

## ANALYSIS OF DIABETIC PATIENTS HOSPITALIZATIONS IN POLAND BY GENDER, AGE AND PLACE OF RESIDENCE

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### ABSTRACT

**Background.** There are few updated data on rates of hospital mortality of diabetic patients and length of their hospital stay on a country level. To determine such rates we provided analysis using claims data from a Nationwide General Hospital Morbidity Study carried out by the National Institute of Public Health – National Institute of Hygiene (NIPH-NIH) in Warsaw from 2010 to 2018.

**Objective.** The aim of the study was to analyze the nine years changes of in-hospital morbidity and mortality in diabetic patients and length of hospital stay using a comparative approach by gender, age and place of residence.

**Material and methods.** The data on all patients from general hospitals in Poland treated because of diabetes were taken from a nationwide database, kept since 1979 by the Department for Monitoring and Analyses of Population Health of NIPH-NIH. This database contains information gathered under the Statistical Research Program of Public Statistics. Hospitalization rates were used to evaluate the ‘hospitalized’ incidence of diabetes (number of hospitalization cases due to diabetes per year by the analyzed unit of population). In-hospital mortality was calculated as the percentage of deceased patients out of all patients hospitalized due to diabetes.

**Results.** The number of cases and hospitalization rates of diabetic patients was rapidly declining by 18.8% for type 2 (E11) and 23.7% for type 1 (E10) diabetes. The downward tendency in the scope of hospitalization affected mainly older women and rural residents. Hospital mortality due to diabetes rose up dangerously to 3.77% exceeding the rates recorded eight years earlier.

**Conclusions.** The recent reduction in hospitalization rates of people with diabetes in Poland may be associated with an unexpected increase in hospital mortality.

**Key words:** *epidemiology, inpatient diabetes mellitus, mortality, length of hospital stay*

### STRESZCZENIE

**Wprowadzenie.** Niewiele jest aktualnych danych na temat śmiertelności szpitalnej pacjentów z cukrzycą i długości ich pobytu w szpitalu w skali kraju. W celu określenia takich wskaźników przeprowadzono analizę z wykorzystaniem danych z Ogólnopolskiego Badania Chorobowości Szpitalnej Ogólnej prowadzonego przez Narodowy Instytut Zdrowia Publicznego – Państwowy Zakład Higieny PIB w ramach Programu Badań Statystycznych Statystyki Publicznej w Polsce w latach 2010-2018.

**Cel.** Celem pracy była analiza dziesięcioletnich zmian chorobowości i śmiertelności szpitalnej pacjentów z cukrzycą i długości pobytu w szpitalu, stosując podejście porównawcze z uwzględnieniem płci, wieku i miejsca zamieszkania.

**Material i metody.** Dane o wszystkich pacjentach leczonych z powodu cukrzycy ze szpitali ogólnych w Polsce zaczerpnięto z ogólnopolskiej bazy danych, prowadzonej od 1979 r. przez Zakład Monitorowania i Analizy Stanu Zdrowia Ludności NIZP-PZH PIB. Baza ta zawiera informacje zebrane w ramach Programu Badań Statystycznych Statystyki Publicznej. Do oceny zachorowalności na cukrzycę „w szpitalu” (liczba hospitalizacji z powodu cukrzycy w ciągu roku w analizowanej jednostce populacji) wykorzystano wskaźniki hospitalizacji, śmiertelność szpitalną wyliczono jako odsetek zmarłych spośród wszystkich pacjentów hospitalizowanych z powodu cukrzycy.

**Wyniki.** Liczba zachorowań i hospitalizacji pacjentów z cukrzycą gwałtownie spadała: E11, typ 2 o 18,8% i E10, typ 1 cukrzycy o 23,7% w okresie objętym analizą. Tendencja spadkowa w zakresie hospitalizacji dotyczyła głównie starszych kobiet i mieszkańców wsi. Śmiertelność szpitalna z powodu cukrzycy wzrosła niebezpiecznie do 3,77% przekraczając wskaźniki notowane osiem lat wcześniej.

**Wnioski.** Obserwowane ostatnio zmniejszenie liczby hospitalizacji osób chorych na cukrzycę w Polsce przypuszczalnie wiąże się z nieoczekiwanym wzrostem śmiertelności szpitalnej.

**Słowa kluczowe:** *epidemiologia, cukrzyca, leczenie cukrzycy w szpitalu, śmiertelność szpitalna, długość pobytu w szpitalu*

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## INTRODUCTION

Diabetes mellitus is a group of metabolic diseases characterized by hyperglycemia, resulting from a defect in insulin secretion or action, and can damage many organs. Diabetes is recognized by the World Health Organization as a social illness, due to its spread and long-term consequences for affected people [10, 13, 20].

