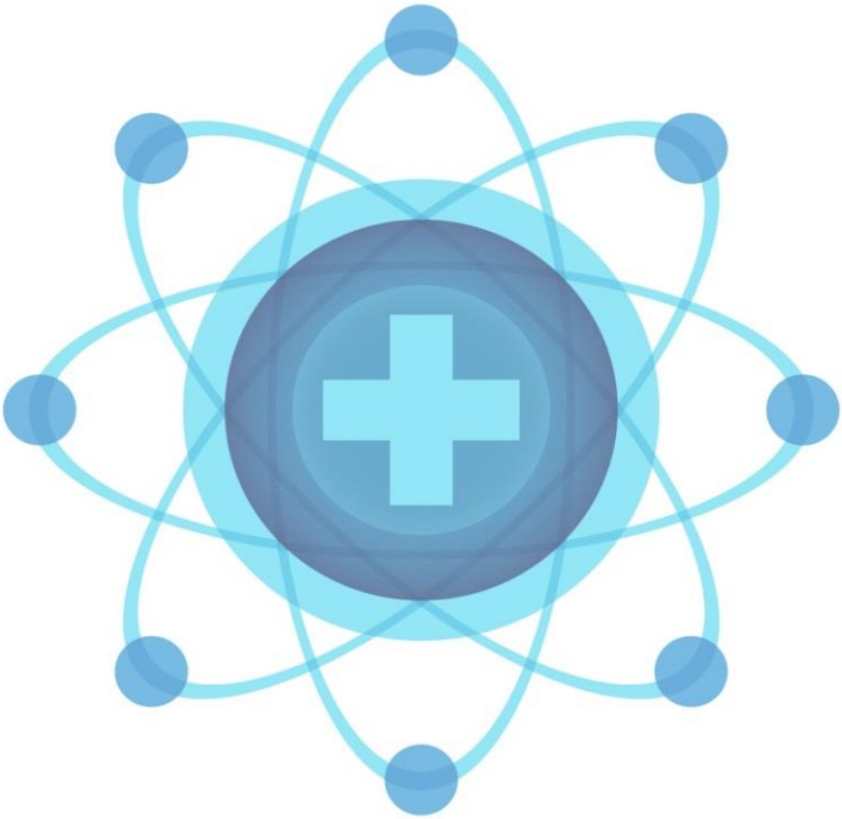

INTERNATIONAL MEDICAL SCIENTIFIC JOURNAL

ART OF MEDICINE

Founder and Publisher **North American Academic Publishing Platforms**
Internet address: http://artofmedicineimsj.us
E-mail: info@artofmedicineimsj.us
11931 Barlow Pl Philadelphia, PA 19116, USA +1 (929) 266-0862

Available at https://www.bookwire.com/
ISBN: 978-0-578-26510-0

Mathematical model for calculating the level of contamination of the territory with intestinal parasitic diseases

Makhmudova L.B[1]., Tashpulatova Sh.A[2].
Research Institute of Medical Parasitology named after L.M. Isaeva[1], Tashkent Medical Academy[2]

Currently, more than 300 species of helminths and more than 50 protozoa are known to cause diseases in humans. Helminthiases are widespread among the world's population. According to modern WHO estimates, ¼ of the world's population is infected with intestinal parasites [1; 2; 3; 4]. Parasitic diseases are especially common in tropical and subtropical regions of Asia, Africa and Latin America, where most of the world's population lives. It occurs even beyond the Arctic Circle (Kola Peninsula, Taimyr, Yamal), so intestinal helminthiases are an urgent public health problem. These diseases lead to poor health and well-being in poor countries around the world [5; 6; 7]. It was recognized that the main risk group for these diseases are children of school and adolescence, regardless of the region. The prophylactic use of anthelmintic drugs in these groups is part of the national policy of some countries with endemic regions [8; 9].

