

# Incidence of type 1 diabetes mellitus in age group 0–14 in Warmia and Mazury Region between 1994–2003

## Abstract

**Background.** The incidence rate of type 1 diabetes (T1DM) has dramatically increased in some countries. The aim of the study was to establish the annual incidence rate of T1DM in children under the age 15, detect any gender differences on the age of onset in Olsztyn Region during the years 1994–2003.

**Materials and methods.** Between 1994–2003 all newly diagnosed cases of T1DM in the age group 0–14 years in Olsztyn Region were recorded prospectively. General data on the population were taken from the Demographic Yearbook of Poland. Incidence in the group aged 0–14 years by age, sex, were calculated per 100,000 population.

**Results.** A total number of new cases registered 1994–2003 was 183. The incidence rate per year was 11.0 be-

fore age 15 years. There was no sex differences. In age group 10–14 the highest incidence was recorded — 12.7. Comparing 5-years periods the incidence was changing particularly in the youngest (0–9) age groups. During the 10-year observation period there was a significant tendency toward increasing incidence. The annual increase in incidence was 9.8%.

**Conclusions.** 1. The incidence rate per year was 11.0/100 000 in children before age 15 in Olsztyn Region. 2. In years 1994–2003 the incidence of T1DM was growing. 3. The annual increase in incidence was 9.8%.

**key words:** type 1 diabetes mellitus, children, epidemiology, incidence

## Introduction

The incidence of type 1 diabetes mellitus varies in different regions of the world; the highest and still growing incidence is noted in Finland (48.5/100 000/year), whereas the lowest in China (0.1/100 000/year) [1]. In Poland, incidence of type 1 diabetes mellitus was low and stable in 70s — 3.6/100 000/year but rose to 6.6/100 000/year in 80s [2]. In last decade the incidence of childhood diabetes has rapidly increased in Middle-East Europe and in Poland [3–7]. Epidemiological studies of

larger populations may reveal the influence of genetic and environmental factors that affect the onset of the disease.

The aim of the study was to establish the annual incidence of type 1 diabetes mellitus in children aged 0–14 with respect to age and gender in Olsztyn County between 1995 and 2003.

## Materials and methods

### Prospective register of type 1 diabetes mellitus

The following inclusion criteria were applied to register type 1 diabetes mellitus:

- age 0–14 years at onset;
- onset between 1/01/1994 and 31/12/2003;
- diagnosis of type 1 diabetes mellitus by physician according to WHO criteria (1985);
- the date of first injection of insulin was assumed as the date of diagnosis;

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Diabetologia Doświadczalna i Kliniczna 2006, 6, 5, 242–247  
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- permanent residence in Olsztyn or Olsztyn county (despite territorial changes after 01/01/1999 the register of type 1 diabetes mellitus, due to epidemiological considerations, covered the same area, formerly defined as Olsztyn County);
  - cases not confirmed as type 1 diabetes mellitus were excluded from register (MODY, type 2 diabetes mellitus, transient diabetes of the newborn).
- The register was approved by local Ethics Committee.

### Recording of the new cases

The cases of newly diagnosed type 1 diabetes mellitus were recorded from following sources:

- medical records of County Paediatric Hospital in Olsztyn (children and youngsters below 18 years of age);
- medical records of internal medicine departments of hospitals in Olsztyn County;
- registers of the County Diabetological Polyclinic for Children and Adolescent in Olsztyn;
- registers of the Warmia-Mazury Public Health Centre in Olsztyn [8–10].

Register tightness was evaluated by capture-recapture method.

### Incidence rate

Incidence rate was defined as the number of new cases of type 1 diabetes mellitus per 100 000 individuals per year, with 95% CI.

Incidence rate and trends of incidence were calculated for:

- the whole population aged 0–14 years;
- different age groups;
- girls and boys;
- two 5-years periods of observation: 1994–1998 and 1999–2003.

Statistical analysis of data was performed with Excel XP and Statistica 6,0 software.

## Results

In the period 1994–2003 183 newly onset type 1 diabetes mellitus were registered in age group 0–14 years (91 girls and 92 boys). The tightness of the register for that period was 99.1%.

Table 1 shows that mean incidence in observation period was 11/100 000/year [CI 9.4–12.5]. The highest incidence was in 2002 and 2003 [17.3/100 000/year (CI 10.5–24.1) and 17.2/100 000/year (CI 10.3–24.1)].

The incidence of type 1 diabetes mellitus for girls aged 0–14 was 11.2/100 000/year (CI 8.9–13.4) and for boys 10.8/100 000/year (CI 8.6–13) (Table 2).