According to the estimates of the National Health Fund, from 1,800 up to 2,400 k people suffer from diabetes in Poland [18]. The analysis of the frequency of hospitalization of people with diabetes in Poland is based on data from a Nationwide General Hospital Morbidity Study carried out by the National Institute of Public Health National Institute of Hygiene (NIPH - NIH) from 2010 to 2018. The analysis takes into account the E10-E14 diagnoses, particularly E10 (type 1 diabetes) and E 11 (type 2 diabetes), according to revision 10 of the International Statistical Classification of Diseases and Health Problems (ICD-10). This work is a continuation of the analysis of hospitalization of diabetic patients conducted by NIPH – NIH in the years 1980-1999 [14] and 2005-2009 [7]

## AIMS

1. The assessment of the dynamics of changes in the frequency of hospitalization and the length of hospital stay of patients with diabetes in Poland in 2010-2018.
2. The analysis of hospitalization by sex and age.
3. The assessment of the dynamics of changes in hospital mortality of people hospitalized in 2010-2018 due to diabetes.
4. The assessment of territorial differentiation of hospital morbidity

## MATERIAL AND METHODS

The data on patients hospitalized in Poland because of diabetes were taken from a nationwide database, kept since 1979 by the Department for Monitoring and Analyses of Population Health of the National Institute of Public Health – National Institute of Hygiene in Warsaw. This database contains information gathered under the Statistical Research Program of Public Statistics. The data come from all general hospitals in Poland. The analyzed data relate to patients for whom the main cause of hospitalization was diabetes, as classified in the International Classification of Diseases and Health Problems ICD-10: E10 (insulin-dependent diabetes mellitus), E11 (non-insulin-dependent diabetes mellitus), E12 (malnutrition-related diabetes mellitus), E13 (other specified diabetes mellitus) and E14 (unspecified diabetes mellitus). Hospitalization

rates were used to evaluate the ‘hospitalized’ incidence of diabetes (number of hospitalization cases due to diabetes per year by the analyzed unit of population). In-hospital mortality was calculated as the percentage of deceased patients out of all patients hospitalized due to diabetes.

## RESULTS

### *Diabetes Mellitus: hospitalization rates in Poland*

Hospitalization frequency due to diabetes mellitus (E10-E14) in 2018 is much lower than in 2010 and 2014. Hospitalization rates per 100 k population were 231.5 in 2010, then 196.3 in 2014 and 188.1 in 2018. During the 9 analyzed years, these rates decreased by 18.8%.

Adult patients diagnosed with type 2 diabetes (E11) constitute the largest group of patients treated in hospital among diabetics, with 48,866 cases in 2010. Among these patients, the hospitalization rate decreased by 18.8%.

Another large group of hospitalized patients (37,215 people in 2010) is patients with type 1 (E10) diabetes (Table 1, Figure 1). Within 9 years, the frequency of hospitalization of these patients decreased by as much as 23.7%.

The remaining types of diabetes, E12-E14, concern smaller groups of patients (a total of 2323 cases in 2010) and, except for diabetes associated with malnutrition (E12), there was no downward trend in the frequency of their hospitalizations.

### **Diabetes-associated hospitalizations by age and gender groups**

During the 9 years analyzed, serious discrepancies in hospital treatment between women and men were observed. The negative percentage difference in the frequency of hospitalization of women was 25.5%. At that time, the frequency of male hospitalizations decreased by only 11.6%. The change in the hospital admission management of people with diabetes is therefore most visible for women. This trend is especially observed in the most numerous group of patients with type 2 diabetes (E11). Over the nine-year period, the difference in admission rates was 18.8%; at that time, the hospital admission of women decreased significantly by 24.9%, while that of men only by 11.7%.

The frequency of hospitalizations for type 2 diabetes increases very slowly with age, and rises after the age of 40 (Table 2, Figure 2). For example – the rate for women before the age of 40 was 39.1 per 100 k, while after the age of 80 – as many as 659.7.

In 2010-2018, there was a strong downward tendency in the frequency of hospitalization of patients with type 2 diabetes, especially in people over the age of 30, as younger patients were hospitalized more often

Table 1. Hospitalization trends in different types of diabetes mellitus in 2010, 2014 and 2018. Hospitalization rates per 100 k inhabitants