A number of scientific studies are being carried out in the world to study the effect of intestinal parasitic infections on the human body, early diagnosis of diseases, prevention of complications, improvement of preventive measures among the population, especially schoolchildren, preschoolers, but among them methods for assessing the incidence of parasitic diseases in the region have not been developed.

Accordingly, **the purpose of the study is** to determine the prevalence of intestinal parasitic diseases in the districts of the Samarkand region.

Materials and research methods. In order to study the incidence of parasitic diseases in the region, an analysis was made of the data of the Sanitary and Epidemiological Service of the World and Public Health of the Republic of Uzbekistan for the period 2000-2021.

Using the analysis, the leading parasitic diseases of the intestine in the Samarkand region in the studied years were identified, and to determine the level of parasitic diseases of the intestine in the districts of the Samarkand region, a mathematical model was developed for calculating the level of parasitic diseases of a certain territory, proposed by de Silva & Hall (2010) ((**Palh**) studied [10].

$$Palh = a + t + h - (a \times t + a \times h + t \times h) + a \times t \times h / 1{,}06$$

where a = prevalence rate (%) of ascariasis
t = trichocephaly prevalence rate (%)
h = hookworm prevalence (%)

We adapted this mathematical calculation model proposed by de Silva & Hall (2010) taking into account the leading parasitic diseases for (**Pelh**) Samarkand region and developed this mathematical model.

$$Pelh = e + l + h - (e \times l + e \times h + l \times h) + e \times l \times h / 1{,}06$$

Where e = Enterobiasis prevalence rate (%)
l = giardiasis prevalence rate (%)
h = prevalence rate of hymenolepiasis (%)

Digital materials of the study were processed by the method of variation statistics using Microsoft Excel 2016 (XR). To study the structure of intestinal parasites, we used the following statistical formula:

Structure of intestinal parasitoses (%) = occurrence of one parasitosis * 100 / all intestinal parasitic diseases

Results. An analysis of the dynamics of the overall incidence of parasitic diseases in the Samarkand region for 2000-2021 shows that the average incidence rate per 100,000 population over these years was 363.4 and from 160.3 (2020) to 480.8 (2006). But at this point it should be noted that the indicator in 2020 has an unusual "jump" in size. That is, in 2020, due to the COVID-19 pandemic, there was a change in the balance of priorities in health care and, as a result, the population's appeals for other diseases, including parasitic ones, and the diagnosis and detection of diseases. decreased somewhat. It is for this reason that the incidence of parasitic diseases in 2020 (160.3) was recorded 2.3 times lower than the average (363.4). Since this situation represents an abnormal deviation in the dynamics of the incidence of parasitic diseases in the region, in order to avoid methodological errors, it is advisable at the following stages of the analysis (especially in analyzes related to incidence rates). In this case, that is, after excluding the figure for 2020 from the figures for 2000-2021, the average incidence rate is 373.1 per 100,000 population (Fig. 1).
According to the results of the analysis, it was noted that during 2000-2015. in all years except 2008 (333.0), the incidence of parasitic diseases was above the average (373.1), and during 2016-2021. than the average. So, in the long-term dynamics of parasitic diseases in the Samarkand region, two periods are distinguished - a period of high incidence and a period of relative decline.

