



Dynamics of Diseases of the Upper Digestive Tract in Children

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

In the Russian Federation, there is a tendency to increase the incidence of a number of nosologies, the prevalence of chronic diseases and the deterioration of health among children and adolescents. Diseases of the digestive organs occupy a leading place in the structure of somatic pathology of childhood.

According to the statistical data of the Ministry of Health of the Republic of North Ossetia – Alania (RNO – Alania), for seven years the prevalence of pathology of the digestive organs, including inflammatory bowel diseases, among children and adolescents has increased in the republic as a whole and regions separately. By 2022, it is predicted that the level of general and newly detected morbidity among children with pathology of the upper digestive tract will increase by 1.5-2 times.

Keywords: Morbidity; children; adolescents; digestive organs.

1. INTRODUCTION

The greatest increase in morbidity is observed among school-age children, who make up 70% of the child population [1-5]. Of particular concern are the unfavorable health indicators of children living in environmentally unfavorable territories [6-8]. The problem of the prevalence of digestive diseases, including chronic ones, in pediatric practice remains urgent [9-14].

The data on morbidity reflect the real picture of the health status of the population and allow us to develop measures to improve it on a national scale [15]. Morbidity is a multicomponent concept that includes several aspects: primary morbidity, prevalence, frequency of diseases detected during medical examinations, exhausted or true morbidity [16-19].

Morbidity among the population as a whole or individual groups is a statistical indicator that characterizes the state of health of the population or the number of registered diseases per 100 thousand, 10 thousand or 1 thousand people. The main method of studying morbidity in the Russian Federation is the analysis of the population's appeal for medical care, data from professional and targeted medical examinations with the use of modern analytical high-tech equipment [20-22]. The morbidity indicator is used in a comprehensive assessment of the health status of the population, to justify medical and social measures aimed at improving it. Information about morbidity serves as the basis for actuarial calculations when organizing medical insurance.

Medical examination is a method of systematic medical supervision in medical institutions of the health status of certain groups of the population in order to prevent and early detect diseases, their timely treatment and prevention.

The aim of the work was to study the dynamics of intensive morbidity rates and the coverage of dispensary observation of children with pathology of the digestive organs, including inflammatory diseases of the upper digestive tract (UDT).

2. MATERIALS AND METHODS

The reports of the Ministry of Health of the Republic of North Ossetia (RNO) – Alania served as materials for studying the incidence of

children and adolescents with diseases of the digestive organs. Multivariate regression analysis was used to identify the trend in the incidence of children and adolescents with digestive pathology [23].

To solve the tasks, a survey was conducted of 1288 children aged 4 to 18 years. There were 625 boys and 663 girls. The survey was conducted in children's institutions (kindergartens, schools) in Vladikavkaz and districts of the Republic of Alania, characterized by various indicators of the environmental situation, water supply sources, the socio-economic status of the population, the volume of medical care. The questionnaire, along with the passport part, provided data on heredity, obstetric history, child development, past illnesses and social – hygienic characteristics, as well as data characterizing pain and dyspeptic syndromes in the examined children (abdominal pain in the epigastrium and pyloroduodenal zone, the presence of nausea, vomiting, heartburn and belching, general clinical examination (determination of soreness in the epigastrium and pyloroduodenal region) and diagnosis of helicobacter infection using a non-invasive smoke test. The reports of the Ministry of Health of the Republic of North Ossetia (RSO) – Alania served as materials for studying the incidence of children and adolescents with diseases of the digestive organs. Multivariate regression analysis was used to identify the trend in the incidence of children and adolescents with digestive pathology. Statistical processing was carried out using the computer statistical program Statistica 5.5. The reliability of the differences in the compared indicators was evaluated according to the Student's parametric criterion. The results were considered reliable with an error probability of $P < 0.05$, which is generally accepted when conducting medical scientific research.

3. RESULTS AND DISCUSSION

An analysis of the annual statistical reports of the Ministry of Health of the Republic of Kazakhstan for the period 2012-2018 showed that the total incidence of digestive pathology increased from 3371.2 to 4871.2 per 100 thousand population, that is, by 1.44 times (Table 1).

