САХАРНЫЙ ДИАБЕТ У ДЕТЕЙ И ПОДРОСТКОВ ПО ДАННЫМ ФЕДЕРАЛЬНОГО РЕГИСТРА РОССИЙСКОЙ ФЕДЕРАЦИИ: ДИНАМИКА ОСНОВНЫХ ЭПИДЕМИОЛОГИЧЕСКИХ ХАРАКТЕРИСТИК ЗА 2013–2016 ГГ.

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ОБОСНОВАНИЕ. Данные регистра являются основным источником информации о пациентах с сахарным диабетом (СД) для повышения качества организации лечебной и профилактической помощи.

ЦЕЛЬ. Провести анализ эпидемиологических характеристик СД (распространенности, заболеваемости, смертности) у детей и подростков в РФ по данным Федерального регистра СД, оценить динамику данных параметров за период 2013–2016 гг., состояние углеводного обмена, структуру инсулинотерапии, частоту госпитализаций и частоту развития диабетических осложнений в данных возрастных группах.

МАТЕРИАЛЫ И МЕТОДЫ. Объектом исследования является база данных Федерального регистра СД – 81 региона РФ, включенного в систему онлайн-регистра.

РЕЗУЛЬТАТЫ. Общая численность пациентов с СД до 18 лет в РФ на 31.12.2016 г. составила 33 081 человек, из них с СД 1 типа (СД1) – 95,9% (31 727 чел.) и СД 2 типа (СД2) – 4,1% (1354 чел.). Распространенность СД1 в 2013–2016 гг. у детей составила 81,0–91,4/100 тыс. детского населения (д.н.), у подростков – 212,8–209,5/100 тыс. подросткового населения (п.н.). Заболеваемость СД1 у детей в 2016 г. составила 14,2/100 тыс. д.н., у подростков – 10,0/100 тыс. п.н. Распределение по уровню HbA_{1c} у пациентов с СД1 в 2016 г: дети: <7,5% – 32%, 7,6–9,0% – 33%, >9% – 35%; подростки: <7,5% – 25%, 7,6–9,0% – 30%, >9% – 45%. Среди осложнений у детей и подростков наиболее часто регистрируется диабетическая нейропатия при СД1 в 10,9% и 40,8% случаев, при СД2 – в 4,7% и 8,8% соответственно, из сопутствующих заболеваний – артериальная гипертония и дислипидемия. Госпитализировались в анамнезе 43,8% детей и 49,2% подростков, большинство госпитализаций в 2016 г. (дети 71,9%, подростки 67,1%) было по причине СД.

ЗАКЛЮЧЕНИЕ. Установлено, что в динамике 2013–2016 гг. сохраняется рост распространенности СД1 у детей при относительно стабильных показателях у подростков. По данным регистра, в последние два года отмечено снижение темпов заболеваемости СД1 и, напротив, рост заболеваемости СД2 у детей. Установлены значительные межрегиональные различия в уровне заболеваемости и распространенности СД в регионах, расположенных в различных географических областях РФ. Частота диабетических осложнений у детей и подростков с СД варьирует. Установлена четкая связь частоты госпитализаций с выраженностью декомпенсации СД. В структуре терапии данной возрастной группы соотношение инсулинотерапии в шприцах-ручках и помповой терапии по данным регистра составляет 80,9%/15,1%.

КЛЮЧЕВЫЕ СЛОВА: сахарный диабет; эпидемиология; дети; подростки; распространенность; заболеваемость; смертность

DIABETES MELLITUS IN CHILDREN AND ADOLESCENTS ACCORDING TO THE FEDERAL DIABETES REGISTRY IN THE RUSSIAN FEDERATION: DYNAMICS OF MAJOR EPIDEMIOLOGICAL CHARACTERISTICS FOR 2013–2016

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BACKGROUND: The data of the register is the main source of up-to-date information about patients with diabetes mellitus (DM). It's very important for improving the quality of medical care organization.

AIMS: to analyze the main epidemiological DM characteristics in Russian Federation (RF) (prevalence, incidence, mortality) in children and adolescents, to assess the dynamics of these parameters for the period 2013 – 2016, to analyze the status of compensation for carbohydrate metabolism, therapy of DM1, prevalence of diabetic complications and the reasons for hospitalizations in these age groups.

MATERIALS AND METHODS: The database of Federal DM registry of 81 regions was included in the online system.

RESULTS: The total number of patients under the age of 18 with DM in RF on 31.12.2016 was 33081 people, there were 95,9% (31727 people) with DM1 and 4,1% (1354 patients) with DM2. The prevalence of DM1 in 2013–2016 in children: 81.0 –

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91.4 / 100 ths., in adolescents – 212,8–209,5 / 100 ths. The DM1 incidence/100 thousand population in 2016 in children was 14,2/100 ths., in adolescents 10,0/100 ths. HbA_{1c} levels in DM1 was in children: <7,5% in 32%, 7,6–9,0% in 33%, >9% in 35% of the patients; in adolescents <7,5% in 25%, 7,6–9,0% in 30%, >9% in 45% of the patients. Among complications in children and adolescents with DM1, diabetic neuropathy is the most often recorded (in 10,9% of cases and 40,8%, respectively); among DM2 patients, diabetic neuropathy is registered in 4,7% and 8,8% in children and adolescents, respectively. There are associated diseases in DM2 patients – arterial hypertension and dyslipidemia. 43,8% of children and 49,2% of adolescents were hospitalized in the anamnesis, most hospitalizations in 2016 (children 71,9%, adolescents 67,1%) were due to diabetes.

CONCLUSIONS: It is established that in the dynamics of 2013–2016 the prevalence of DM1 in children continues to increase, with relatively stable indicators in adolescents. According to the register, during last two years there has been a decrease in the incidence of DM1 and, on the contrary, an increase in the prevalence/incidence of DM2 in children. Significant interregional differences in the level of incidence/prevalence have been established, especially in regions located in various geographic regions of the RF. The frequency of diabetic complications in children and adolescents with diabetes varies. There is an association of hospitalizations with higher HbA_{1c} level. In the structure of therapy of this age group the ratio of insulin therapy in syringes-pens and pump therapy is 80.9% / 15.1% according to the register.

KEYWORDS: diabetes mellitus; epidemiology; diabetes registry; prevalence, adolescents; incidence; mortality

The organisation of treatment and preventive care for children and adolescents with diabetes mellitus (DM) is a priority in the healthcare system of all countries of the world. DM is the most common endocrine and metabolic disorder in children [1]. Thus, according to the International Diabetes Federation (IDF), in 2000 there were 395,000 children with type 1 DM (DM1) worldwide. In 2017, according to the eighth edition of the IDF atlas [2], the total number of patients with DM1 younger than 20 years increased to 1,106,000, which included 586,000 children (age < 15 years), with total number of children in the world population of 1.94 billion. Approximately 96,100 children fall ill with DM1 every year, with the highest incidence rates recorded in the United States, India and Brazil; according to IDF, Russia ranks sixth in the number of new cases of DM1 in children per year (3100/year).

In the Russian Federation, epidemiological studies in children and adolescents were initiated by the Endocrinology Research Center in the 1990s. The first data on the prevalence of DM in children in the Moscow population were published in 1999 [3]. Currently, the main source of epidemiological characteristics of DM in different age groups is the Federal (formerly State) Register of DM patients.