Type of diabetes	2010 N = 88409			2014 N = 75560.0			2018 N = 72240			Percentage difference 2010-2018		
	Overall	M	F	Overall	M	F	Overall	M	F	Overall	M	F
Overall	231.54	232.49	230.66	196.3	205.8	187.5	188.1	205.4	171.9	<b>-18.8</b>	<b>-11.7</b>	<b>-25.5</b>
E10	97.5	103.5	91.8	80.4	89.2	72.1	74.4	85.9	63.6	<b>-23.7</b>	<b>-17.0</b>	<b>-30.7</b>
E11	128.0	121.6	134	107.3	106	108.4	103.9	107.4	100.6	<b>-18.8</b>	<b>-11.7</b>	<b>-24.9</b>
E12	0.19	0.23	0.15	0.2	0.3	0.2	0.1	0.2	0.1	<b>-47.4</b>	<b>-13.0</b>	<b>-33.3</b>
E13	3.09	4.13	2.11	4.5	5.5	3.5	4.3	5.6	3.1	39.2	35.6	46.9
E14	2.83	3.07	2.59	4	4.8	3.3	5.3	6.2	4.4	87.3	102.0	69.9



Figure 1. Hospitalization trends in different types of diabetes (E10-E14 overall) in 2010-2018. Hospitalization rates per 100 k inhabitant

Table 2. Hospitalization trends in type 2 diabetes mellitus (E11) by age and gender (2010-2018). Hospitalization rate per 100 k inhabitants

Age groups (in years)	2010			2014			2018			Percentage difference 2010-2018		
	Overall	M	F	Overall	M	F	Overall	M	F	Overall	M	F
Overall	128.0	121.6	134.0	108.4	107.3	106	100.6	103.9	107.4	33.2	23.2	13.2
0-9	0.9	0.8	0.9	0.4	0.4	0.3	1.2	0.9	0.7	<b>-25.0</b>	<b>0.0</b>	<b>14.3</b>
10-19	2.9	2.3	3.5	3.1	3.1	3.1	2.8	3.3	3.8	<b>25.0</b>	<b>-12.1</b>	<b>-39.5</b>
20-29	4.4	5.1	3.7	3.6	4.8	5.9	5.7	6.3	6.9	<b>-35.1</b>	<b>-30.2</b>	<b>-26.1</b>
30-39	15.4	20.8	9.9	8.0	12.8	17.6	8.6	15.2	21.5	15.1	1.3	-3.3
40-49	62.2	85.3	39.1	27.9	49.4	70.8	24.4	44.1	63.6	60.2	41.0	34.1
50-59	176.0	226.2	129.7	98.1	134.6	173.1	80.0	115.6	152.6	62.1	52.2	48.2
60-69	353.3	388.2	325.0	227.1	264.5	309.2	180.2	228.9	286.6	80.4	54.3	35.5
70-79	533.6	484.8	564.3	435.0	423.4	405.4	389.2	402.0	420.8	45.0	32.7	15.2
80+	639.0	590.7	659.7	551.7	544.3	527.6	508.6	502.6	489.2	29.7	27.1	20.7

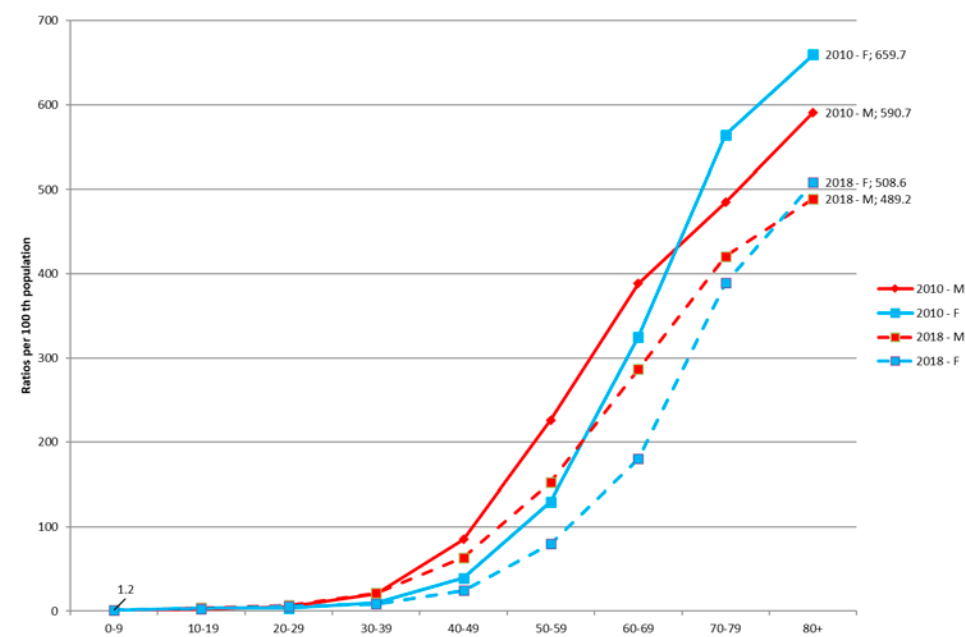


Figure 2. Hospitalization trends in type 2 diabetes mellitus (E11) by age and gender (2010-2018). Hospitalization rate per 100 k inhabitants

in 2010 compared to 2018. Both in 2010 and 2018, men were hospitalized more often than women, except for the oldest age groups (Table 3).