The growth rate of the total morbidity of the children's population with diseases of the digestive organs was 30.8%. During the same

period, the primary incidence increased from 1583.2 to 2194.7 per 100 thousand population and moved from the 8th to the 5th rank in the structure of all newly detected pathology in children. The growth rate of primary morbidity was 27.9%.

The growth of gastroenterological pathology and the increase in primary morbidity indicators require an in-depth analysis of the medical and social situation in the republic, the development and implementation of a set of measures to improve living conditions and lifestyle, the formation of targeted prevention and treatment programs.

The health of the population in the republic, as well as in the country, is influenced by genetic

factors, conditions and lifestyle, the health protection system, state policy in the social sphere, new management technologies in healthcare.

We analyzed the demographic situation and the prevalence of diseases of the digestive system, including UDT, in recent years on the territory of the republic using a multivariate regression analysis. When analyzing the trend, that is, leveling fluctuations and determining the trend, there was a significant dynamics of an increase in the prevalence of general and newly detected morbidity of the children's population with diseases of the digestive organs, the availability of personnel – pediatricians, the volume of endoscopic examinations and a decrease in the number of children's population (Fig. 1).

Table 1. Dynamics of indicators of general and primary morbidity of children with pathology of the digestive organs (per 100 thousand children)

Index	Year								Growth rate, %
	2012	2013	2014	2015	2016	2017	2018		
General morbidity	3371,21	3778,7	4358,2	4884,3	6983,8	6109,6	4871,2	30,8	
Newly detected morbidity	1583,2	1977,2	2526,01	2803,7	4561,9	3562,3	2194,7	27,9	

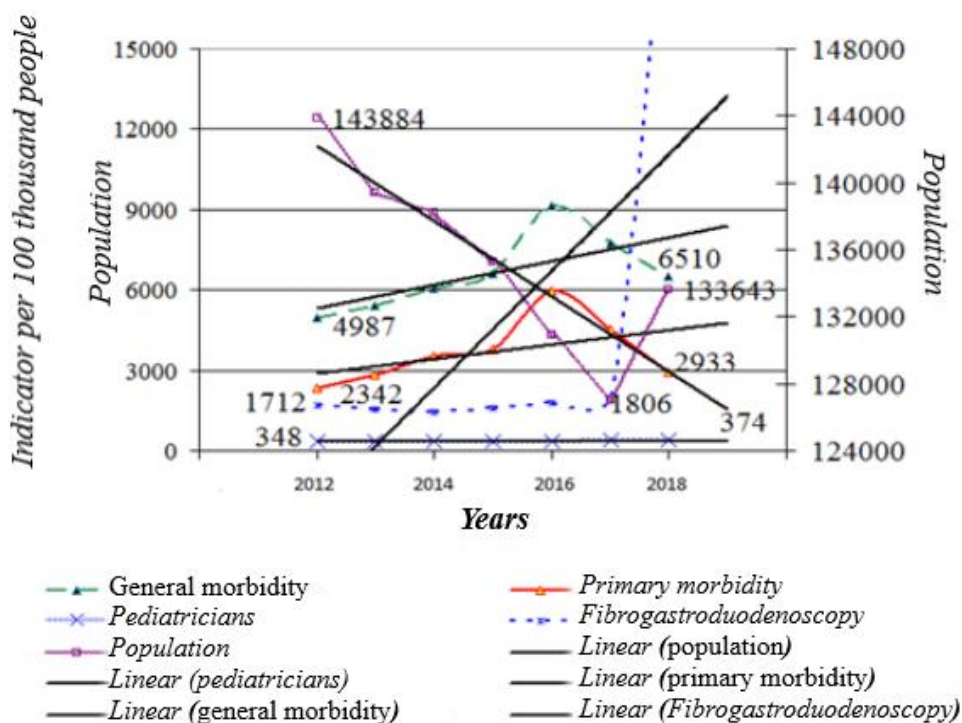


Fig. 1. Dynamics of general and newly detected morbidity, depending on the availability of pediatricians and the volume of esophagogastrroduodenoscopy performed