Since 1996, the Federal State Budgetary Institution National Medical Research Center for Endocrinology of the Ministry of Health of Russia has been the key methodological and organisational reference centre of the Federal Register of DM Patients in the Russian Federation, based on Order No. 404 of the Ministry of Health of the Russian Federation dated 10 December 1996, within the framework of the Federal Targeted Program 'Diabetes mellitus' (then on paper carriers). Since 2014, the DM register has been transformed into a single electronic database of the Russian Federation with authorised online access, including most regions of Russia in 2017 (81 regions of the Russian Federation). This has enabled improvement in the quality of assessment of the prevalence of DM and diabetic complications in the Russian Federation [4].

In the modern presentation, the DM register is an automated information and analytical system for clinical and epidemiological monitoring of DM in the whole country. The DM register provides for monitoring patients from the moment of inclusion in the register throughout the period of the disease, recording the presence and type of complications, carbohydrate metabolism and other laboratory parameters, as well as evaluation of the structure of therapy in dynamics and analysis of the structure of mortality.

AIM

We analysed the main epidemiological characteristics of DM in children and adolescents in the Russian Federation (prevalence, incidence, mortality), and the state of compensation of carbohydrate metabolism according to the Federal Register of DM Patients, to assess the dynamics of these parameters between 2013 and 2016. We also analysed the frequency of diabetic complications, causes of hospitalisations in these age groups and schemes of insulin therapy.

METHODS

The object of the study was the database of the Federal Register of DM Patients covering 81 regions of the Russian Federation, included in the online register system.

The total number of children and adolescents with DM in the Russian Federation was indicated by data as of 31 December 2016 (79 regions from the online register and 6 regions that did not work online in 2016, according to the Federal State Statistics Service [Rosstat]) [5]. Rates of prevalence, incidence and mortality were presented for the 81 regions of the Russian Federation, included in the online register in 2017.

To calculate the prevalence, incidence and mortality rates for 100,000 cases in the paediatric (p.p.; children aged less than 15 years) and adolescent (a.p.; 15–18 years old) populations, information on the population in the regions of the Russian Federation was used according to the Rosstat [6]. Prevalence was an indicator that estimated the number of all cases of the disease, registered in the current calendar year. Incidence (primary, on applying to hospital) was an indicator that estimated the number of new cases of the disease, first recorded in the current calendar year. Mortality was an indicator that estimated the number of deaths among patients with this disease. Prevalence, incidence and mortality were calculated for 100,000 of the population of the corresponding age group.

Table 1. Indicators of prevalence of DM in children and adolescents per 100,000 people as of 31 December 2016 (81 regions of the Russian Federation according to the online register)

81 regions of the RF	Number of people, n				Per 100,000 population			
	DM1	DM2	Other DM types	Total	DM1	DM2	Other DM types	Total
Children (0–<15)	21 636	993	129	22 758	91.4	4.2	0.5	96.1
Adolescents (15–<18)	8062	279	47	8388	209.5	7.2	1.2	217.9
Total <18 years old	29 698	1272	176	31 146	107.9	4.6	0.6	113.1

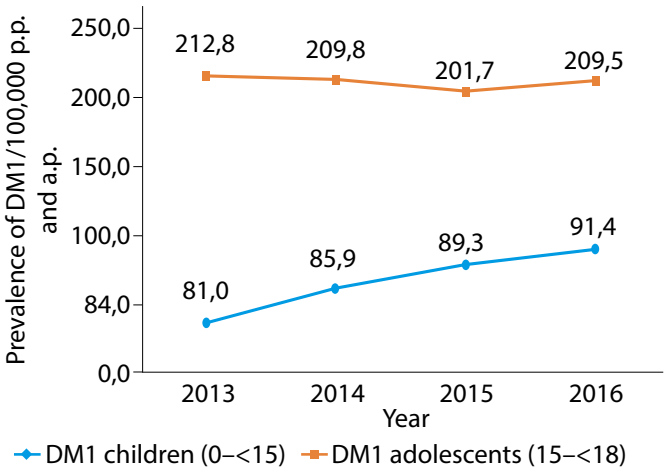

Figure 1. Dynamics of prevalence of DM1 in children and adolescents/100,000 population, 2013–2016, 81 regions in the Russian Federation.

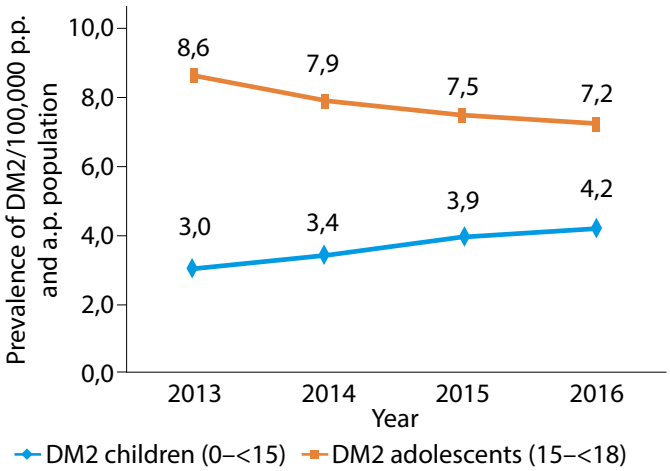

Figure 3. Dynamics of prevalence of DM2 in children and adolescents/100,000 population, 2013–2016, 81 regions in the Russian Federation.

RESULTS

Analysis of DM Prevalence in Children and Adolescents in the Russian Federation

The total number of children and adolescents with DM as of 31 December 2016 in the Russian Federation was 33,081, of whom 95.9% (31,727 patients) had DM1 and 4.1% (1354 patients) had type 2 DM (DM2) [5].

The prevalence of DM per 100,000 population, according to the online register in the 81 regions of the Russian Federation is presented in Table 1. Data for each of the 81 regions are presented in Appendix 1.

Type 1 DM (DM1)

The prevalence rate of DM1 per 100,000 of the population indicated the primary increase in this indicator among children (from 81.0 to 91.4/100,000 p.p. in 2013–2016) with a relatively stable prevalence of DM1 in adolescents (212.8 vs. 209.5/100,000 a.p., respectively; Fig. 1). The age distribution in the groups reflected a steady increase in the number of patients with DM1 among those <18 years in all age groups, namely 5 to 9 years, 10 to 14 years, and 15 to <18 years, except for the group 0 to 4 years old, where a stable number of patients was noted for 4 years (Fig. 2).

According to the data as of 1 January 2012, where the questionnaire information from the regions and the data of the State Register of DM were analysed in aggregate, the prevalence of DM1 in children as of 1 January 2012 was 72.8/100,000 p.p. [7]. Thus, as of 31 December 2016, the prevalence of DM1 in children was 1.25 times higher than in 2012 (91.4/100,000 p.p.). In an earlier analysis of DM1 prevalence in children in the Russian Federation over a 10-year period (2000–2009),

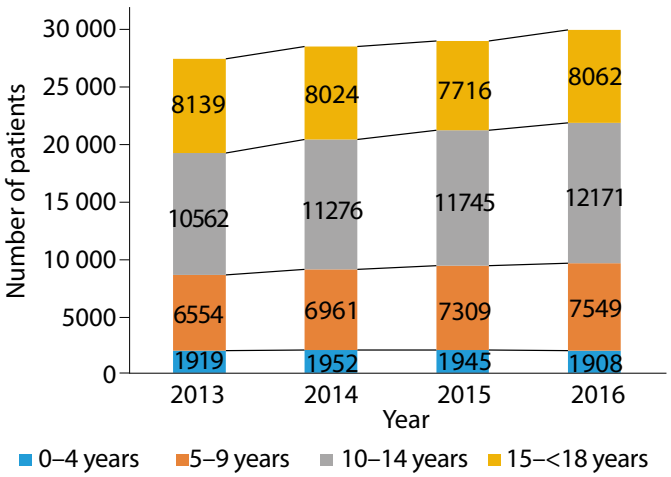

Figure 2. Dynamics of the number of DM1 patients <18 years old, by age groups, 2013–2016, 81 regions in the Russian Federation.

