

## EPIDEMIOLOGICAL ANALYSIS OF THE PREVALENCE OF IRON DEFICIENCY ANEMIA IN THE REPUBLIC OF UZBEKISTAN FOR 2007-2019

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**Abstract: Research objective: to assess the structure and dynamics of the IDA incidence in the Republic of Uzbekistan in the period from 2007 to 2019.**

**Material and methods.** The research was carried out at the Department of Hematology of the Bukhara branch of the Tashkent Medical Academy. The data of official statistical report, accounts and reports, informational and analytical materials collected from 2007 to 2019 were used during the analysis. Mainly, the analysis included the state of epidemiological situation in the Kashkadarya, Bukhara and Navoi regions, as well as separately the Republic of Karakalpakstan. The study was comprehensive, using descriptive and analytical epidemiological methods, retrospective epidemiological analysis, and medical statistics.

**Results and discussion.** During the analysis it was established that in the Republic of Uzbekistan for the period from 2007 to 2019, there was a changing of the severity grade of IDA for public health according to the WHO recommendations from medium (prevalence 20.0–39.9%) to moderate (5.0-19.9%). In some regions, where in 2007 the IDA incidence ratio was severe ( $\geq 40\%$ ), changing to the medium grade was achieved during 12 years.

**Conclusion.** The epidemiological analysis showed the significant regression of the IDA incidence ratio in the Republic of Uzbekistan in the period from 2007 to 2019. However, among adolescents the prevalence of the disease remained high, requiring the development of a new approach to the treatment and carrying out preventive measures. In addition, it was established that in some regions the incidence was much higher than in the country as whole, requiring a deeper study of pathology in the indicated region.

**Key words:** iron deficiency anemia, epidemiology, overall incidence, regional features of epidemiology.

### INTRODUCTION

Iron deficiency anemia (IDA) is a widespread pathology among the population, which, according to the World Health Organization (WHO), is the first in the list of 38 most common human diseases [1,4]. As known, IDA is more common in developing countries than in advanced ones. For example, in India, up to 88% of pregnant women and 74% of non-pregnant suffer from anemia; in Africa - about 50% of pregnant women and 40% of non-pregnant. In the countries of the Latin America and the Caribbean, the prevalence of IDA in pregnant and non-pregnant women is about 40% and 30%, respectively [7,13,18].

The incidence of IDA makes 20%, while iron deficiency (ID) is revealed in 50% of the population in whole [2,3]. IDA is the most common malnutrition worldwide, diagnosed in many children and women in developing countries, and is the only type of nutritional

deficiency prevalent on a large scale in industrialized countries [8]. However, according to the statistics about 50% of preschool children and pregnant women worldwide suffer from IDA [10].

ID and IDA reduce work productivity of the population, leading to serious economic impacts and obstructs the country's development. Invisible but prevalent in many developing countries, outcomes of ID and IDA are hidden behind statistics on overall mortality rates, maternal bleeding, school underperformance and disability. Health outcomes are latent, but destructive, imperceptibly weakening the potential for the development of people, society and the national economy [1,6,7,10].

According to the severity grade of the WHO experts, the prevalence of IDA among the population can be moderate - from 5 to 19.9%, medium - from 20 to 39.9%, and severe - 40% or more [17, 18]. With anemia prevalence rate more than 40%, the problem requires measures at the state level. The similar situation was observed in the Republic of Uzbekistan, one of the developing countries of the Central Asia, where in the middle of 90s the incidence rate of IDA in some regions was more than 40%. In this regard, the country began to carry out preventive and health-improving measures, the first results of which appeared already in 2006-2007 [5,9].

Despite the fact that preventative measures in this direction began to show results, the incidence rate in some regions remained high and presented a serious problem for the country's health. The following years were characterized by significant changes in the structure and work of the health care system, which became more focused on the prevention of diseases.

## **RESEARCH OBJECTIVE**

To assess the structure and dynamics of the IDA incidence in the Republic of Uzbekistan in the period from 2007 to 2019.

## **MATERIAL AND METHODS**

The research was carried out at the Department of Hematology of the Bukhara branch of the Tashkent Medical Academy. The research materials were the data of official statistical report, accounts and reports, informational and analytical materials collected from 2007 to 2019. The material was collected as a result of collaboration with the Ministry of Health of the Republic of Uzbekistan, as well as regional, city and district health departments in the regions of the country. A particular emphasis was made on the analysis of the epidemiological situation in the Kashkadarya, Bukhara and Navoi regions, as well as separately in the Republic of Karakalpakstan.