The method of multivariate regression analysis also studied the mutual influence of demographic and medical factors on the dynamics of UDT diseases. The maximum high cumulative effect is reflected in the dynamics of primary (95.29%) and general morbidity (88.81%), the minimum – in the dynamics of medical examination (74.6%). In recent years, the staffing rate of district pediatricians in the republic has increased from 19.2 to 22.2 per 10 thousand children; the coverage of esophagogastroduodenofibroscopy per 1000 children has increased from 11.9 to 16.2%. Together, these two indicators primarily affect the detection of diseases of the digestive system, including UDT ($r = 0.81$). The data of prognostic studies shown in Table 2 indicate that the incidence of diseases of the digestive system tends to increase. According to forecasts, by 2022, the intensive indicators of general morbidity will increase by 1.9 times, the newly detected one-by 2.3 times compared to the indicators of 2016; the demographic situation in

the republic will improve, by 2022 the number of children's population will increase by 3.6 times compared to 2016.

The data presented in Table 2 demonstrate an improvement in the quality of medical care as a result of an increase in the staff of pediatricians and the number of endoscopic examinations: the staffing of pediatricians and the volume of endoscopic examinations will increase by 1.2 times by 2022 compared to 2016.

Along with the increase in the pathology of the digestive organs, in general, there is an increase in the pathology of UDT in children. From 2012 to 2018, the cumulative prevalence (total incidence) the pathology of UDT has almost doubled (from 336.0 in 2012 to 565.40 in 2018), and the primary incidence has increased by 1.25 times (from 197.40 to 246.90 per 100 thousand population) (Fig. 2).