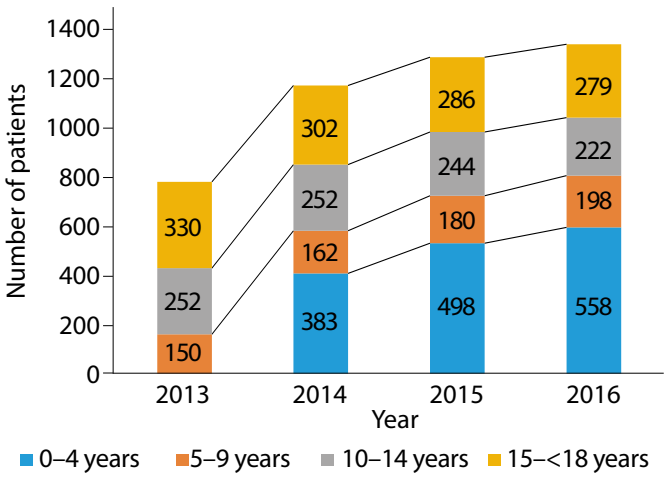

Figure 4. Dynamics of the number of DM2 patients <18 years old, by age groups, 2013–2016, 81 regions in the Russian Federation.

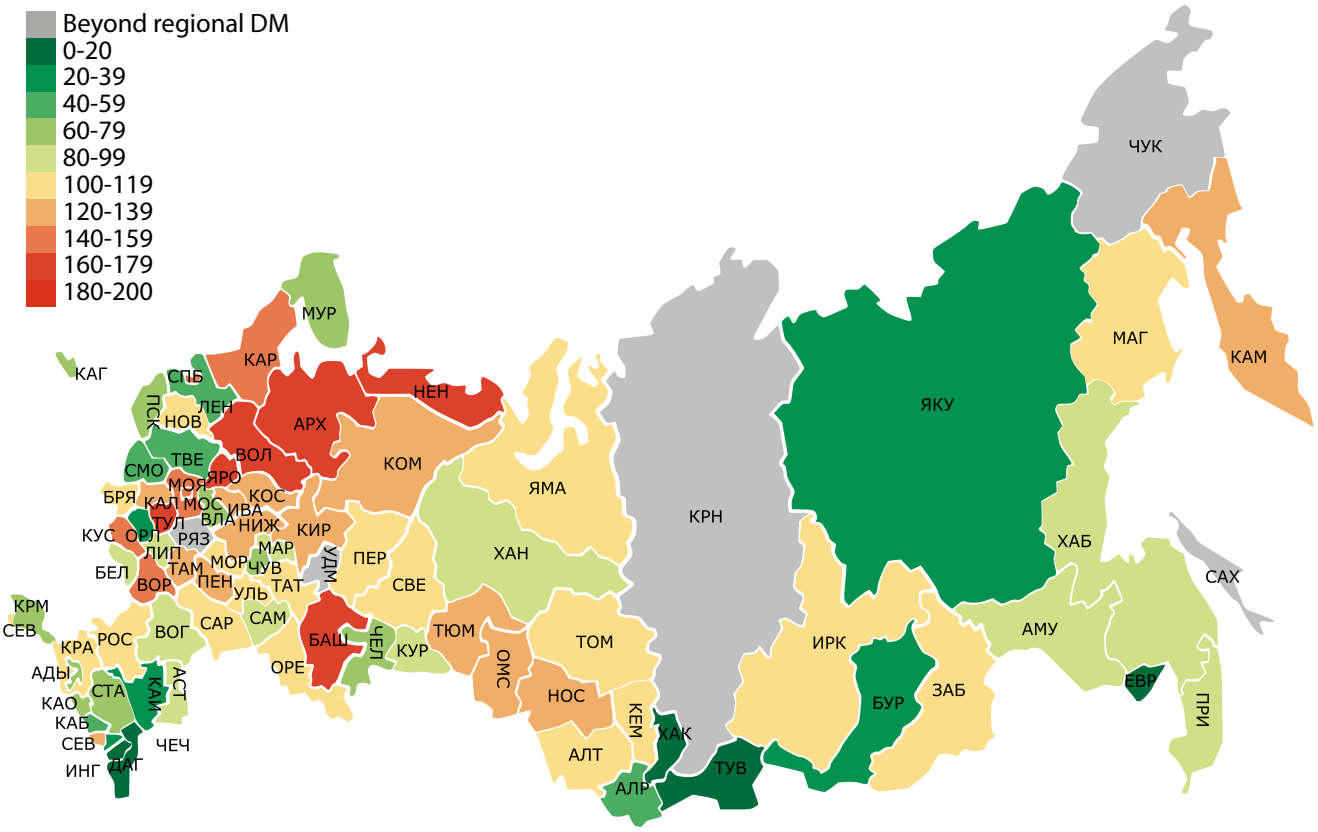

Figure 5. The prevalence rate of DM1 per 100,000 population <18 years old (children and adolescents).

Table 2. Analysis of DM prevalence (%) depending on the place of residence of patients <18 years of age

Populated area	DM1		DM2	
	2015	2016	2015	2016
City	20 440 (71.4%)	21 054 (71.0%)	656 (55.1%)	635 (52.0%)
Town/Village	6208 (21.7%)	6417 (21.7%)	384 (32.3%)	405 (33.1%)
No data available	1984 (6.9%)	2165 (7.3%)	150 (12.6%)	182 (14.9%)

the prevalence rate increased from 59.4 to 80.6 per 100,000 p.p. [8].

Similar tendencies can be traced in the group of adolescents. The prevalence as of 1 January 2012 was 92.6 per 100,000 a.p. [7]; thus, in 2016 this indicator increased by 2.26 times and amounted to 209.5 per 100,000 a.p. In the analysis of DM1 prevalence in adolescents in the Russian Federation (2000–2009), the prevalence rate increased from 108.5 to 183.5 per 100,000 a.p. [8]. Data on DM2 in children and adolescents have not been analysed previously to our knowledge.

Type 2 DM (DM2)

Dynamics of the prevalence of DM2 per 100,000 p.p. also demonstrated the primary increase in this indicator among children (from 3.0–4.2/100,000 p.p. in 2013–2016; Fig. 3). In the a.p. population, there was a slight decrease in the prevalence of DM2 (from 8.6/100,000 a.p. in 2013 to 7.2/100,000 a.p. in 2016). The dynamics of the number of patients with DM2 among those <18 years old by age groups of 0 to 4, 5 to 9, 10 to 14 and 15 to <18 years confirmed the general tendencies (Fig. 4) [2]. The increase in the number of children with DM2 in the younger age group from 0 to 4 years was the most pronounced, which may reflect an earlier diagnosis of DM2 in children.