The study was comprehensive, using descriptive and analytical epidemiological methods, retrospective epidemiological analysis, and medical statistics.

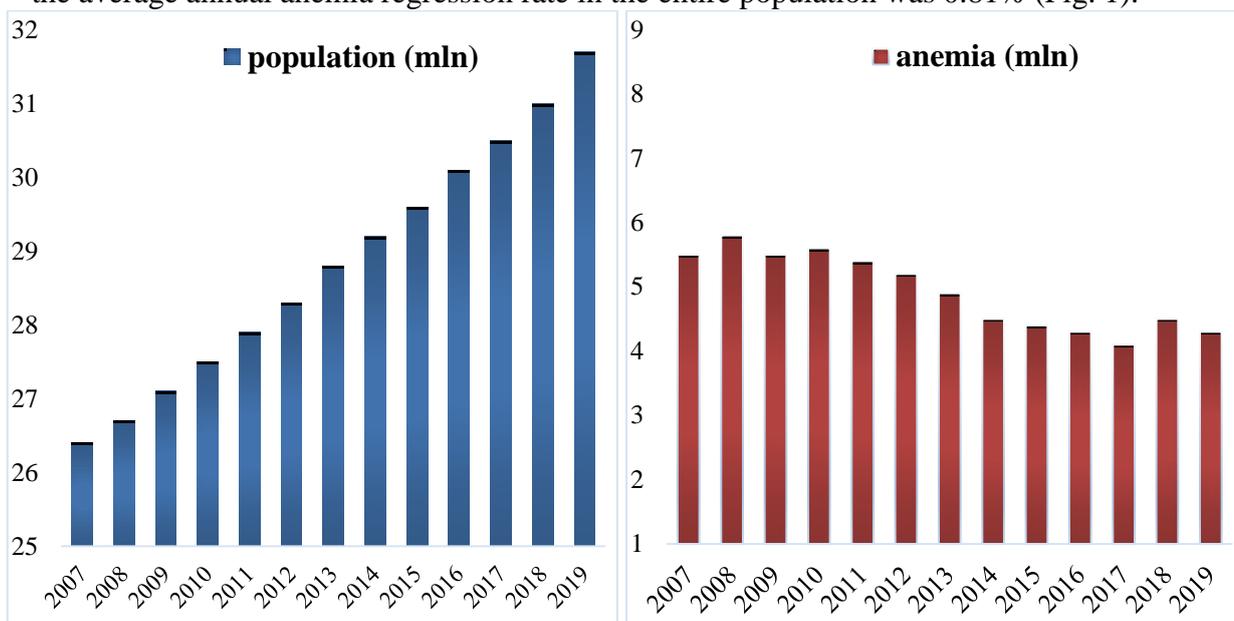
Statistical analysis included the data collection and integration into a single computer database. The processing was performed using the computer programs STATISTICA and BIostat. Both parametric and non-parametric methods were applied for the analysis. Mean values, standard errors, and standard deviations were calculated for quantitative indicators. Trend lines were drawn to predict further morbidity with the calculation of R-squared value ( $R^2$ ).

## **RESULTS**

The analyzed period was characterized by an increase in the total population from 26 million to 31 million inhabitants [14].

The dynamics of the absolute number of anemia cases among the population was not uniform during the first 3 years. Only beginning with 2010 a steady decrease began in the number of cases from 5.6 million to 4.1 million in 2017. At the same time, in the period from