In the less common type 1 diabetes (E10), the incidence of hospitalization increases with age in both men and women, except for a decrease in the 20-29 age group. A significant increase in the number of hospitalizations occurs among men over 40 and among women over 50. There was a strong downward trend in the frequency of hospitalizations of patients with type 1 diabetes in 2010-2018, when the rate decreased by 33%: from 98 per 100 k down to 64 per 100 k population. However, this reduction

only applies to people over the age of 30. In younger patients treated for type 1 diabetes, an increase in the frequency of hospitalizations in those years was observed (Figure 3).

### Comorbidities

People with diabetes are known to suffer from other concomitant chronic diseases, which is confirmed in our material on hospitalized patients: every second person with type 2 diabetes and every fourth person with type 1 diabetes is also treated for cardiovascular disease. Gender does not differentiate these frequencies (Table 4).

Table 3. Hospitalization trends in type 1 diabetes mellitus (E10) by age and gender (2010-2018). Hospitalization rate per 100 k inhabitants

Age groups (in years)	2010 N = 37215			2014			2018			Percentage difference 2010-2018		
	Overall	M	F	Overall	M	F	Overall	M	F	Overall	M	F
Overall	97.5	103.5	91.8	80.4	89.2	72.1	74.4	85.9	63.6	31.0	20.5	44.3
0-9	54.4	51.6	57.4	54.4	53.8	55.1	58.4	58.8	58.0	-6.8	-12.2	-1.0
10-19	123.9	119.4	128.6	131.7	128.5	135.0	159.4	159.1	159.8	-22.3	-25.0	-19.5
20-29	40.7	40.4	41.1	38.5	38.2	38.7	41.7	46.8	36.3	-2.4	-13.7	13.2
30-39	46.9	57.0	36.5	39.3	47.8	30.5	40.8	49.5	32.0	15.0	15.2	14.1
40-49	62.1	83.9	40.3	52.6	69.0	36.0	43.1	59.0	27.0	44.1	42.2	49.3
50-59	104.7	137.8	74.1	78.8	106.6	52.4	60.6	83.6	38.5	72.8	64.8	92.5
60-69	179.8	211.6	154.0	121.5	158.1	90.9	91.4	125.7	62.4	96.7	68.3	146.8
70-79	229.0	231.6	227.4	164.2	178.4	155.0	132.8	155.0	117.8	72.4	49.4	93.0
80+	242.8	235.6	245.9	181.4	191.3	177.0	140.8	160.3	132.1	72.4	47.0	86.1

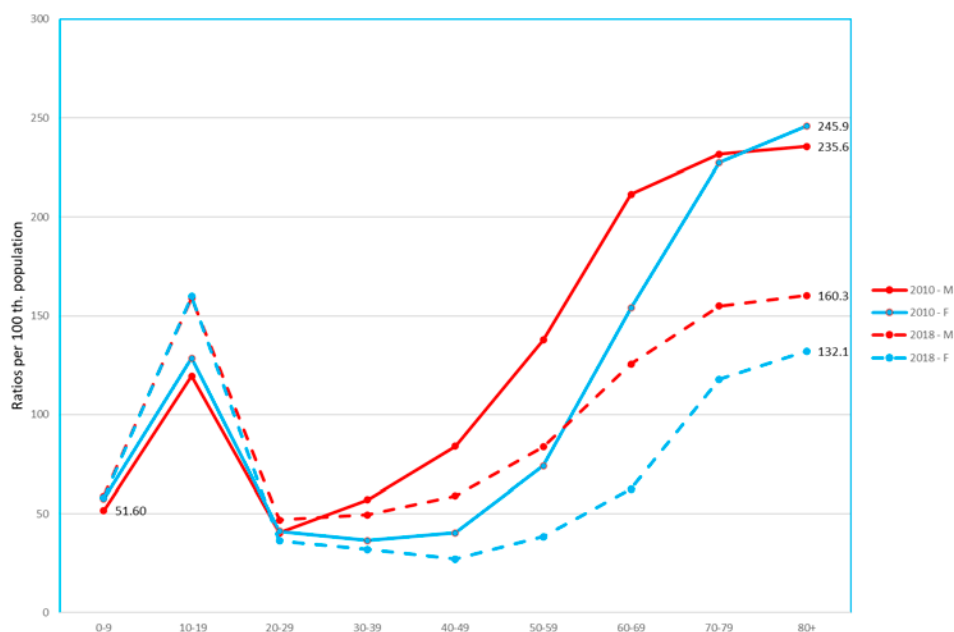


Figure 3. Hospitalization trends in type 1 diabetes mellitus (E10) by age and gender (2010-2018). Hospitalization rate per 100 k inhabitants