Thus, children aged 0 to 14 years represented the highest-risk cohort, where not only the increase in the prevalence of DM1, pathognomonic for this age group, is noted but also an increase in the prevalence of DM2. This dangerous tendency may result from the high prevalence of overweight and obesity not only in adults but also in children. Existing world data confirm similar tendencies in other countries of the world [2]. Given the expected duration of DM in the onset in childhood, the risk of development of chronic diabetic complications increases, which is very likely to become a serious healthcare problem due to severe

Table 3. The incidence rates of DM in children and adolescents per 100,000 people as of 31 December 2016 (81 regions of the Russian Federation according to the online register).)

81 regions of the RF	Number of people.				Per 100,000 population			
	DM1	DM2	Other DM types	Total	DM1	DM2	Other DM types	Total
Children (0–<15)	3352	228	26	3606	14.2	1.0	0.1	15.3
Adolescents (15–<18)	384	44	6	434	10.0	1.1	0.2	11.3
Total <18 years old	3736	272	32	4040	13.6	1.0	0.1	14.7

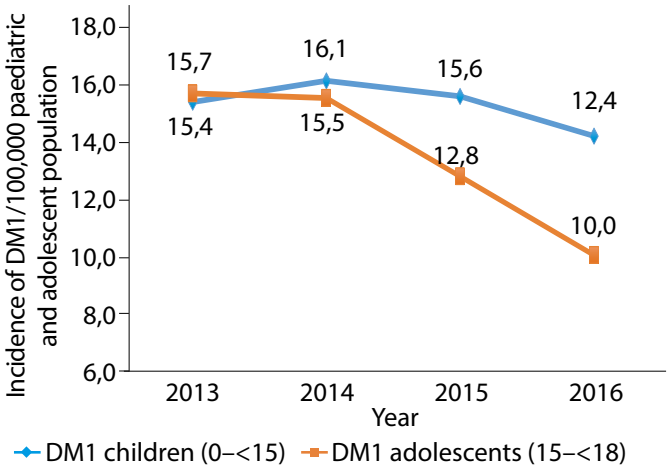

Figure 6. Dynamics of incidence of DM1 in children and adolescents/100,000 population, 2013–2016, 81 regions in the Russian Federation.

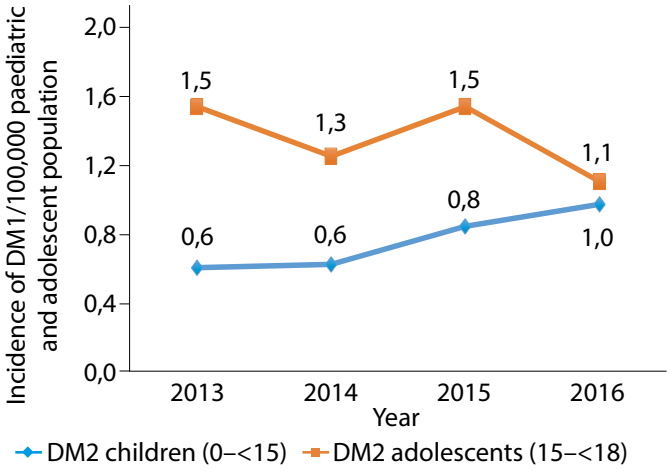

Figure 8. Dynamics of incidence of DM2 in children and adolescents/100,000 population, 2013–2016, 81 regions in the Russian Federation.

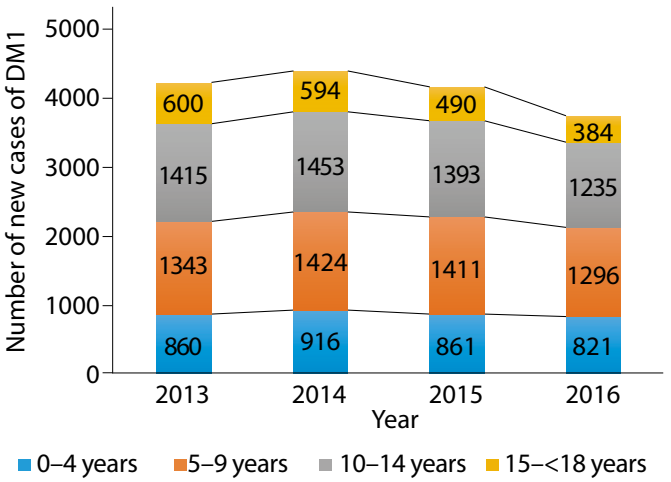

Figure 7. Dynamics of the number of new cases of DM1 per year in patients <18 years old by age groups, 2013–2016, 81 regions in the Russian Federation.

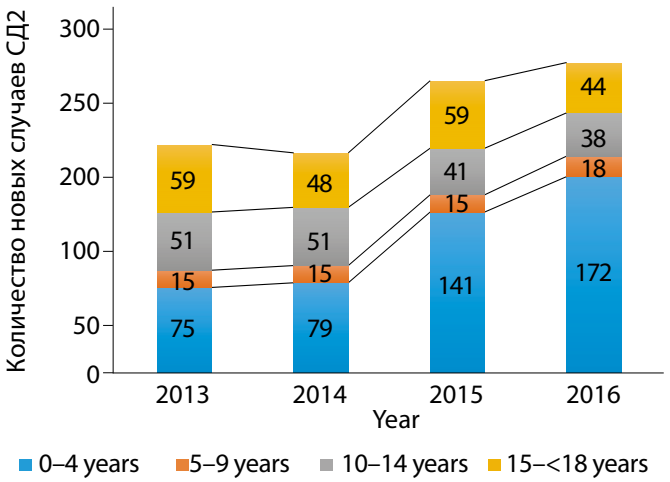

Figure 9. Динамика количества новых случаев СД2 в год у лиц до 18 лет по возрастным группам, 2013–2016 гг., 81 регион РФ.

health consequences of patients and social harm to society as a whole. This aspect of the DM epidemic in children requires the focused attention of health authorities.

Data on the prevalence of DM1 per 100,000 population in patients <18 years indicates the significant geographical differences in the indicator (Fig. 5), which is the classical 'north-south' and 'west-east' gradient, with the highest prevalence of DM1 in the northwestern regions of the Russian Federation [3, 7, 9, 10].

Among the analysis of factors influencing the epidemiological situation of DM, much attention is paid to the processes of urbanisation and the influence of environmental factors on the development and course of the disease and its complications [7]. According to the Federal Register, significantly higher prevalence rates of DM among the paediatric population of cities has been recorded (Table 2).

Analysis of Incidence of Diabetes Mellitus in the Russian Federation

The incidence rates of DM per 100,000 of the population according to the online register in the 81 regions of the Russian Federation for 2016 are presented in Table 3. Data for each of the 81 regions are given in Appendix 2.

Type 1 DM (DM1)

The dynamics of the incidence of DM1 in children per 100,000 p.p. indicated the peak of the indicator in 2014 with a value of 16.1 per 100,000 p.p. and further reduced to 14.2 per 100,000 p.p. in 2016; in adolescents a decrease from 15.7 per 100,000 a.p. in 2013 to 10.0 per 100,000 a.p. in 2016 was reported (Fig. 6). According to the data of 1 January 2012, where the questionnaire data from the regions and the data of the State Registry

Table 4. Mortality rates for DM in children and adolescents per 100,000 population as of 31 December 2016 (81 regions of the Russian Federation according to the online register).