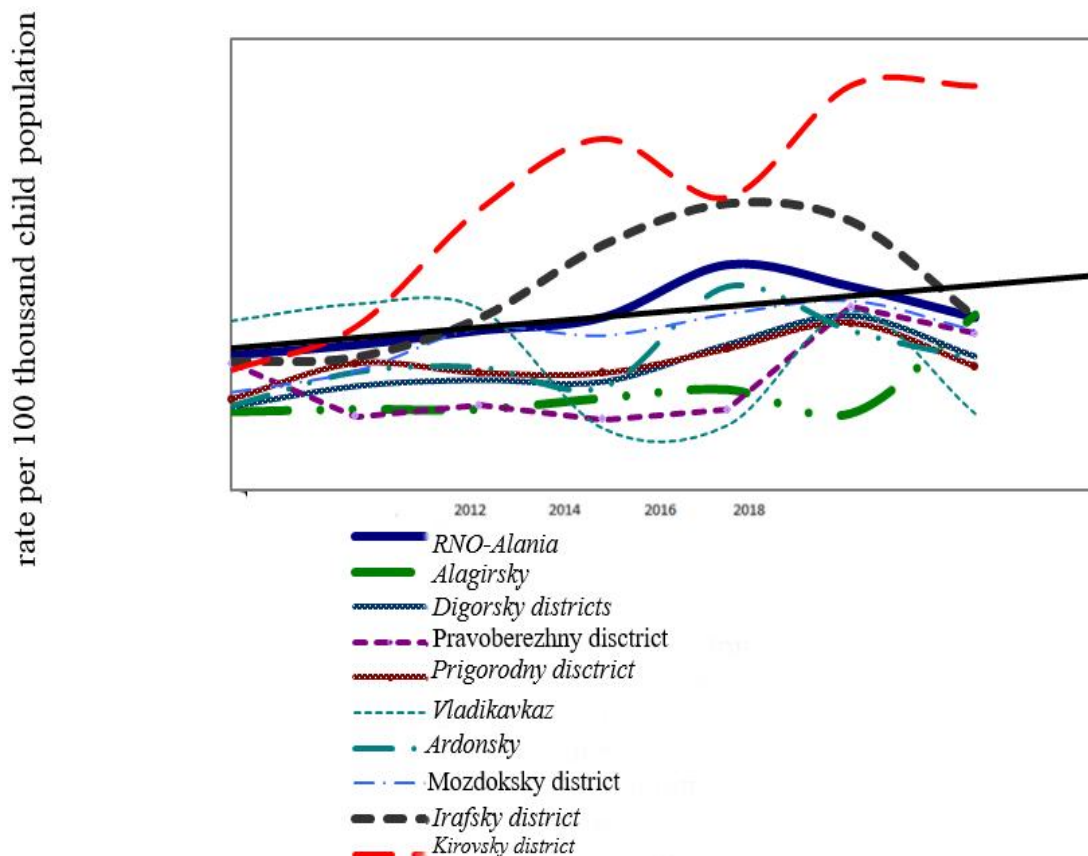


Fig. 2. Dynamics of indicators of the general morbidity of children with pathology of the digestive organs, including UDT, in the regions of the RNO-Alania

Table 2. Forecast of morbidity rates, children's population, availability of pediatricians and the volume of endoscopic examinations in RNO-Alania

Index	Lineardependence	A polynomial-type regression equation	Forecastofvaluesfor 2022
Generalmorbidity	$y = 349,08x - 692223$ R2 = 0,6876	$y = -96,83x^2 + 387874x - 4E+08$ R2 = 0,8316	9427,8
Newlydetectedmorbidity	$y = 183,96x - 364740$ R2 = 0,2983	$y = -136,61x^2 + 546908x - 5E+08$ R2 = 0,746	5019,6
Population	$y = -2245,3x + (5 \cdot 10^6)$ R2 = 0,7428	$y = 467,32x^2 - 2E+06x + 2E+09$ R2 = 0,8393	486947
Availabilityofpediatricians	$y = 5,1786x - 9998,2$ R2 = 0,8544	$y = -0,631x^2 + 2530,3x - 3E+06$ R2 = 0,8924	410,786
Esophagogastroduodenofibroscopy	$y = 2178,9x - 4E+06$ R2 = 0,3887	$y = 1198,6x^2 - 5E+06x + 5E+09$ R2 = 0,7415	379,589

As can be seen from Fig. 2, during the period 2012-2018, the growth of intensive indicators of the general and newly detected morbidity of children with UDT pathology in Vladikavkaz and the regions of the republic increased. Thus, the growth rate of the total morbidity of children with UDT in the republic was 68.3%, the first-time detected-25.1%.

According to the growth rate of morbidity levels, areas with high, medium and low growth rates of intensive morbidity indicators are identified. In recent years, a very high rate of increase in the incidence of UDT has been recorded in the Kirov and Irafsky districts – more than 80%. The Kirovsky district is home to refugees from neighboring South Ossetia, who emigrated in 2008 because of the fighting and the unstable situation. Unsatisfactory living conditions, low material income, eating disorders, unfavorable psychosomatic state of refugees and a number of other risk factors could contribute to such a high increase in the incidence of UDT pathology among children.

The Irafsky district is mountainous, the level of provision of qualified medical care and the volume of instrumental research are low.

The districts with an average growth rate in recent years include the Ardonsky, Alagirsky, Digorsky districts (the growth rate is up to 70%). In the Pravoberezhny district, Prigorodny districts and the city of Vladikavkaz, a moderate increase in the levels of general and newly detected morbidity was registered (an increase rate of about 30%). Only in the Mozdoksky district,

despite the pollution of the environment, there is a tendency to reduce the levels of general and newly detected morbidity among children with UDT pathology. Thus, the rate of reduction of the general morbidity in recent years was 20.2%, and the first-time detected-41.7%.

The analysis of prognostic studies also indicates a tendency to increase the levels of general and newly detected incidence of UDT pathology among the children's population (Table 3).

According to the regression analysis, the growth of the levels of general and newly detected morbidity in the regions of the republic will continue by 2022. The growth rate varies between 40-60%. In Vladikavkaz, a less intensive increase in morbidity rates was registered compared to rural areas.