Table 4. The frequency of predominant concomitant diseases among hospitalized patients with diabetes mellitus in 2009 by gender and type of diabetes

Concomitant diseases	Type 1 diabetes (E10)			Type 2 diabetes (E11)		
	Overall	M	F	Overall	M	F
E00-E90	27.3	23.7	31.4	21.4	21.7	21.4
I00-I99	26.9	27.7	26.0	39.4	40.5	39.4
L00-L99	9.0	11.4	6.2	4.6	3.3	4.6
N00-N99	8.9	8.2	9.7	10.8	11.1	10.8
K00-K93	6.8	7.8	5.7	5.2	4.6	5.2
J00-J99	3.3	3.4	3.1	3.5	3.4	3.5
D50-D89	2.8	2.7	3.0	2.8	2.7	2.8
Other diseases	15.0	15.0	15.0	12.4	12.6	12.4

### Average length of hospital stay

The length of hospital stay in days is presented in Table 5 and Figure 4.

A very young patient usually stays less than a week. People aged 10-19 years stay in hospital for the shortest time: 4.5 days. The observation period does not change this trend. Each subsequent age group is hospitalized longer than the younger one. During the analyzed 9 years, the hospitalization of patients treated for the most common type 2 diabetes (E11) became significantly shorter, starting from the 20-29 age group. Nevertheless, most significant reductions in terms of hospital stay in the period 2010-2018 mainly affected women over the age of 70.

### Hospitalization of city and country dwellers

Data from Polish hospitals reveal that the place of residence is clearly related to the chance of inpatient treatment of the most common type 2 diabetes. In 2010-2018, the hospitalization rate decreased among urban patients by 17.5%, while among patients living in the countryside by as much as 20.8 % (Table 6, Figure 5).

### Territorial differences of diabetic patient hospitalization

In order to analyze the territorial differentiation of diabetic patient hospitalizations, the crude and standardized rates of hospitalization by voivodship and sex of patients treated in hospitals in 2010 and 2018 were calculated. It was found that men were hospitalized more often than women in all voivodships.

Table 5. The average length of hospital stay (in days) by age groups among diabetic patients (2010, 2014, 2018)

Age	2010						2014						2018					
	Overall		M		F		Overall		M		F		Overall		M		F	
	X	SD	X	SD	X	SD	X	SD	X	SD	X	SD	X	SD	X	SD	X	SD
Total	8.0	7.7	8.1	8.2	8.0	8.3	7.6	8.7	7.8	8.9	7.4	8.5	7.7	7.9	7.7	8.1	7.6	7.7
0-9	5.3	5.5	5.4	5.7	5.3	5.3	5.0	5.1	5.2	5.1	4.9	5.1	5.3	5.3	5.1	5.4	5.4	5.3
10-19	4.6	4.4	4.6	4.4	4.7	4.4	4.1	3.7	4.0	3.7	4.1	3.7	4.5	3.8	4.5	3.9	4.5	3.7
20-29	6.0	4.0	6.1	3.9	6.0	4.2	5.3	4.0	5.4	3.8	5.2	4.2	5.5	3.9	5.8	4.2	5.3	3.4
30-39	6.9	6.1	6.9	5.8	6.8	6.6	6.3	6.3	6.5	6.7	5.9	5.3	6.3	6.3	6.4	5.7	6.1	7.3
40-49	7.7	7.3	7.8	7.4	7.5	7.1	7.0	6.8	7.2	7.0	6.5	6.0	7.1	6.9	7.2	7.2	6.9	6.1
50-59	8.2	7.9	8.3	8.5	8.0	7.0	7.9	8.1	8.3	8.8	7.1	6.3	7.8	7.7	7.9	8.1	7.5	7.0
60-69	8.7	8.4	9.1	9.5	8.4	7.1	8.4	9.4	8.9	10.2	7.7	8.0	8.3	8.5	8.5	9.3	8.1	7.4
70-79	8.8	10.4	9.1	8.6	8.7	11.3	8.6	9.4	9.1	9.8	8.2	9.1	8.4	7.6	8.7	8.4	8.2	7.0
80+	8.6	7.5	8.7	8.3	8.6	7.2	8.8	11.0	9.0	10.6	8.7	11.1	8.5	9.8	8.8	9.0	8.5	10.2