81 regions of the RF	Number of people			Per 100,000 population		
	DM1	DM2	Total	DM1	DM2	Total
Children (0–<15)	12	9	21	0.05	0.04	0.089
Adolescents (15–<18)	4	1	5	0.10	0.03	0.13
Total <18 years old	16	10	26	0.06	0.04	0.095

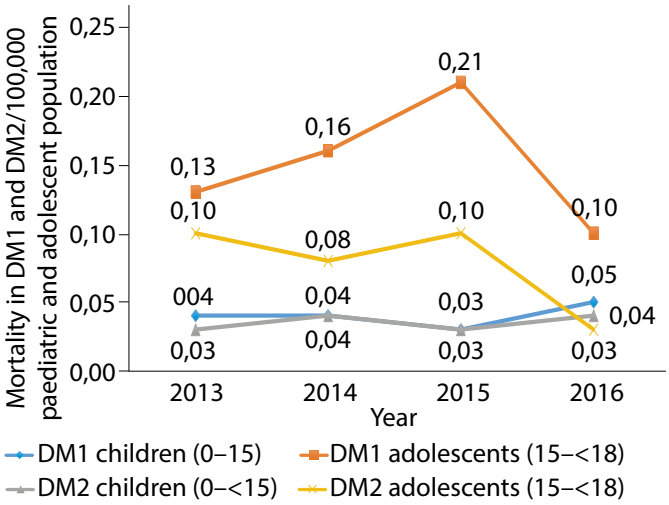

Figure 10. The dynamics of mortality in children and adolescents with DM1 and DM2/100,000 population, 2013–2016, 81 region of the Russian Federation.

of DM were analysed in aggregate, an annual average increase in incidence of 2.82% per year was recorded for the 11 years between 2001 and 2011 with an indicator of 12.4 per 100,000 p.p. and 15.3 per 100,000 a.p. in 2011 [7]. According to our data, as of 31 December 2016, the incidence of DM1 was 14.2 per 100,000 p.p., which is 1.14 times higher than in 2011, and 10.0 per 100,000 a.p., which is 1.5 times lower than in 2011. Thus, in contrast with the stable increase in the prevalence of DM1, we should note a relative stabilisation of the rates of growth in the incidence of DM1 in children and adolescents.

The distribution of the number of patients by age reflects a relative decrease in the DM1 incidence in patients <18 years old over the last 2 years in all age groups, namely 0 to 4, 5 to 9, 10 to 14 and 15 to <18 years (Fig. 7).

Type 2 DM (DM2)

The dynamics of the DM2 incidence per 100,000 population also indicated a predominant increase in this indicator among children (from 0.6–1.0/100,000 p.p. in 2013–2016; Fig. 8). In the adolescents, there was a relative decrease in the incidence of DM2 (from 1.5 to 1.1/100,000 a.p.). In age groups of 0 to 4, 5 to 9, 10 to 14 and 15 to <18 years (Fig. 9), the increase in the number of children with DM2 was most pronounced in the younger age group from 0 to 4 years.

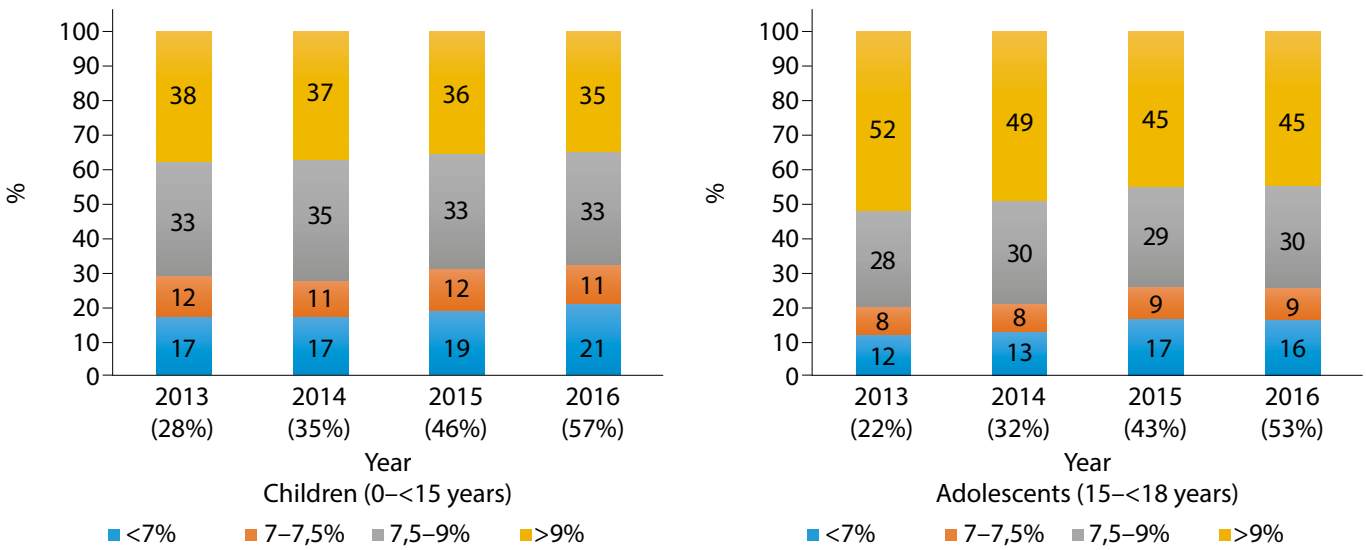

Figure 11. Dynamics of HbA1c in children and adolescents with DM1, 2013–2016 (81 regions of the Russian Federation according to the online register).).

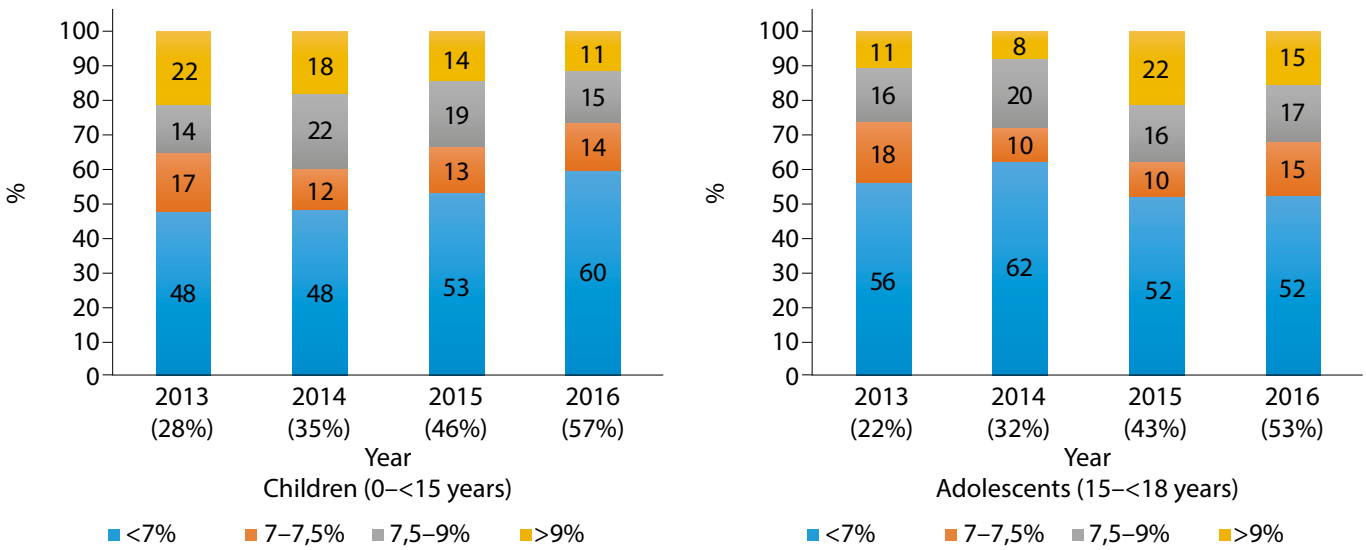

Figure 12. Dynamics of HbA1c in children and adolescents with DM2, 2013–2016 (81 regions of the Russian Federation according to the online register).