For the whole studied population and for different age groups there were no statistically significant diffe-

**Table 1.** The incidence of type 1 diabetes mellitus in the age group 0–14 in years 1994–2003 in Warmia and Mazury Region, Poland

Years	Incidence rate* (95% CI)
1994	4.6 (1.6–7.7)
1995	11.7 (6.8–16.5)
1996	6.5 (2.8–10.2)
1997	9.0 (4.6–13.4)
1998	15.9 (9.9–21.9)
1999	10.4 (5.5–15.4)
2000	7.0 (2.9–11.2)
2001	13.9 (8.0–19.9)
2002	17.3 (10.5–24.1)
2003	17.2 (10.3–24.1)
1994–2003	11.0 (9.4–12.5)

\*Incidence rate per 100 000 of population/year

**Table 2.** The incidence rate of type 1 diabetes in the age group 0–14 according to sex in years 1994–2003 in Warmia and Mazury Region, Poland

Years	Incidence rate* (95% CI)	
	Girls	Boys
1994	3.2 (–0.4–6.7)	6.0 (1.2–10.9)
1995	9.8 (3.4–16.1)	13.5 (6.2–20.8)
1996	7.8 (2.0–13.6)	5.3 (0.7–10.0)
1997	11.5 (4.4–18.7)	6.6 (1.3–11.9)
1998	14.5 (6.3–22.6)	17.3 (8.5–26.0)
1999	8.8 (2.3–15.3)	12.0 (4.6–19.4)
2000	7.8 (1.6–14.1)	6.2 (0.8–11.7)
2001	13.6 (5.2–22.0)	14.2 (5.8–22.7)
2002	19.9 (9.5–30.3)	14.9 (6.1–23.6)
2003	19.1 (8.7–29.5)	15.4 (6.3–24.5)
1994–2003	11.2 (8.9–13.4)	10.8 (8.6–13.0)

\*Incidence rate per 100 000 population/year

rences with respect to gender. The highest incidence was observed in girls aged 5–9 and 10–14 — 13.7/100 000/year (CI 9.3–18.2) and 10.8/100 000/year (CI 7.2–14.4), respectively. In group of boys the highest incidence was noted between 10–14 years old 14.5/100 000/year (CI 10.4–18.5) and 5–9 years old 9.9/100 000/year (CI 6.3–13.6) (Table 3).

When periods 1994–1998 and 1999–2003 were compared, we found statistically significant increased incidence of type 1 diabetes mellitus in younger age groups. In group 0–4 incidence increased from 4.8/100 000/year (CI 2.1–7.5) to 10.7/100 000/year (CI 6.3–15.2) ( $P < 0.001$ ) and in group 5–9 increased from 9.3/100 000/year (CI 5.8–12.7) to 14.9/100 000/year (CI 10.1–19.7) ( $P < 0.001$ ) (Table 4).

**Table 3.** The incidence rate of type 1 diabetes in the age group 0–14 according to age subgroups and sex in years 1994–2003 in Warmia and Mazury Region, Poland

Age groups	Incidence index* (95% CI)			P
	Overall	Female	Male	
0–4	7.5 (5.0–10.0)	8.6 (4.7–12.4)	6.4 (3.2–9.7)	0.51
5–9	11.8 (8.9–14.7)	13.7 (9.3–18.2)	9.9 (6.3–13.6)	0.24
10–14	12.7 (10.0–15.4)	10.8 (7.2–14.4)	14.5 (10.4–18.5)	0.22
0–14	11.0 (9.4–12.5)	11.2 (8.9–13.4)	10.8 (8.6–13.0)	0.88

\*Incidence rate per 100 000 population/year

**Table 4.** The incidence rate of type 1 diabetes in the age group 0–14 according to age subgroups in two periods of observation (1995–1999 and 2000–2004) in Warmia and Mazury Region, Poland

Age groups	Incidence rate* (95% CI)			P
	1994–2003	1994–1998	1999–2003	
0–4	7.5 (5.0–10.0)	4.8 (2.1–7.5)	10.7 (6.3–15.2)	< 0.001
5–9	11.8 (8.9–14.7)	9.3 (5.8–12.7)	14.9 (10.1–19.7)	< 0.001
10–14	12.7 (10.0–15.4)	12.5 (8.8–16.1)	12.9 (8.9–17.0)	0.72

\*Incidence rate per 100 000 population/year

**Table 5.** Relative increase in incidence of type 1 diabetes in age group 0–14 in years 1994–2003 in Warmia and Mazury Region, Poland

Age groups	Increase in yearly incidence (%)
0–14	9.8
0–14 female	12.3
0–14 male	7.3

\*Increase in yearly incidence refers to mean values during observation period

Analysis of trends of incidence revealed annual increase of 9.8% in whole population. The annual increase of incidence in the age group 0–14 was higher in girls compared to boys — 12.3% and 7.3% respectively (Table 5).