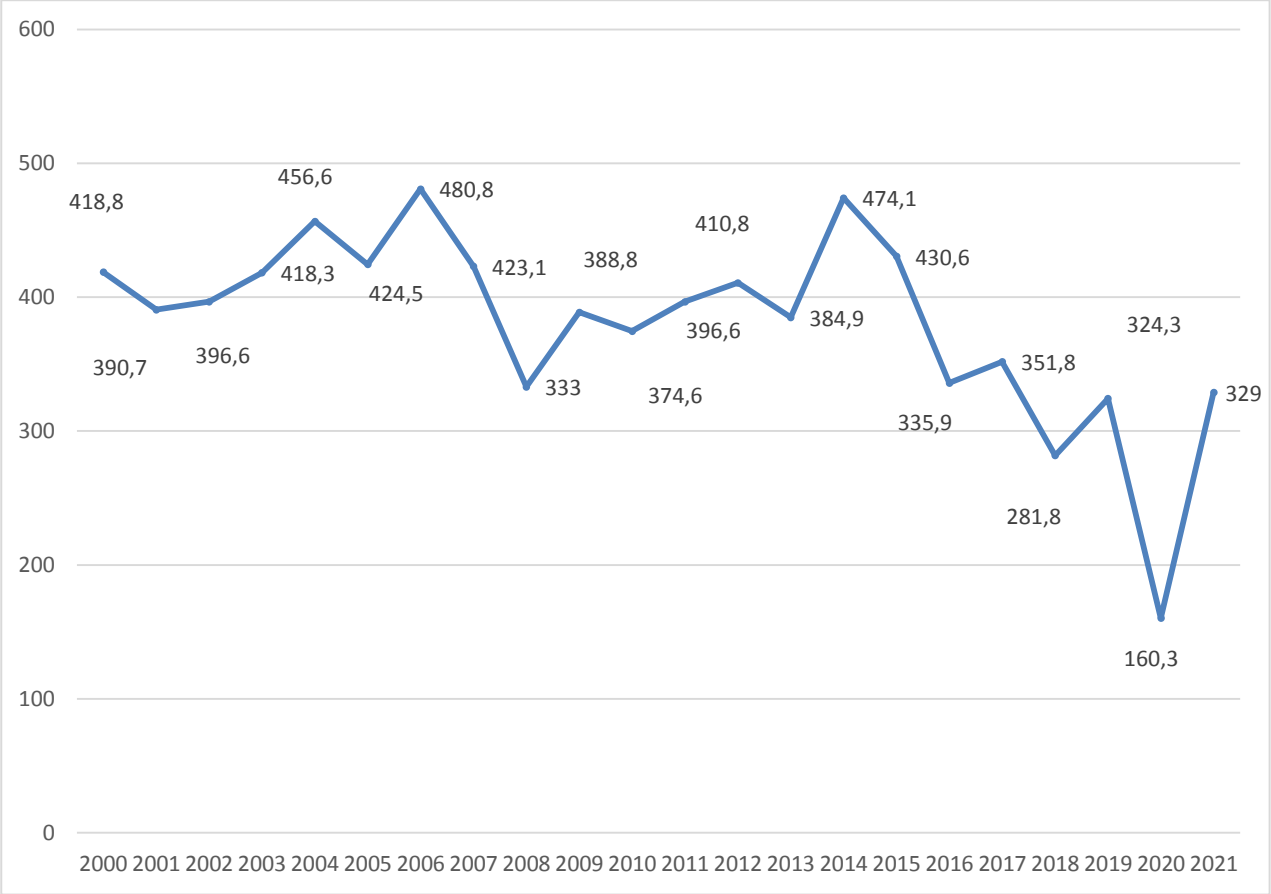

Figure 1. Dynamics of the incidence of parasitic diseases in the Samarkand region, 2020-2021 (per 100,000 inhabitants)

During the period of high-speed transmission (2000-2015), the incidence exceeded the average by 1.1 (2010) - 1.3 (2006) times, and during this period the incidence did not decrease, i.e. the incidence is observed at the beginning of the year (2000) 418.8, and at the end of the observed years (2015) 430.6.