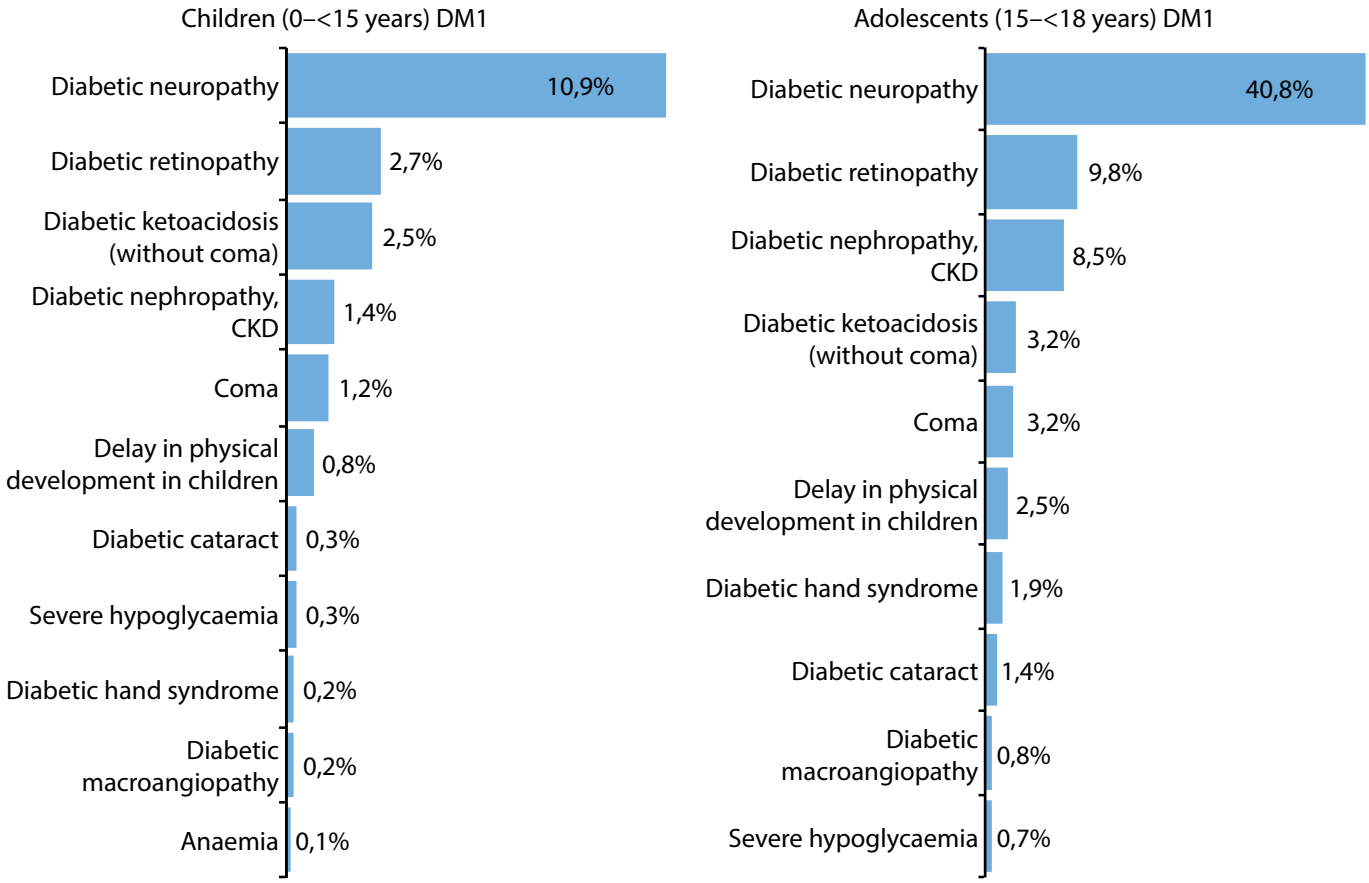

Figure 13. The frequency of complications with DM1 in children (N = 20,234 patients) and adolescents (N = 8271 patients), 81 regions of the Russian Federation, 2016.

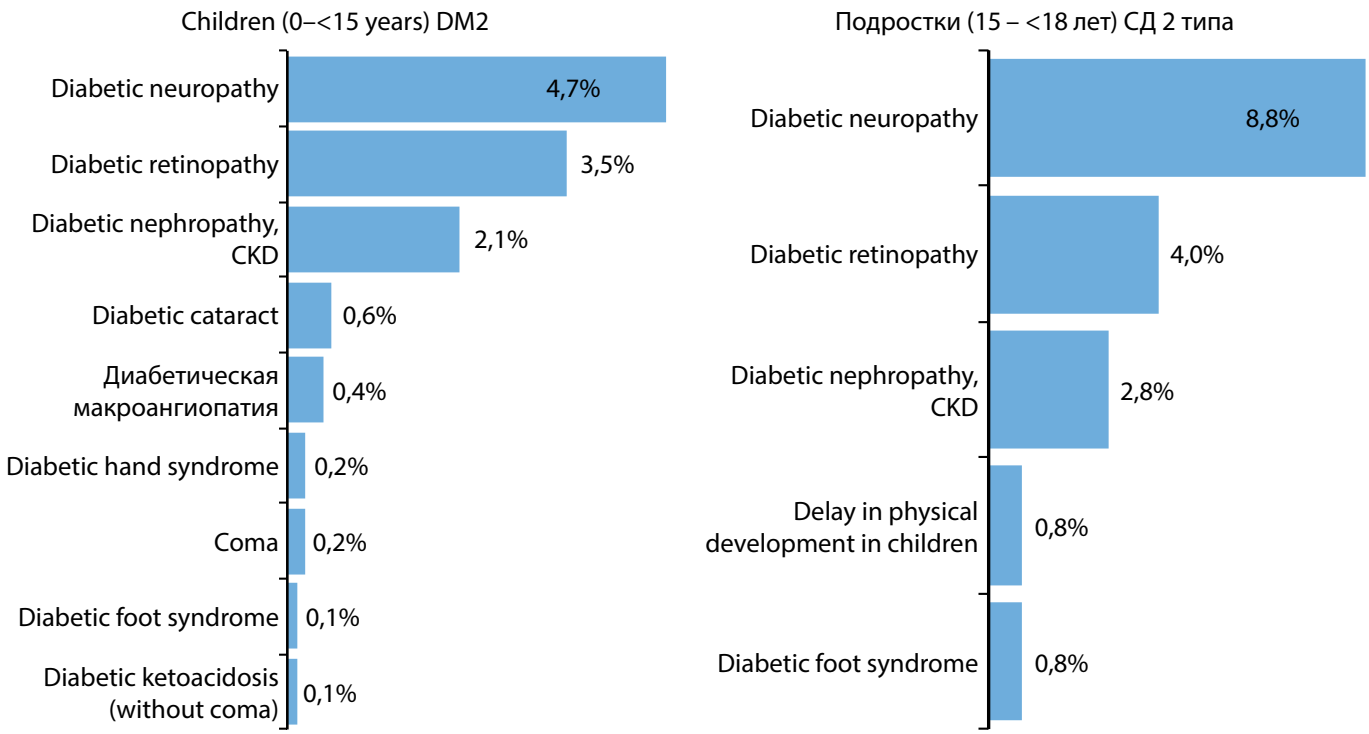

Figure 14. The frequency of DM2 complications in children (N = 894 patients) and adolescents (N = 249 patients), 81 regions of the Russian Federation, 2016.