M – Male; F – Female

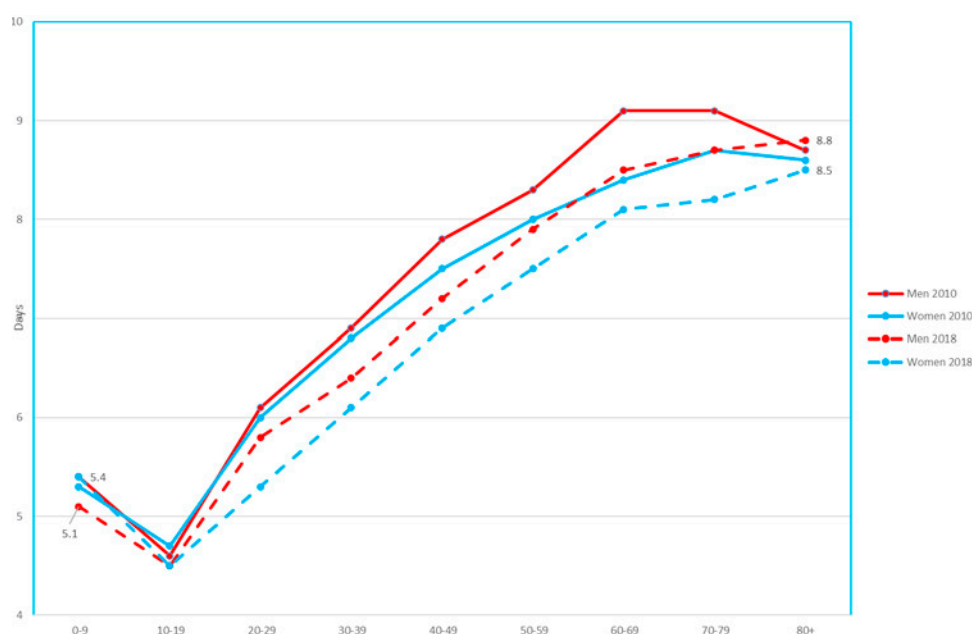


Figure 4. The average length of hospital stay (in days) by age groups among diabetic patients (2010 and 2018)

Table 6. Hospitalization trends in type 1 (E10) and type 2 (E11) diabetes mellitus by place of residence (2010-2018). Hospitalization rates per 100 k inhabitants

Item	2010			2014			2018			Percentage difference		
	M	F	Overall	M	F	Overall	M	F	Overall	M	F	Overall
<b>Urban</b>												
E10	108.7	92	99.9	84.7	72.2	82.5	89.8	63.9	76.2	18.9	28.1	23.7
E11	128.4	130.1	129.3	112.3	107.4	109.7	114.5	99.7	106.7	13.9	30.4	22.6
<b>Rural</b>												
E10	95.8	91.6	93.7	81.9	72	77.2	80	63.2	71.8	15.8	28.4	21.9
E11	111.5	140.3	126	96.4	110.2	103.6	96.8	102.1	99.8	14.7	38.2	26.2

M – Male; F – Female

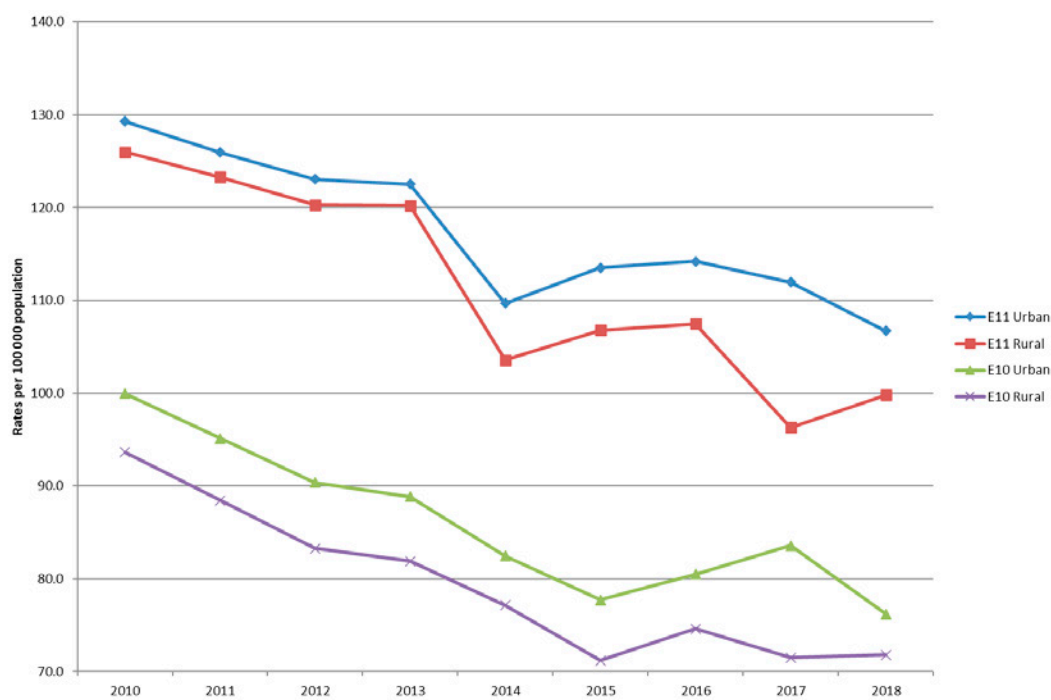


Figure 5. Hospitalization trends in type 1 (E10) and type 2 (E11) diabetes mellitus by place of residence (2010-2018). Hospitalization rates per 100 k inhabitants