## Discussion

In 90s many studies worldwide, particularly in Europe, provided data on increasing incidence of type 1 diabetes mellitus in children aged 0–14 [1, 11, 12].

Analysis of studies on incidence of type 1 diabetes mellitus in children aged 0–14 in 1994 in Olsztyn County showed the rate of 4.6/100 000/year. The only region with lower incidence was Wrocław County [3], in other regions incidence was higher: Kraków County 6.9,

Warszawa County 6.8, Białystok County 6.5 (age group 0–18), Silesia 7.28 and Rzeszów County 11.5/100 000 [3, 4, 13, 14].

The first epidemiological studies on incidence of type 1 diabetes mellitus in children aged 0–14 performed in Wielkopolska between 1970 and 1981 showed even lower rates (3.5/100 000/year). In periods 1982–1983 and 1982–1984 significant increase of incidence was observed — 6.1/100 000 and 6.6/100 000, respectively [2, 15]. In other regions of Poland in 80s the incidence was lower and mean values were: Rzeszów 5.11/100 000, Łódź Region 5.27/100 000 [5, 7]. The study “Trzy Miasta” (Three Cities) commenced in 1987, evaluated the incidence at 5.6/100 000 in Kraków County, 3.7/100 000 in Wrocław County and 2.1/100 000 in Warszawa County [3]. By the end of 80s, similar values of incidence were observed in other regions of Poland. In Białystok County in age group 0–18 the incidence was 4.6/100 000 and in Silesia in age group 0–14 — 4.7/100 000 [4, 14]. These observations were in concordance with data of EURODIAB Group, which included some centers from Poland. These data indicated relatively low incidence of type 1 diabetes mellitus in Poland [16].

In following years, the incidence of type 1 diabetes mellitus in age group 0–14 increased from 4.63 in 1994 to 17.2/100 000 in 2003, with mean 10.9/100 000. Similar values of incidence were found in other centers in Poland. The study “Trzy Miasta” showed increase of incidence in Kraków from 5.6 to 15.2 with mean 8.4;

in Wrocław from 3.7 to 13.2 with mean 6.5 and in Warszawa from 2.1 to 12.8 with mean 7.9/100 000/year [3]. Increase of incidence was also observed in Silesian region in period 1989–2002, mean value 5.67 between 1989 and 1995 rose to 10.88/100 000 between 1996–2002, which were comparable with mean values found in Olsztyn County [4, 17].

In about the same period (1988–1999) the incidence of type 1 diabetes mellitus in age group 0–18 in northeast Poland (Białystok) was lower, with mean 7.33/100 000 and increase from 4.6 to 10.1/100 000 [14].

This rapid increase of incidence in Middle-East Europe in the beginning of 90s was probably the effect of dynamic, economic transformations and environmental changes as the result of adaptation to Western standards.

In Western European countries and Sardinia the incidence rates of type 1 diabetes mellitus were quite high but stable in the respective period of time. The only exception was Finland [16], with growing incidence from 35 to 48.5/100 000 in period 1983–1998 [18].

In Olsztyn County the peaks of incidence of type 1 diabetes mellitus in age group 0–14 were noted in 1995, 1998, 2001, 2002 and 2003 (11.7, 15.9, 13.9, 17.3 and 17.2/100 000 respectively). Similarly, high values were observed in Warszawa, Kraków, Bydgoszcz and Upper Silesian Counties and also in Germany and Slovakia [3, 17, 19–22]. In other countries of Middle-East Europe incidence was lower, 5.7 in Bielarus, 9.9 in Czech Republic, 7.87 in Hungary, 11.2 in Estonia, 6.9 in Latvia and 7.3 in Lithuania [18, 23–25].

The highest incidence rates, not only in Europe but also worldwide, were found in Finland (48.5) and Sardinia (49.3) [18, 26], slightly lower in other Scandinavian countries and United Kingdom [1, 16, 27–30]. Outside Europe, high incidence, over 20/100 000, was noted in Canada, Australia, New Zealand and USA [1, 12, 31, 32]. In Asian populations and in part of South America incidence of type 1 diabetes mellitus was below 1/100 000 [1].