There were significant differences in DM incidence and prevalence between regions, which also may reflect ethnic and geographical characteristics. The indicators are influenced significantly by the quality of the register-keeping. The lack of attention to the regularity of updating the registry database can be the main factor in the artificial understating of the DM incidence in a number of regions.

World tendencies reveal an increase in the DM1 incidence among children; the average annual rate of increase is 3% [2]. There are significant geographical differences: a more pronounced increase in the DM1 incidence is observed in some countries of Central and Eastern Europe. In addition, a number of European studies indicate that, in relative terms, this increase is most pronounced among young children [11].

Table 5. The number of hospitalisations in DM paediatric and adolescent patients (81 regions of the Russian Federation according to the online register)

Group	Hospitalisation in history (for any reason)		Hospitalisation in 2016 (for any reason)		Hospitalisation in 2016 (due to DM)	
	n	%	n	%	n	%
Children (0–<15)	9257	43.8	6209	61.7	4466	71.9
Adolescents (15–<18)	4194	49.2	2526	60.2	1696	67.1

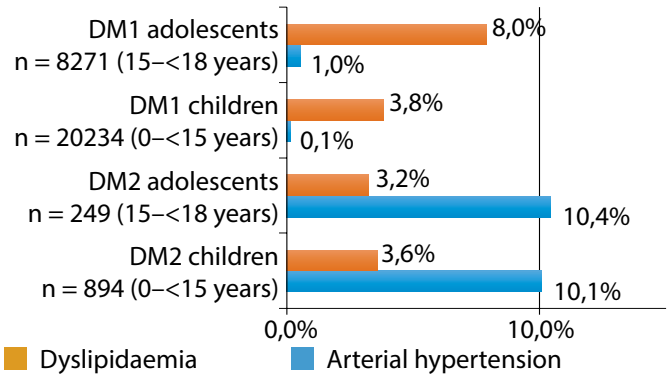

Figure 15. Frequency of concomitant diseases with DM in children and adolescents, 81 in the Russian Federation, 2016.

Analysis of Mortality in Patients With Diabetes Mellitus in the Russian Federation

The mortality rates for DM in children and adolescents are presented according to the online register in 81 regions of the Russian Federation (Table 4).

Mortality rates in all age groups of children and adolescents are at a steadily low level from 0.03 per 100,000 p.p. to 0.21 per 100,000 a.p. (Fig. 10). Data on causes of death between 2013 and 2016 are presented in Appendix 3. Unfortunately, 'cause of death is not established' was one of the most frequent causes of death; that is, the data were not classified.

As of 1 January 2012, where the questionnaire data from the regions and the data of the State Registry of DM were analysed in aggregate, the mortality rate of children with DM1 was an average of 0.07 per 100,000 p.p. (from 0–0.26 in different regions) [7]. Thus, there was no increase in the mortality rate over the 5-year period.

Analysis of the State of Carbohydrate Metabolism Compensation (Hba1c Level)

Distribution of children and adolescents according to the level of glycated haemoglobin A1c (HbA1c) in dynamics in 2013 to 2016 is shown in Figures 11 and 12.

Taking into account the admissible target level of HbA1c for children and adolescents <7.5% [12], the unsatisfactory indicators of this parameter with the achievement of the target level in only 32.2% of children and 25.5% of adolescents can be noted. The proportion of patients with pronounced decompensation of HbA1c > 9% in the a.p. group reached 45%. Nevertheless, there were significant positive dynamics of the indicator in the period from 2013 to 2016 with an increase in the proportion of patients with targeted HbA1c control. The worst indicators of HbA1c in the a.p. group may be due to the objective complexity of glycaemic control during puberty. The data obtained indicated the priority importance of teaching children and adolescents in 'schools for patients with DM' and the need for more careful glycaemic control, and, therefore, the provision of self-monitoring tools in an appropriate amount [13].

The positive moment can be the fact that, in contrast to adult patients [5], this indicator in children and adolescents is recorded in the register significantly more often, in 57% and 53% of patients, respectively. The monitoring of patients with DM clinically to assess the effectiveness of hypoglycaemic therapy and timely decision-making on the need for its adjustment, and organizationally as a target indicator of the proportion of patients with HbA1c data entered into the register is indicated in Figures 11 and 12. HbA1c control is necessary for quality of diabetic care. For this purpose, it is required not only to improve the quality of HbA1c data entry into the register (in 100% of patients) but also to increase the measurement frequency of this parameter. Taking into account that in children of a special cohort of risk, the targeted indicators should be individualised to avoid severe hypoglycaemia [14], this issue becomes even more relevant.

The frequency of determining the level of HbA1c, necessary for patients with DM is determined by the provision of 'algorithms for specialised medical care for patients with DM' and is one every three months [12].

Analysis of Prevalence of Complications

The distribution of the frequency of diabetic complications with DM1 and DM2 according to 81 regions of the Russian Federation is shown in Figures 13 to 15.

Thus, in children and adolescents with DM, the most common chronic complication was that of a metabolic disorder, which is diabetic neuropathy (10.9% and 40.8%, respectively, with DM1; 4.7% and 8.8%, respectively, with DM2). With DM1, microvascular complications (retinopathy and nephropathy) are less common in the p.p. group, their incidence did not exceed 2.7% and 1.4%; in the a.p. group, the incidence of microvascular complications was higher (9.8% and 8.5% of retinopathy and nephropathy, respectively; Fig. 13). With DM2, microvascular complications in children and adolescents were recorded in a comparable percentage of cases (Fig. 14). In addition, with DM2, the pathology range changed to a higher frequency of concomitant diseases, such as arterial hypertension (10.4%), dyslipidaemia (3.6%) and as a consequence of the metabolic syndrome in DM2 (Fig. 15). The incidence of acute complications, such as diabetic coma (3.2% vs. 1.2%) and ketoacidosis (2.5% vs. 8%) was 3 to 3.4 times higher in the a.p. group, as a result of the difficulties described above in achieving stable glycaemia in this age period [15].

Analysis of Hospitalisations

The number of hospitalisations in children and adolescents according to the online register is shown in Table 5: 43.8% of children and 49.2% of adolescents were

Table 6. Clinical characteristics of patients under the age of 18 (children + adolescents), depending on the presence or absence of hospitalisations in the history (81 regions of the Russian Federation according to the online register).

Indicator	Hospitalisation in history (for any reason)		Hospitalisation in 2016 (for any reason)		Hospitalisation in 2016 (due to DM)	
	No	Yes	No	Yes	No	Yes
DM onset, year	6.7	6.8	6.5	7.0*	6.4	7.2 *
Current age, years	11.2	11.9*	12.4*	11.5	12.3 *	11.3
Duration of	4.4	5.1 *	6.0*	4.6	5.9*	4.1
HbA1c, % (final visit)	8.5	8.8*	8.41	9.00*	8.61	9.01*

* - there is a significant difference between the groups, a group with a large index ($P < 0.05$) was marked.