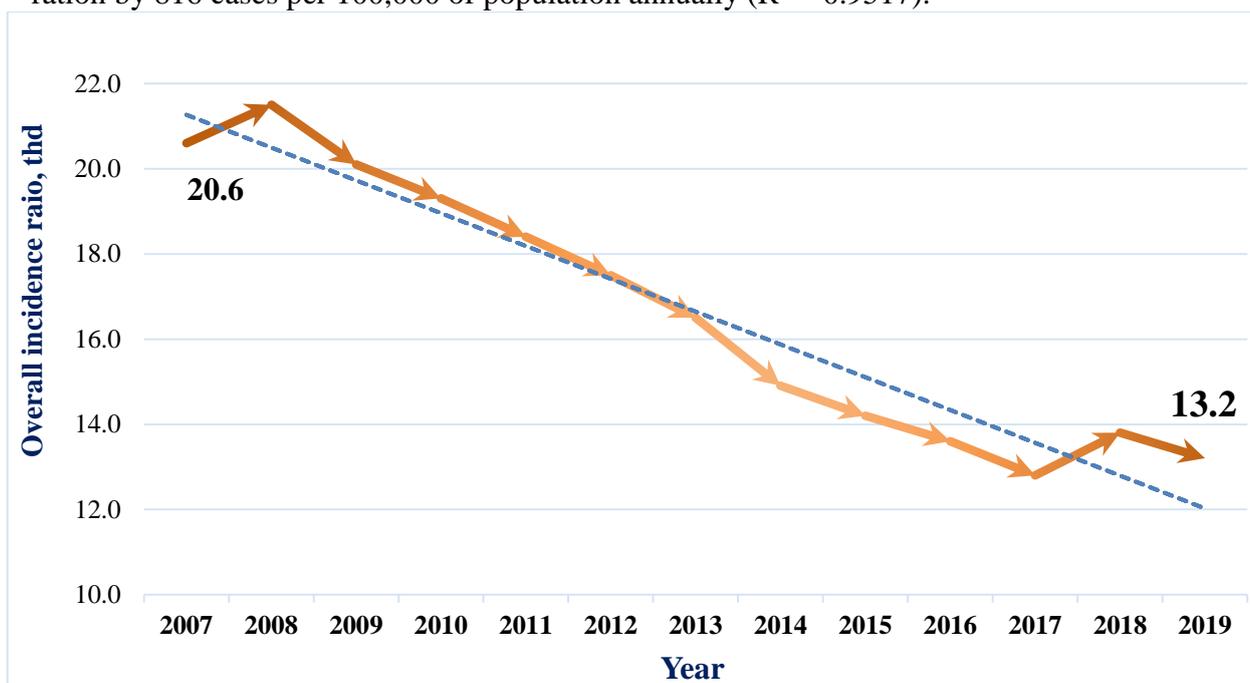
2007 to 2018 in the country, the average annual population increase concluded 1.45%, while the average annual anemia regression rate in the entire population was 0.81% (Fig. 1).



**Fig.1. Comparison of the dynamics of the country's population and the absolute number of anemia cases in all age groups from 2007 to 2018**

The analysis of general and primary disease incidence rates per 100,000 of population in the Republic of Uzbekistan for the period from 2007 to 2019 is presented in the Fig. 2 and 3. The diagrams show that there was a significant decrease in both indicators.

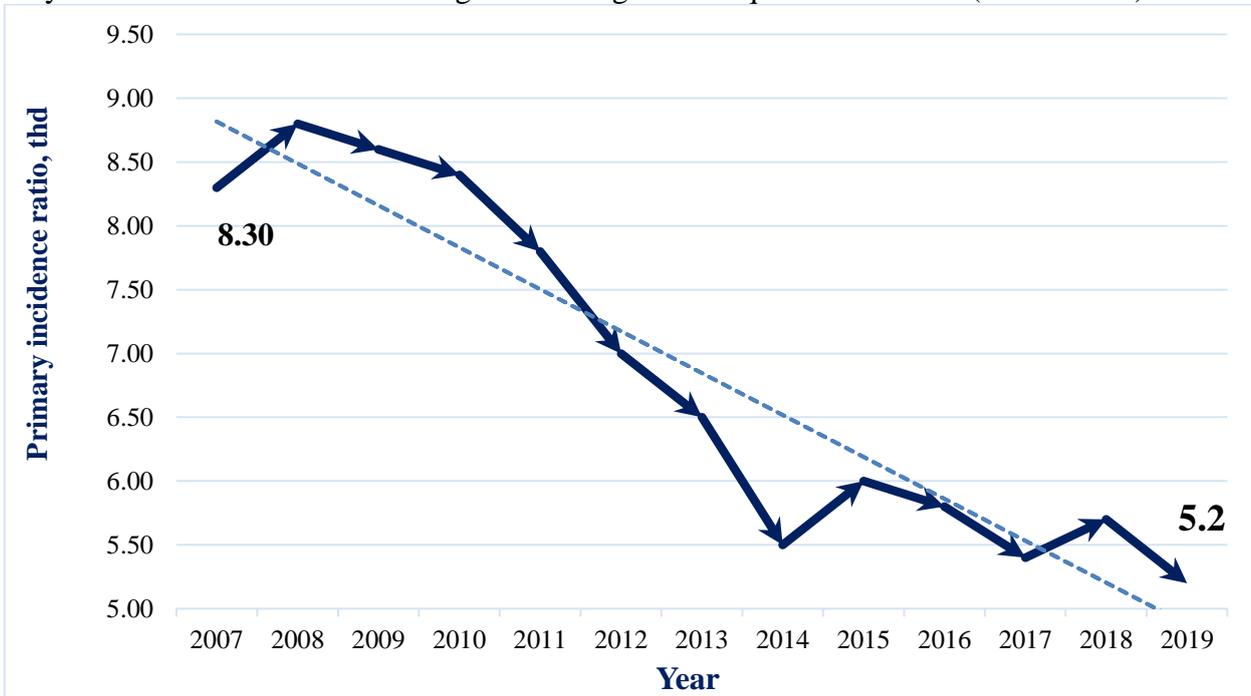
The overall incidence ratio was 20,620 per 100 thousand population. After a slight increase in 2008, it began to decrease steadily, which continued until 2017. In 2018, a slight increase in the overall incidence ratio up to 13,837 cases per 100 thousand of population was recorded. Nevertheless, the diagram shows that over 12 years there has been a decrease in the overall incidence ratio by almost 33%. At the same time, on average, there was a decrease in the ratio by 816 cases per 100,000 of population annually ( $R^2 = 0.9517$ ).