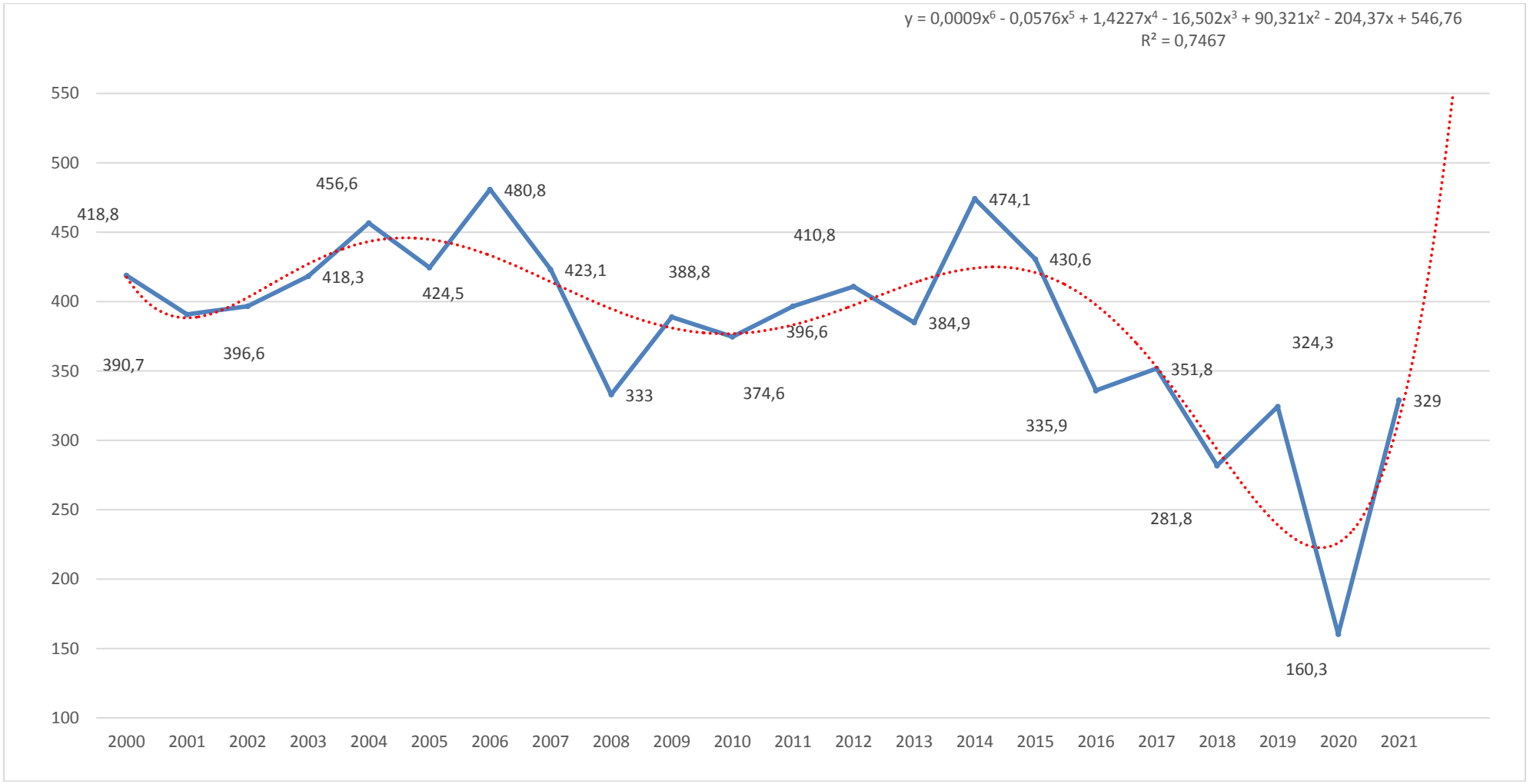

Figure 2. Trend (trend) of the dynamics of parasitic diseases in Samarkand region, 2020-2021 (per 100,000 inhabitants)

So, the factors that determine the incidence of parasitic diseases in the region had a steady impact on the population during these years.

During the period of relative decline (2016-2021), it was noted that the incidence was 1.1 (2017) - 1.3 (2018) times lower than the average. The incidence decreased in 2016 compared to 2000 by 1.2 times, and by 2021 - by 1.3 times.

In the years under study, when studying the dynamics of the incidence of parasitic diseases in the Samarkand region, it was found that the incidence rate increased and decreased in waves, and in subsequent years, an increase in the incidence was predicted with a confidence interval of 75.0% ($R^2 = 0.7467$) (Fig. 2).