For the standardized coefficients, this difference was on average 23% for type 1 diabetes and 22% for type 2 diabetes.

In 2018, this difference increased and for all voivodships it averaged 36% and 34% respectively for type 1 and type 2 diabetes. There were significant differences in the frequency of hospitalizations due to diabetes between voivodships both in 2010 and 2018

In 2010, patients with type 1 diabetes were hospitalized most often in the Lubuskie voivodship (132 per 100,000) and least often in the Śląskie voivodship (61 per 100,000), so the difference was more than twofold.

In 2018, patients with type 1 diabetes were most often hospitalized in the Lubuskie voivodship, but the rate of hospitalization was already lower (108.2 per 100,000). The least frequent hospitalizations were in the Małopolskie voivodship (45 per 100,000).

Among patients with type 2 diabetes, an equally high variability range of hospitalization rates is observed – in 2010, hospitalization rates were the highest in the Łódzkie voivodship (196 per 100,000), and the lowest in the Pomeranian voivodship (56 per 100,000). In 2018, the hospitalization variability for type 2 diabetes remained also very high. The most frequent hospitalizations were still in the Łódzkie

Table 7. Hospital mortality rates (%) due to type 1 and type 2 diabetes mellitus by age and gender (2005-2009)

Item	Type 1 diabetes mellitus				Type 2 diabetes mellitus			
	2010		2018		2010		2018	
	M	F	M	F	M	F	M	F
Overall	1.49	1.86	2.20	2.58	1.90	2.37	2.76	3.77
0-9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10-19	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00
20-29	0.08	0.00	0.09	0.23	0.00	1.06	0.00	0.00
30-39	0.60	0.68	1.02	0.40	0.00	0.11	1.06	0.75
40-49	0.99	0.72	1.06	0.55	0.53	0.51	0.11	1.22
50-59	1.07	0.76	1.66	1.68	0.68	1.26	0.51	1.16
60-69	1.79	1.83	3.03	3.56	1.38	2.18	1.26	2.05
70-79	3.56	2.91	5.75	4.29	3.21	5.58	2.18	2.78
80+	7.89	6.52	12.47	10.64	5.94	2.37	5.58	7.75

M – Male; F – Female

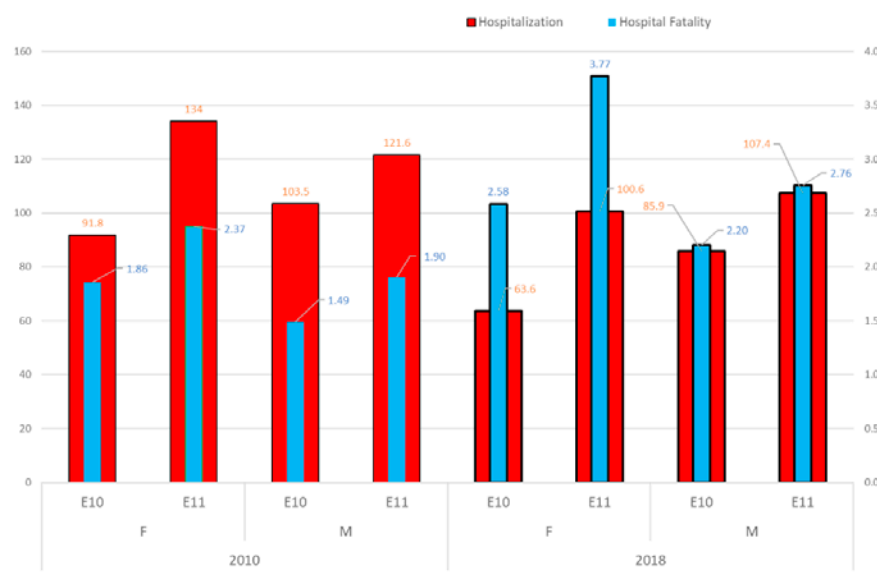


Figure 6. Hospitalization and hospital mortality due to diabetes in Poland in 2010 and 2018

voivodship (111 per 100,000), while the least frequent in the Zachodniopomorskie voivodship (30 per 100,000).