At the same time, a significant increase in the prevalence of separately chronic gastritis, chronic gastroduodenitis and duodenal ulcer is shown. The total incidence of chronic gastritis and chronic gastroduodenitis increased by 1.61 times (from 321.1 to 516.3 per 100 thousand population), duodenal ulcer - by 3.26 times (from 14.9 to 48.6 per 100 thousand population). Similar indicators for registered pathology were 1.19 (from 194.7 to 231.2 per 100 thousand population) and 5.81 times (from 2.7 to 15.7 per 100 thousand population), respectively.

The share of various variants of chronic gastritis and chronic gastroduodenitis in combination with duodenal ulcer is 1/3 of the total pathology of the digestive organs in children.

Table 3. Dynamics of the rate of increase in the incidence of gastroduodenal pathology among children for the period from 2014 to 2022

District	Intensive indicators per 100 thousand population		Growth rate	Intensive indicators per 100 thousand population		Growth rate
	2014	2022		2014	2022	
Alagirsky	285.5	586.54	51.3%	156.1	360.36	56.7%
Ardonsky	222.1	418.5	46.9%	218.8	387.6	45.5%
Prigorodny	378.8	970.91	61.1%	163	346.88	53%
Pravoberezhny	283.2	743.3	61.9%	210.1	244.5	14.1%
Digorsky	454.8	777.75	41.5%	250.1	536	53.3%
Irafsky	595.9	1295.8	54%	141.9	288.37	50.7%
Mozdoksky	353.7	246.53	43.5%	165.8	38.83	327.2%*
Kirovsky	1452.4	2841.6	48.9%	1198.3	2385	49.7%
Vladikavkaz	580.7	758.63	23.4%	280.4	307.93	8.9%
RNO-Alania	565.4	880.11	35.7%	246.9	406	39.2%

* Intensive indicators of general morbidity in the Mozdoksky district within the error remain unchanged, so the dynamics and prognostic data cannot be determined by statistical methods

Table 4. Dynamics of the specific weight of UDT diseases in the structure of all registered pathology of the digestive organs in children in the RNO-Alania, %

District	Year						
	2012	2013	2014	2015	2016	2017	2018
Vladikavkaz	3.35	3.34	4.01	5.73	9.18	11.14	12.16
Alagirsky	24.53	14.41	16.04	15.93	1.74	1.09	11.75
Ardonsky	4.93	4.4	3.61	5.93	4.15	8.4	6.91
Prigorodny	18.18	6.72	6.03	2.52	14.02	11.35	12.77
Pravoberezhny	11.45	36.37	21.21	42.1	27.58	10.31	6.68
Kirovsky	9.58	2.96	8.97	10.48	7.91	10.26	4.85
Mozdoksky	23.47	10.09	10.99	9.1	4.8	4.86	8.12
Irafsky	18.08	13.39	12.39	14.16	2.16	11.84	13.61
RNO-Alania	9.96	5.39	6.21	6.37	6.13	9.09	11.61

Table 5. Dynamics of the specific weight of UDT diseases in the structure of the first registered pathology of the digestive organs in children in the RNO-Alania, %

District	Year						
	2012	2013	2014	2015	2016	2017	2018
Vladikavkaz	11.1	2.39	23.47	4.95	9.9	12.52	12.94
Alagirsky	25	11.62	6.24	10.44	9.99	1.98	5.19
Ardonsky	6.46	5.07	5.79	14.28	2.29	10.17	11.6
Prigorodny	23.53	18.6	1.71	14.49	8.44	10.9	15.46
Pravoberezhny	15.98	5.37	8.22	4.65	10.28	14.49	9.42
Kirovsky	4.65	2.34	9.89	10.91	7.28	10.31	5.58
Mozdoksky	27.96	6.67	9.72	7.98	2.14	1.6	5.57
Irafsky	3.99	12.9	10.61	15.79	1.2	19.77	14.67
RNO-Alania	2.44	3.12	4.54	2.69	2.57	2.81	7.81

Over the past seven years, the share of UDT diseases in the structure of all registered pathology of the digestive organs has increased from 9.96 to 11.61 per 100 thousand population ($p < 0.05$), and the newly detected incidence- from 11.25 to 12.47 per 100 thousand population ($p < 0.05$). Since 2012, the share of UDT diseases in the structure of general pathology of the digestive organs has stabilized. During this period, it increased by only 1.65% in the republic as a whole. At the same time, an increase was recorded in some areas, and a decrease in the proportion of UDT pathology in others. Thus, the share of UDT diseases in the structure of digestive diseases in Vladikavkaz increased from 3.35 to 12.16%, in the Ardonsky district- from 4.93 to 6.91% (Table 4).