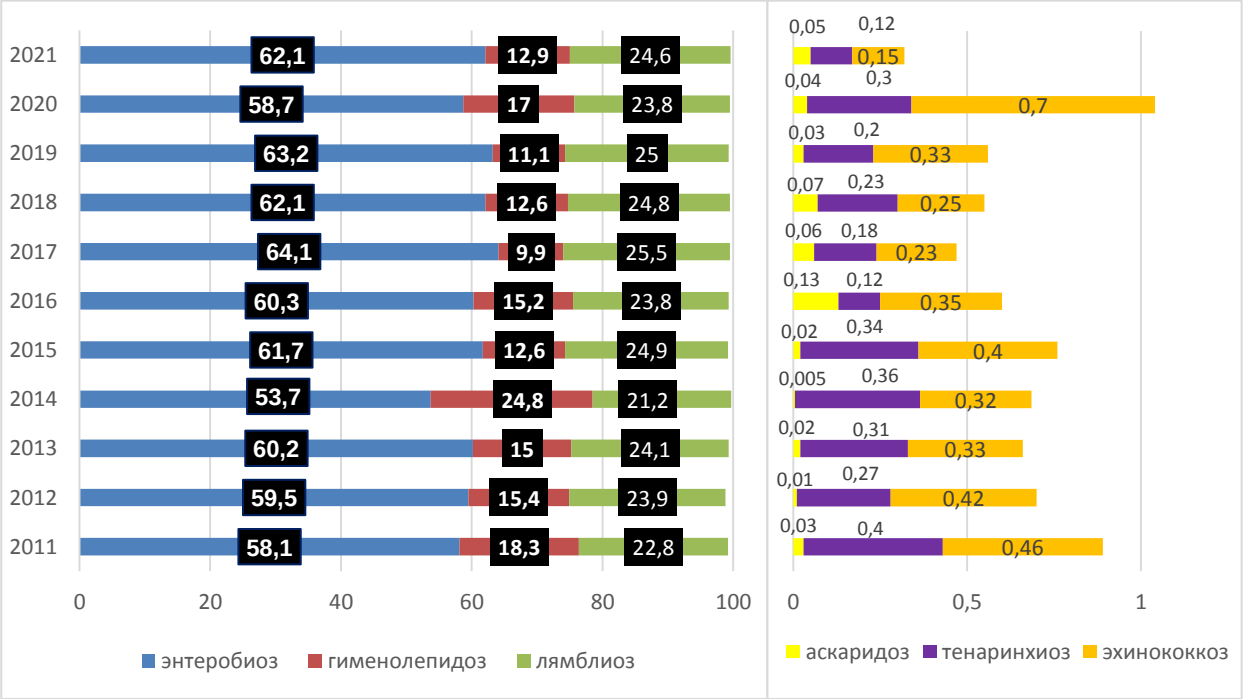

Figure 3. Structural structure of intestinal parasites in Samarkand region (%)

At the next stage, we analyzed the structural structure (structure) of intestinal parasitic diseases identified in the Samarkand region over the years. We used the following statistical formula:

Composition of intestinal parasitic diseases (%) = incidence of one parasite *100 / all identified intestinal parasitic diseases

According to the results, enterobiasis took the leading place among intestinal parasitosis identified over the past 11 years and averaged 60.3% in the period from 2011 to 2021. During the studied years, its occurrence ranged from 53.7% to 63.2%. The next place was occupied by giardiasis, on average 24.03%, giardiasis fluctuated in the studied years from 21.2% to 25.5%. Among the intestinal parasitosis identified in the Samarkand region, hymenolepidoses occupy the third place (average 15.0%), observed in the range of 9.9-18.3% over the past 10 years. Among the intestinal parasitosis identified in the Samarkand region, teniarhynchiosis is an extremely low percentage - 0.28%; echinococcosis - 0.33%, and ascariasis (average 0.02% per year)

was in last place. The incidence of these identified intestinal parasites did not change statistically significantly over the years (Figure 3).