#### Hospital mortality rate

During the analyzed nine years, there was a dangerous significant change in terms of total hospital mortality, both among men and women. Particular attention should be paid to the significant increase in hospital mortality in these patients with age, especially after the age of 60, both for men and women. Among people aged 80 and over, the mortality rate even exceeds 10%. The mortality percentage of women admitted to hospital for type 2 diabetes (E11) increased sharply from 2.37 to 3.77 over the 9 years analyzed (Table 7, Figure 6).

## DISCUSSION

### The prevalence of diabetes in Poland. Diabetic patient hospitalization rates. Comparison between 1980 and 2018

According to the results of the presented analysis, over the nine-year period, the number of cases and hospitalization rates of diabetes per 100,000 population was rapidly declining. A comparison with the years 2005-2009 reveals a completely different picture of the situation – then, the number of hospitalized patients was increasing and the rates per 100,000 rose every year [7]. An even earlier study covering the years 1980-1999, due to the longest follow-up period, allowed for the conclusion that “after a decrease in the frequency of hospitalizations at the beginning of the 1980s, for the next 10 years, there was a constant increase” [14].

In the general population, type 2 diabetics constitute 85-90% of all diabetic cases [1, 2, 4, 17]. Among hospitalized cases, these are also the most numerous group of diabetic patients, but their percentage is smaller: 55.2. Other patients with type 1 diabetes and other types are represented more often than outside hospital. Therefore, hospitals are struggling with very risky situations: people who are undiagnosed before their hospital admission, patients with complications such as cardiovascular complications, retinopathy, diabetic foot syndrome, and patients who have to stay in the Intensive Care Unit [3, 9, 11, 12].

#### Territorial differences

The downward tendency in the scope of hospitalization affected rural residents more strongly than urban residents. This inequality persists despite the passage of time, which is not justified in the epidemiological situation and indicates a lack of control over the hospital treatment availability.

The picture of voivodship variability in the analyzed years is “mosaic” in nature and is very difficult to interpret. An objective assessment of the situation of the selected area requires taking into account regional diabetes prevention and treatment programs, local material and human resources, local government activity, the existence of patient associations, and other variables, which does not constitute the subject matter of our work.

When assessing the inter-voivodship diversification of diabetic patient hospitalizations, it can be concluded that the reduction in the frequency of diabetic patient hospitalizations recommended by diabetes specialists and health care organizers [15, 16, 17, 22] is implemented in Polish hospitals in all voivodships, which can be seen from the comparison of standardized



hospitalization rates in 2010 and 2018. More than twice as serious a concern is caused by epidemiologically unjustified differences between extreme voivodships in terms of the frequency of hospitalization of patients with type 1 diabetes and type 2 diabetes, which applies to both 2010 and 2018.

### Comorbidities, coronary heart disease

Diabetic patients are also treated in hospital for comorbidities, mainly ischemic heart disease. This most common health burden can lead to a diabetic patient dying prematurely. According to diabetologists, “the overriding goal of treating diabetes is to reduce the risk of cardiovascular complications and extend the life of patients” [5].

Shortening the period of inpatient treatment as a case of the general trend of financing in hospitals [2, 6]. The total length of hospital stay in Poland for all reasons is one of the shortest in the European Union countries [21]. According to *Gajewska's* analysis [7], the length of hospital stay decreased from 9.1 days to 8.1 days. In the following years, we observed a reduction in the hospital treatment of diabetic patients to 7.7 days, which has remained essentially unchanged

### High mortality and decreasing hospitalization rates over a 9-year follow-up

In 2010-2018, a shocking change took place, as shown in Figure 6. Hospital mortality due to diabetes rose dangerously in 2018, exceeding the rates recorded ten years earlier. The most common reason for hospitalization in the group of diabetic patients, type 2 diabetes (E11), is an area where there is a record increase in hospital mortality rate among women from 2.37 to 3.77% [1]. A similar process accelerated in a group of patients hospitalized for type 1 diabetes (E10). Mortality among people treated with type 1 diabetes increased the severity among women from 1.86 to 2.58% and among men from 1.49 to 2.20%.

The background of these unexpected, negative effects of diabetes hospitalization in 2010-2020 is the inexorable reduction in hospital admissions, shown in the same Figure 6. The hospitalization mortality rates decreased year by year, among women more dynamically than among men.

## CONCLUSIONS

The recent drastic reduction in hospitalization rates of people with diabetes in Poland is associated with an unexpected increase in hospital mortality among these patients and the disclosure of evident inequalities in access to hospital treatment among women, inhabitants of rural areas and some voivodships.

### Conflict of interest

*The authors declare no conflict of interest.*

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