**Fig. 2. Dynamics of the indicator of overall incidence from 2007 to 2019**

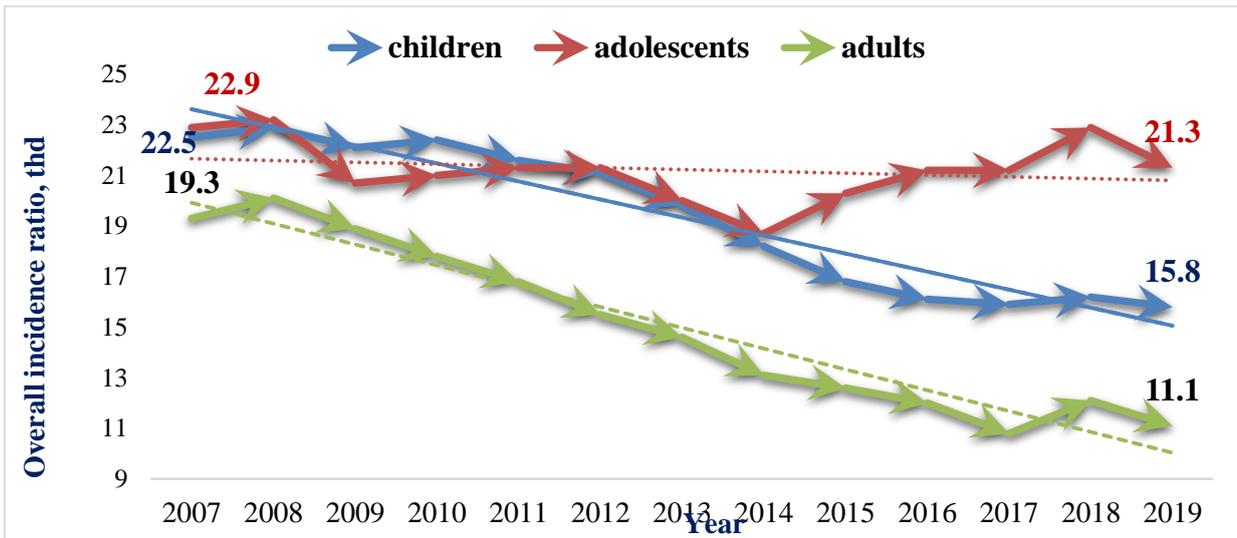
Analysis of the primary incidence ratio showed that in 2007 there were 8.3 thousand

cases per 100 thousand of population. In 2008, there was an increase in the indicator almost to 9 thousand cases, followed by the decrease over the next 6 years, which reached its lowest point in 2014 and concluded 5.5 thousand cases. During the next 4 years, periods of increase and decline alternated until in 2019 the primary incidence ratio reached the final point of 5.2 thousand cases. The data of diagram show that during 12 years there was a decrease in the rate by more than 30% with the average annual regression equal to 343 cases ( $R^2 = 0.8729$ ).