Using the developed mathematical model, we separately assessed the level of intestinal parasitic diseases in all districts of the Samarkand region, taking into account the incidence of leading intestinal parasites observed in 2018 and 2019. Areas with an incidence of intestinal parasitic diseases ≥ 50% are hyperendemic; Areas with ≥20 <50% were assessed as mesoendemic areas, and areas with <20% as hypoendemic areas. As shown in Figure 4, in Pakhtachinsky, Payariksky, Nurabadsky, Urgutsky and Koshrabotsky districts, the incidence of intestinal parasitic infections was ≥ 50%, so these areas were identified as hyperendemic.

In Dzhambai, Ishtikhan, Kattakurgan, Okdarya, Pastdargom districts and the city of Kattakorgon, the level of infection with intestinal parasitic infections was in the range ≥20 <50%, according to which these districts of the Samarkand region were assessed as mesoendemic areas according to the level of infection. Narpay, Bulungur, Tailok, Samarkand districts and the city of Samarkand were identified as hypoendemic zones due to the level of infestation <20%.

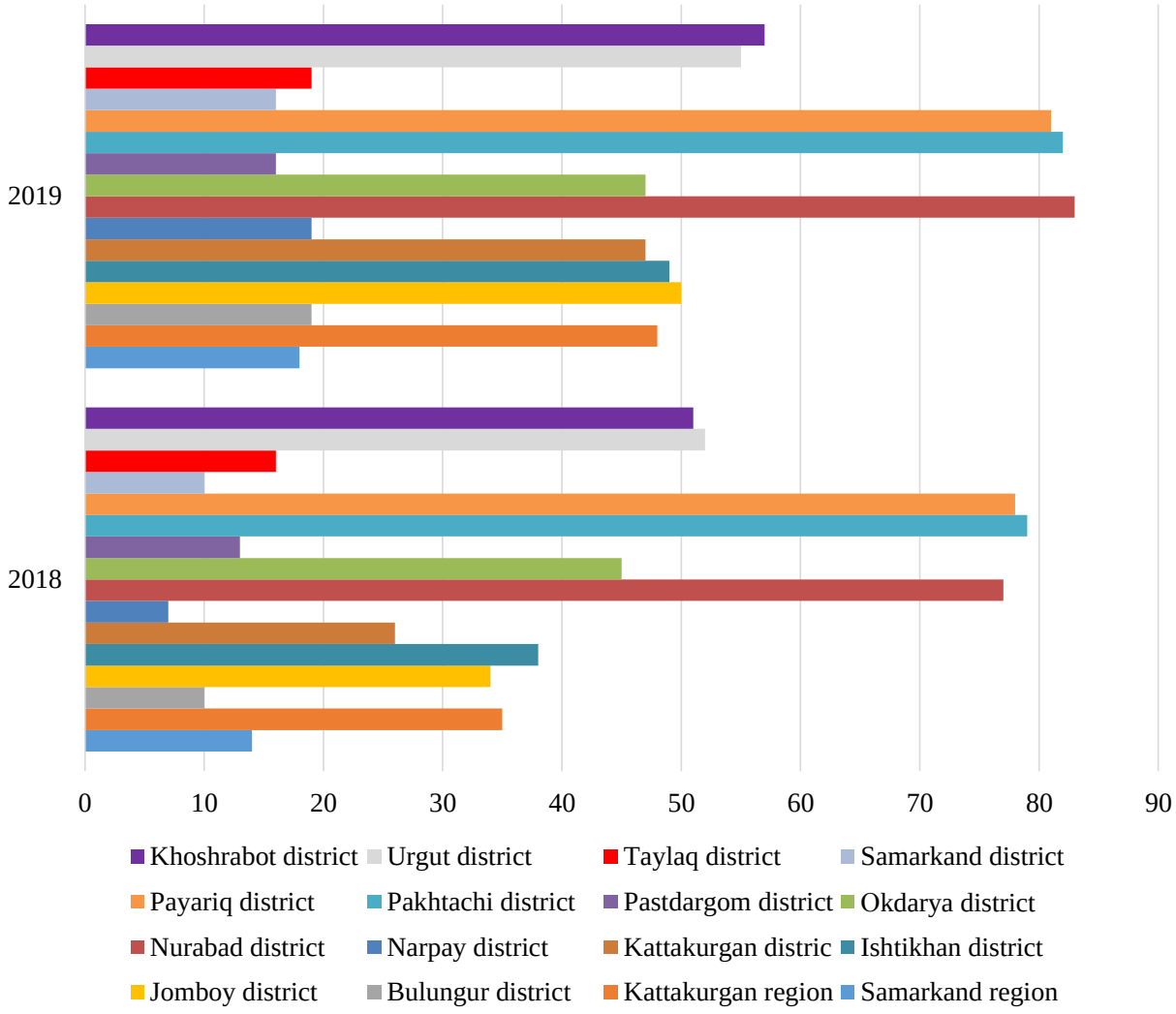

Figure 4. Assessment of the level of infection of the districts of the Samarkand region with parasitic diseases (2018-2019) (%) using a mathematical calculation model (Pelh)

Conclusions. In the period 2011-2021 the incidence of parasitic diseases in the Samarkand region is divided into two periods - a period of high incidence and a period of relative decline. The trend in the dynamics of the incidence is undulating, and the incidence is predicted to increase in subsequent years with a confidence interval of 75.0%. Enterobiasis, hymenolepiasis and giardiasis occupy leading positions in the structure of the identified intestinal parasites. When assessing the level of infection with intestinal parasitic diseases in the districts of Samarkand region using the developed mathematical model, it was found that the level of infection with intestinal parasitic diseases is unevenly distributed over the regions.

