diabetes in Poland in particular. The chosen HCA method estimates maximum costs but it does not take into account the unemployment rate or marginal efficiency.

As presented in the SMG/KRC report, “Diabetes treatment and costs in Poland” [23], the expenses allocated to diabetes treatment in Poland are definitely lower (almost 3 times) than in countries of the so-called “old European Union”. Analyzing carefully the expenses connected with diabetes in Poland, we can see that the highest share belongs to costs of hospitalization, in-patients’ treatment and pharmacotherapy [14]. The structure of funds allocated for diabetes treatment in Poland is similar to the structure of expenses typical to the developing countries and it differs from the one which can be observed in modern European countries. Additionally, taking into account indirect costs connected with diabetes in the developed countries, the direct investment in controlling diabetes does not exceed 25% of the total costs connected with diabetes. On the basis of the identified studies’ findings it can be assumed that economic growth in Poland will

contribute to the changes in the health care system, bringing the rise in financial investment dedicated to hospital and in-patients’ care (i.e. the rise in doctors’, nurses’ and medical staff salaries to reduce immigration). It should be also stressed that in the subsequent years and decades, the number of patients with diabetes in Poland will grow (it is estimated that in 2035 the number of patients with diabetes world-wide will rise from 382 million to almost 592 million [10], which in consequence will additionally burden the budget with costs of medical care, in particular within the scope of complications treatment, and will bring the rise of indirect costs generated by complications, the so-called costs connected with sickness absence at work, reduced productivity, lowered standard of life, reduced productivity of patients’ carers or disability pensions which at present absorb a significant part of the Polish GDP [23].

The analysis of the reimbursement expenses of the National Health Fund has proved that the reimbursement of drugs in diabetes therapy amounted to 1.3 billion PLN in 2012 and 1.5 billion PLN in 2013. These figures made up 19% and 21%, respectively of the total

**Figure 5.** Individual categories of indirect costs of diabetes type 2 in Poland in 2012



Source: Own elaboration based on Zakład Ubezpieczeń Społecznych (ZUS) – Portal Statystyczny ZUS, <http://www.psz.zus.pl/>; accessed: 20.07.2014 [22].

NHF expenses allocated for the reimbursement of drugs and medical products in Poland. It should be also highlighted that the highest costs (almost half of them) are generated by the reimbursement of glucose test strips and insulin (mostly human insulin) [20, 21]. In turn, the analysis of indirect costs of diabetes has indicated that in 2012 these costs amounted to almost 60 million PLN in case of diabetes type 1 and over 66 million PLN in case of diabetes type 2. What is more, sickness absence had the highest share in indirect costs in case of diabetes type 1. A significant share in indirect costs was also observed in case of medical decisions about long-term disability to work (disability pension). In 2012, 95% of indirect costs of diabetes type 2 in Poland consisted of the cost of sickness absence [22].

The conclusions presented within the above research review, especially those referring to Poland, should to a greater extent draw the attention of decision-makers in health care as well as the public opinion. A number of steps should be taken to try and reduce diabetes type 2 prevalence, to carry out earlier and better diagnosis as well as to reduce and delay the onset of diabetes complications. To achieve this aim, effective health and education programmes should be implemented, while patients should be provided with professional care and access to modern therapeutic methods.

## Note

<sup>1</sup> Purchasing Power Parity – a way of expressing the currency of one country in the currency of another country. It defines a relation between the level of prices in one country to the level of prices in another country.