**Fig. 3. Dynamics of the primary incidence rate in the period from 2007 to 2019**

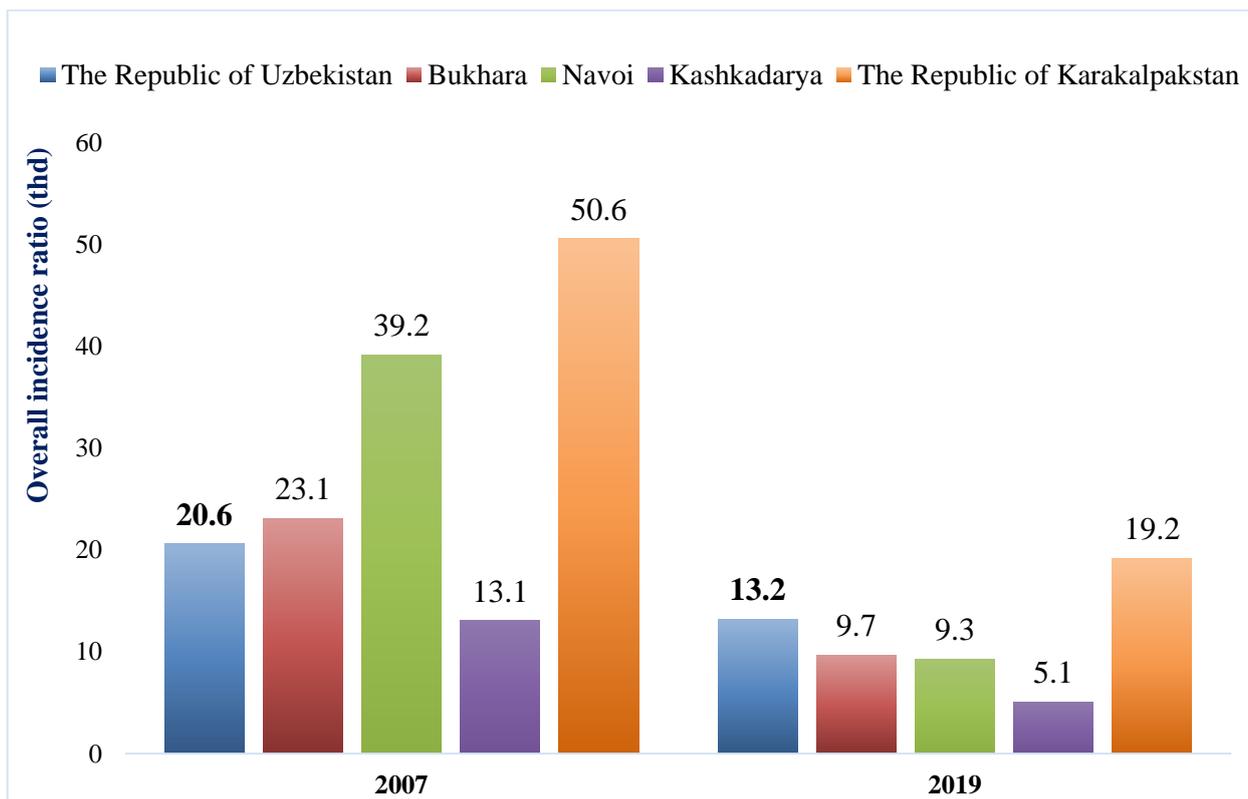
The analysis of dynamic changes in the IDA incidence rate in individual age groups is presented in the Fig. 4. It can be seen from the graph that consideration of the overall incidence ratio per 100,000 population, depending on the age group, shows significantly higher values in children (under 14 years old) and adolescents (15-17 years old) compared with the adult population. So in 2008, the total incidence ratio of anemia was 22,657 per 100,000 children, and 22,973 cases per 100,000 adolescents. In adults, this rate was 19,347 cases. After increasing the indicator in 2008, the overall incidence rate in children and adults decreased steadily during the next 9 years. Children, over the past period, had decrease in the ratio regression by 28%, while in adults it was 37%. At the same time, the average annual regression was almost 750 cases in children ( $R^2 = 0.9211$ ) and almost 870 cases ( $R^2 = 0.947$ ) in adults per 100,000 population.



**Fig. 4. Dynamics of the general incidence ratio of anemia per 100,000 in different age groups**

The dynamics of the overall incidence in the group of adolescents during the specified period did not have a stable trend. The graph shows that during the first 3 years there was a significant decrease in incidence from 23% at the beginning to almost 20% in 2009. During the next 3 years, there was a slight increase in the ratio, followed by a sharp decrease over the next 2 years, when in 2014 the lowest ratio was recorded 19,000 cases per 100,000 adolescents. However, during the last 4 years of observation, there was a repeated increase in the ratio, which in 2018 surpassed the initial ratio of 2008 and concluded 22,993 cases per 100,000 adolescents.