References

1. World Health Organization. Report of the third global meeting of the partners for parasite control. Deworming for Health and Development Geneva, 29–30 November 2020
2. World Health Organization, UNICEF. Prevention and control of schistosomiasis and soil-transmitted helminthiasis. Joint statement. 2021
3. Dr Vivian Awelch P et all. Mass deworming to improve developmental health and wellbeing of children in low-income and middle-income countries: a systematic review and network meta-analysis //The Lancet Global Health Volume 5, Issue 1, January 2017, Pages e40-e50
4. Faria CP, Zanini GM, Dias GS, da Silva S, de Freitas MB, Almendra R, et al., Geospatial distribution of intestinal parasitic infections in Rio de Janeiro (Brazil) and its association with social determinants. PLoS Negl Trop Dis, 2017. 11(3): p. e0005445.
5. Kumar H., Jain K., Jain R. A study of prevalence of intestinal worm infestation and effi cacy of anthelminthic drugs // Med J Armed Forces India. 2014 Apr; 70(2): 144–8.
6. Lin R.J., Chen C.Y., Lu C.M., Ma Y.H.Anthelmintic constituents from ginger (Zingiber offi cinale) against Hymenolepis nana // Acta Trop. 2014 Dec; 140: 50–60.
7. Mumtaz S., Siddiqui H., Ashfaq T. Frequency and risk factors for intestinal parasitic infection in children under five years age at a tertiary care hospital in Karachi // J Pak Med Assoc. – 2009. – 59. – 4. – p. 216-219.
8. Staudacher O, Heimer J, Steiner F, Kayonga Y, Havugimana JM, Ignatius R, et al. Soil-transmitted helminths in southern highland Rwanda: associated factors and effectiveness of school-based preventive chemotherapy. *Tropical Med Int Health.* 2014;**19**(7):812–824.
9. Winiski A et al. Inhibitory activity of pimecrolimus and tacrolimus on induced cytokine mRNA and protein expression in a human T cell line (Jurkat)measured via RT PCR and ELISA // J.Invest . Dermatol. – 2021 119 – 347.
10. WHO Library Cataloguing Publication Date: Helminth control in school age children a guide for managers of control programmes -2hd ed. 2012.-76p.