The dynamics of the growth of the specific weight of UDT diseases in the structure of the first registered pathology in the regions of the republic is different. In four districts (Ardonsky, Kirovsky, Irafsky and Vladikavkaz), the specific weight increases, in the other four it decreases (Table 5).

These results indicate that, in aggregate, the incidence of UDT in these areas has a significant impact on the formation of the indicator of the overall incidence of digestive pathology in each district. At the same time, the frequency of detection of UDT diseases indicates the high qualification of doctors.

The proportion of gastritis/gastroduodenitis and duodenal ulcer in the structure of the general pathology of the digestive organs in the regions of the republic is not the same and does not correspond to the classification of the division of districts into groups by morbidity. The right-bank district, despite the low rates of pathology of the digestive organs, is characterized by a relatively high incidence of UDT for seven years (on average, 352.54 per 100 thousand population). The lowest incidence is in the Ardonsky district (on average, 179.24 per 100 thousand population; in seven years it has increased from 66.5 to 221.1 per 100 thousand population).

During the specified period, the share of UDT in the structure of digestive diseases in the

Digorsky district increased 2.4 times – from 188.30 to 454.80 per 100 thousand population, in the Irafsky district five times—from 105.80 to 595.90 per 100 thousand population, in the Suburban district - from 290.2 to 373.80 per 100 thousand population. In Mozdoksky and Kirovsky districts, there is a tendency to decrease the proportion of UDT diseases (from 443.40 to 353.70 per 100 thousand population and from 266.0 to 185.10 per 100 thousand population, respectively).

The ratio of ulcerative and non-ulcerative lesions in the structure of the registered pathology of the digestive organs for the period 2012-2018 averaged 12.6: 1. Since 2012, this indicator has decreased and in 2018 amounted to 10.62:1. A similar decrease in the ratio of chronic gastritis, chronic gastroduodenitis and duodenal ulcer is noted in the group of newly identified diseases. If before 2012 this indicator was quite variable from 14 : 1 to 16 : 1, then since 2012 it has stabilized in the range of 8 : 1-9 : 1. In the group of dispensary patients, the ratio of ulcerative and non-ulcerative lesions of peptic ulcer disease was recorded within 26:1. Since 2013, this ratio has been 15:1.

4. CONCLUSION

The presented data show that in the republic as a whole and in the districts separately, there is an increase in the general morbidity and newly detected pathology of the digestive organs in children, including inflammatory diseases of the UDT, regardless of economic conditions, the environmental situation, water supply and other unfavorable factors. The total, first-time detected morbidity and the coverage of dispensary observation of children with pathology of the digestive organs, including UDT, in the RNO – Alania has increased by an average of 1.5 times over the past seven years. This process is significantly influenced by the staffing of district medical centers with pediatricians, coverage by instrumental examination methods ($r = 0.61-0.95$).

Multivariate regression analysis allowed us to predict an increase in the level of general and newly detected morbidity of children with UDT pathology in the republic by 1.5–2 times by 2022.

The high frequency of UDT diseases in children in the Russian Federation dictates the need for regular medical examinations with the involvement of pediatric gastroenterologists. In

order to improve the diagnosis of gastroduodenal pathology, it is necessary to conduct a preliminary survey of children using the developed questionnaire cards. Given the high infection rate of the children's population of the RNO-Alania *Helicobacter pylori*, it is advisable to conduct a screening examination with a non-invasive respiratory test (Helic-test) for children and their closest relatives when there are complaints indicating the pathology of UDT.

ETHICAL APPROVAL AND CONSENT

As per international standard or university standard guideline respondents' consent and ethical approval has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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