The analysis of the overall incidence ratio per 100,000 population in the regional aspect is shown in the Fig. 5. For the analysis we used the statistical data of Bukhara, Navoi and Kashkadarya regions, as well as the Republic of Karakalpakstan. The reason of choice of these regions was that they were considered the most problematic in terms of IDA prevalence for many years. The graph shows that in 2007 the overall incidence ratio of IDA per 100,000 population in the Republic of Karakalpakstan exceeded 2 times the average ratio for the whole country and concluded 50.6 thousand cases. The rates of the Navoi region were also 2 times higher than the overall average ratio, making 39.2 thousand, while the incidence in the Bukhara region was about 23.1 thousand. Only the ratio in the Kashkadarya region was 13,1 thousand in 2007, which was significantly lower than the overall average rate of 20.6 thousand.



**Fig. 5. The overall incidence ratio of IDA per 100,000 population in the most problematic regions and all over the Republic for 2007 and 2019**

When analyzing similar data for 2019, it is obvious that, like a decrease in the average ratio all over Uzbekistan, these regions were also characterized by a significant decrease. In all 4 regions, over the past 12 years, we observed a decrease in the overall incidence ratio by more than 2 times compared to 2007. At the same time, in the Republic of Karakalpakstan and Navoi region, regression was noted by 57% and 75%, respectively. The data for 2019 shows that only the rates of the Republic of Karakalpakstan (21.6 thousand) significantly exceed the overall average ratio (13.8 thousand), while in other regions they are lower.

## DISCUSSION

The prevalence of IDA among the population is the indicator that depends on socio-economic factors, as the incidence is associated with a lack of iron and other important nutrients in the body [8]. In this regard, the analysis of its dynamics allows to understand the vector of development not only of the health care, but also of other aspects of state life. The Republic of Uzbekistan is a developing state, with a demographic increase of about 20% over 12 years. However, despite the significant increase in the population, the absolute number of IDA cases among the country's population over the past period decreased by more than 26%. This regression shows that, in general, there was a noticeable progress in the country, associated not only with the improvement of treatment methods and prevention of IDA, but also with a number of socio-economic changes in the life of the country.

The dynamics of the most important epidemiological indicators, overall and primary incidence ratio showed that over the past period they decreased by 33% and 30%, respectively, while the R-squared value ( $R^2$ ) in both cases was quite high. It gives grounds for expecting from the point of view of statistics a further continuation of the incidence regression.

However, it should be noted that analysis of the dynamics of disease incidence in individual age groups established that adolescents (15-17 years old) did not show a general tendency towards stable regression during the studied period, and in 2018 the rate turned out to be slightly higher than the initial one. The higher incidence of IDA in adolescents may be

due to a number of causes. Earlier it was established that among the risk factors contributing to the development of IDA, this age group was characterized by adolescence, chronic blood loss (prolonged and heavy menstruation) and malnutrition [11,12,15,16].

Regional features of IDA prevalence were represented by higher disease incidence ratio in the Navoi region and the Republic of Karakalpakstan, where in 2007 this pathology was determined in almost every second inhabitant. Over the past 12 years, a significant decrease in the incidence ratio was achieved in these regions. However, in the Republic of Karakalpakstan, the rates are still almost 2 times higher than the average rates throughout the country.

In general, according to the WHO recommendations [17,18], in the Republic of Uzbekistan for the period from 2007 to 2019, the changing of the severity grade of IDA for public health from medium (prevalence 20.0–39.9%) to moderate (5.0-19.9%) was achieved. In some regions, where in 2007 the IDA incidence ratio was severe ( $\geq 40\%$ ), changing to the medium grade was achieved during 12 years. Nevertheless, the average overall incidence ratio is still far from the norm (4.9%), which demands to continue and deepen preventive and health-improving measures.

## CONCLUSION

Thus, the conducted epidemiological analysis showed the significant regression of the IDA incidence ratio in the Republic of Uzbekistan in the period from 2007 to 2019. However, in certain age groups, particularly among adolescents, the prevalence of the disease remains high, requiring the development of a new approach to the treatment and carrying out preventive measures.

Besides, the analysis of regional features of the IDA incidence established that in some regions the ratio was much higher than in the country as whole. This fact requires a deeper study of pathology in the indicated region, as well as the analysis of its incidence dynamics and factors contributing to it.

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