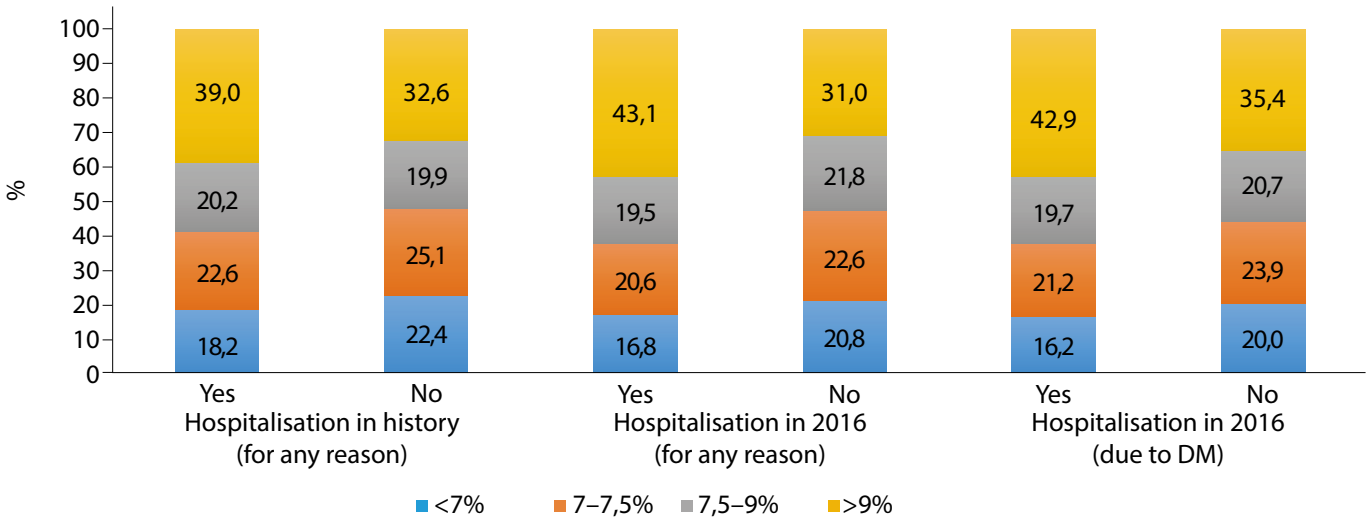

Figure 16. Distribution of paediatric and adolescent patients according to the level of HbA1c, depending on the presence and nature of hospitalisations (81 regions of the Russian Federation according to the online register).

Table 7. Characteristics of therapy in paediatric and adolescent patients with DM (81 regions of the Russian Federation according to the online register).

	Pump insulin therapy, n (%)	Basis-bolus therapy in pen injectors, n (%)			Therapy data are not indicated, n (%)
		Analogues	RHI and analogues	RHI	
Children (0-<15)	2977 (14.6%)	14 675 (72.2%)	1216 (6.0%)	641 (3.2%)	818 (4.0%)
Adolescents (15-<18)	1331 (16.1%)	6067 (73.5%)	429 (5.2%)	108 (1.3%)	318 (3.9%)
Total	4308 (15.1%)	20742 (72.6%)	1645 (5.7%)	749 (2.6%)	1136 (4.0%)

Note: RHI - recombinant human insulin

hospitalised according to anamnesis, most hospitalisations in 2016 (71.9% p.p., 67.1% a.p.) were due to DM.

It should be clarified that in the old format of the registry there was no column for 'hospitalisation due to DM'; it was introduced in 2015, and, therefore, data are presented only for 2016.

Analysis of the clinical characteristics of patients who were hospitalised compared with those with no history of hospitalisations revealed that mean age, duration of DM and HbA1c level were higher in the group with hospitalisations. Also, in the group of 'hospitalisations due to DM', a higher level of HbA1c at a shorter duration and a later onset of disease were noted (Table 6).

The presence of the association of hospitalisations with the severity of DM decompensation was confirmed by the fact that among patients who have ever been hospitalised, including due to DM, the proportion of patients with HbA1c > 9% was higher in all groups compared with patients who were not hospitalised (Fig. 16).

Analysis of Therapy

According to the Federal Register of DM Patients, the majority of paediatric and adolescent patients are treated with the most modern types of insulin therapy, including pump (15.1%) and insulin analogue split (72.6%) therapies (Table 7). According to the data of insulin pump manufacturers, which were obtained based on information provided by users and medical workers, the number of children and adolescents who receive pump insulin therapy can be much higher and reach 40% to 50% of patients in some regions of the Russian Federation, but to our knowledge there are no publications on specific figures for this question. Differences with official registry data may be because the possibility of specifying pump insulin therapy was introduced into the registry in 2015 and data recording may be delayed.

CONCLUSIONS

By the end of 2016, most regions of the Russian Federation (81 regions) participated in the maintenance

of the online registry of DM. Data on the dynamics of the epidemiological characteristics of DM in the age groups of children and adolescents indicated the preservation of a stable increase in the prevalence of DM1 and DM2. As for the incidence rate of DM, the tendencies were different: stabilisation and a relative decrease in the incidence of DM1 were traced compared with the peak of indices between 2013 and 2014, and, on the contrary, an increase in the incidence of DM2. Significant differences in the incidence and prevalence of DM among regions were established, which may reflect not only geographical and ethnic characteristics but also the quality of register-keeping by a specific subject of the Russian Federation. There was an increase in the number of patients with achievement of the target level of HbA1c < 7.5% and the decrease in the proportion of patients with severe decompensation of DM. The frequency of diabetic complications in children and adolescents with DM varies; the most common complications are metabolic (diabetic neuropathy). In the structure of therapy of this age group, the ratio of insulin therapy in pen injectors and pump therapy according to the register is 80.9%/15.1%. Data on the number of hospitalisations in children and adolescents were estimated for the first time. Characteristics of hospitalised patients indicated the relationship between hospitalisations and the severity of DM decompensation.

ADDITIONAL INFORMATION

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ПРИЛОЖЕНИЯ [SUPPLEMENTS]

Приложения доступны на сайте журнала по URL: https://endojournals.ru/index.php/dia/article/view/9460

ПРИЛОЖЕНИЕ 1

Распространённость сахарного диабета в возрастных группах «ДЕТИ» и "ПОДРОСТКИ" по данным онлайн-регистра в 81 регионе Российской Федерации, 31.12.2016 г.

SUPPLEMENT 1

The prevalence of diabetes mellitus in "CHILDREN" and "ADOLESCENTS" age groups according to the online state diabetes register in 81 regions of the Russian Federation, 31.12.2016.

URL: https://endojournals.ru/index.php/dia/article/downloadSuppFile/9460/2381

ПРИЛОЖЕНИЕ 2

Заболеваемость сахарным диабетом в возрастных группах «ДЕТИ» и «ПОДРОСТКИ» по данным онлайн-регистра в 81 регионе Российской Федерации, 31.12.2016 г.

SUPPLEMENT 2

The incidence of diabetes mellitus in "CHILDREN" and "ADOLESCENTS" age groups according to the online state diabetes register in 81 regions of the Russian Federation, 31.12.2016.

URL: https://endojournals.ru/index.php/dia/article/downloadSuppFile/9460/2382

ПРИЛОЖЕНИЕ 3

Структура причин смерти пациентов с сахарным диабетом по данным онлайн-регистра в 81 регионе Российской Федерации.

SUPPLEMENT 3

The cause-of-death structure for patients with diabetes mellitus according to the online state register in 81 regions of the Russian Federation.

URL: https://endojournals.ru/index.php/dia/article/downloadSuppFile/9460/2383

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