In our population, we found that in the age group 0–14 the incidence of type 1 diabetes mellitus increased by 9.8% annually and was the highest in Poland. In Upper Silesia, according to Chobot, the increase of incidence in age group 0–14 was 8.54% [4]. The studies of EURODIAB Programme revealed, that already in 1999 Poland reached the trend of increase of incidence comparable to other post-communistic countries [4, 16, 18, 22–24, 33, 34].

The same authors pointed out that mean trend of increase of incidence of type 1 diabetes mellitus was lower, only 3.2%, but was not distributed evenly. In 90s, the extremely high trend of increase was observed in Middle-East Europe [16]. It was assumed, that rapid increase of incidence was related to dynamic progress of

economic transformations and environmental changes as the result of adaptation to Western standards [4, 16, 18, 22–24, 33, 34]. Although the rates of incidence did not change much in Western Europe and Sardinia, it was still higher than in postcommunitic countries [1, 16, 18, 26, 28–30]. The results of our study showed, that incidence of type 1 diabetes mellitus in our County, in Poland and in Middle-East Europe remained lower than in Northern and Western Europe [4, 16, 18, 22–24, 33–35].

The incidence of type 1 diabetes mellitus in Olsztyn County during observation period was higher for girls than boys, but the difference did not reached statistical significance. The results of our study was in agreement with studies from other regions of Poland [3, 4, 6, 13, 20]. In countries with low incidence of type 1 diabetes mellitus, the girls were more prone to diabetes than boys, whereas in countries with high incidence rates the opposite trend was observed. Again, these differences were not statistically significant [28, 32, 36–38]. Very few studies reported the differences related to gender [14, 26, 35, 39].

In our group of patients with type 1 diabetes mellitus from Olsztyn County we found that peak incidence appeared in younger age for girls than for boys. The highest incidence for girls was observed at age 5–9 (13.7/100 000), whereas for boys at age 10–15 (14.5/100 000). The same pattern of incidence was found in populations in Upper Silesia and Łódź Macroregion [4, 7] and also in other European countries: Sweden, Lithuania, Belgium, Italy and Sardinia and Latvia [18, 26, 35–38].

The incidence of type 1 diabetes mellitus from Olsztyn County was the highest at age of puberty, 10–14 years, with mean of 12.7/100 000. The increase of incidence of type 1 of diabetes was also documented by other authors worldwide [3, 6, 7, 14, 16, 20, 26, 28, 35, 36, 40]. This phenomenon is usually explained by physiological insulin resistance at age of puberty, with increased demand of insulin and subsequent exhaustion of islet cells in children with genetic predisposition.

However the high incidence of diabetes at age 10–14 is well recognized and explained, the increasing incidence in younger age, below 9 and particularly below 4, has become more alarming phenomenon [6, 16, 27, 29, 36, 37, 39, 40–42]. We made the same observation in our region. In age group 0–4 the mean incidence rate in periods 1994–1998 and 1999–2003 increased significantly from 4.8 to 10.7/100 000 and in the age group 5–9 from 9.3 to 14.9/100 000, respectively. Similar results were found in other parts of Poland. In “Trzy Miasta” project, analysis of incidence in Wrocław County revealed significant increase of incidence of type 1 diabetes mellitus in children aged 0–4 and 5–9 [13]. Chobot found the highest increase of incidence before age of 4 and in Bydgoszcz County between 5 and 9 years

old [4, 20]. The highest increase of incidence in age group 0–4 was documented in Finland, Belgium, France and Switzerland [37, 39, 41, 42] and also in age group 5–9 in Italy, Sweden and France [27, 40, 41]. EURODIAB Group found that annual increase in incidence in age group 0–4 was 4.8%, while in older groups was lower — 5–9 years 3.7% and 10–14 years 2.1% per year [16].

Many authors discussed possible reasons of shifting the peak of incidence of type 1 diabetes mellitus towards younger age, which was the case in those countries where overall incidence was high, like Finland, United Kingdom or Switzerland [29, 39, 42]. According to EURODIAB Group, the recent increase of incidence in the youngest age groups was the result of environmental changes. Infections affecting fetal life and perinatal period were potential threatening factors as well as ingestion of cow milk proteins [16]. These factors are still hypothetical, as identification of underlying mainspring remains a difficult task.

## Conclusions

1. The mean incidence rate of type 1 diabetes mellitus in Olsztyn County in children aged 0–14 was 11/100 000/year.
2. In the period 1994–2003 there was increasing trend of incidence of type 1 diabetes mellitus in age group 0–14.
3. The incidence increased by 9.8% annually.

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