## References

1. Sieradzki J., *Choroby układu wewnętrzwydzielniczego*, in: Gajewski P. (ed.), *Interna Szczeklika*, Medycyna Praktyczna, Kraków 2013: 1353–1376.
2. *IDF Diabetes Atlas*, <http://www.diabetesatlas.org/resources/2014-atlas.html>; accessed: 20.07.2014.
3. Hermanowski T., *Szacowanie kosztów społecznych choroby i wpływu stanu zdrowia na aktywność zawodową i wydajność pracy*, Wolters Kluwer, Warszawa 2013.
4. Raport na zlecenie Związku Pracodawców Innowacyjnych Firm Farmaceutycznych INFARMA, *Metodyka pomiaru kosztów pośrednich w polskim systemie ochrony zdrowia*, Warszawa 2013.
5. Gajewski P., Jaeschke R., Brożek J. *Podstawy EBM, czyli medycyny opartej na danych naukowych dla lekarzy i studentów medycyny*, Medycyna Praktyczna, Kraków 2008.
6. Orlewska E., Nowakowska E., *Farmakoekonomika dla studentów i absolwentów Akademii Medycznych*, Wydawnictwo Akademii Medycznej im. Karola Marcinkowskiego w Poznaniu, Poznań 2004: 26–48.
7. Kissimova-Skarbek K., *Koszty obciążenia chorobami*, in: Golinowska S. (ed.), *Od ekonomii do ekonomiki zdrowia. Podręcznik ekonomiki zdrowia*, PWN, Warszawa 2015: 354–391.
8. Drummond M., Stoddart G., Torrance G., *Methods for the Economic Evaluation of Health Care Programmes*, Oxford Medical Publications, Oxford 1987.
9. International Diabetes Federation, *Diabetes Atlas Update 2012, 5th Edition*, Brussels, Belgium, 2012, <http://www.idf.org/diabetesatlas/5e/Update201211.03.2014>; accessed: 20.07.2014.
10. International Diabetes Federation, *Diabetes Atlas Update 2013 6th Edition*, Brussels, Belgium, 2013, <http://www.idf.org/diabetesatlas/download-book>; accessed: 2.07.2014.
11. Zhang Y., Dall TM., Mann SE. et al., *The economic costs of undiagnosed diabetes*, "Popul. Health Manag." 2009; 12 (2): 95–101.
12. Kissimova-Skarbek K., Pach D., Płaczkiwicz E., Szurkowska M., Szybiński Z., *Ocena ekonomicznego obciążenia cukrzycą społeczeństwa Polski*, "Polskie Archiwum Medycyny Wewnętrznej" 2001; 106, 3 (9): 867–875.
13. Kissimova-Skarbek K., *Ekonomika cukrzycy – wybrane zagadnienia metodologiczne*. "Zeszyty Naukowe IZP" 2007; V (1–2): 46–64.
14. Kinalska I., Niewada M., Głogowski C. et al., *Koszty cukrzycy typu 2 w Polsce (badanie CODIP)*, "Diabetologia Praktyczna" 2004; 5 (1): 1–58.
15. Kawalec P., Kielar M., Pilc A., *Koszty leczenia cukrzycy typu 1 i 2 w Polsce*, "Diabetologia Praktyczna" 2006; 7 (5): 287–294.
16. *Cukrzyca, Ukryta pandemia. Sytuacja w Polsce*, Edycja 2013.
17. Kawalec P., Pilc P., *Analiza kosztów leczenia powikłań cukrzycy poniesionych przez płatnika w Polsce w 2002 roku*, "Diabetologia Praktyczna" 2004; 5 (1): 9–14.
18. Leśniowska J., Schubert A., Wojna M. et al., *Costs of diabetes and its complications in Poland*, "Eur. J. Health Econ." 2014; 15 (6): 653–60.
19. Furman R., *Struktura kosztów cukrzycy*. Warszawa (na podstawie Raportu przygotowanego przez Akademię Leona Koźmińskiego) 2011.
20. Komunikaty Departamentu Gospodarki Lekami (DGL). Wartość refundacji cen leków według kodów EAN narastająco od początku roku do grudnia 2012 roku.
21. Obwieszczenie Ministra Zdrowia w sprawie wykazu refundowanych leków, środków spożywczych specjalnego przeznaczenia żywieniowego oraz wyrobów medycznych z okresu 2012 roku.
22. Zakład Ubezpieczeń Społecznych (ZUS) – Portal Statystyczny ZUS, <http://www.psz.zus.pl/>; accessed: 20.07.2014.
23. SMG/KRC, *Leczenie i koszty cukrzycy w Polsce*, 2007.