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## HYGIENE, SANITATION, EPIDEMIOLOGY AND MEDICAL ECOLOGY

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### EPIDEMIOLOGICAL CHARACTERISTICS AND DYNAMICS OF BRUCELLOSIS INCIDENCE AMONG PEOPLE IN AZERBAIJAN (2017-2021)

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**Relevance.** The development of preventive measures and the improvement of the system of medical care for the treatment of zoonotic infections depend on the identification of the incidence rate and important risk factors. The present study aims to determine some epidemiological indicators and trends in the incidence of brucellosis among people in Azerbaijan from 2017 to 2021.

**Methods.** Descriptive cross-sectional retrospective study was carried out on the basis of the Electronic Surveillance System for Infectious Diseases of the Ministry of Health of the Republic of Azerbaijan for 2017-2021. Epidemiological reports on each case of the disease were used to collect data on demographic and background characteristics, risk factors, laboratory test results.

**Results.** In total, 1,711 newly reported cases of brucellosis have been registered in Azerbaijan from 2017 to 2021. The highest (5.3) and lowest (2.2) incidence rates per 100,000 population were observed in 2019 and 2021, respectively. The highest rates during the observation period were in the cities of Baku and Sumgayit, Shemkir region. The cumulative percentages of the disease were estimated for various variables by the following indicators: by sex: 70.6% for men; by age groups: 10.7% for the age group 26-30; by occupation: unemployed 45.8%; by place of residence: 81.6% for residents of districts and villages.

**Conclusions.** Despite the general decrease in the number of newly reported cases of brucellosis by years and cumulative characteristics, a detailed descriptive analysis revealed epidemiological features of the spread of cases by years depending on risk groups.

**Keywords:** brucellosis, incidence, trends, zoonosis, Azerbaijan.

**Introduction.** An analysis of the incidence of brucellosis among the population of Azerbaijan in the early years showed that over the past 10 years, the number of cases has gradually increased with a peak in 2019 (550 confirmed cases) [3, 5]. In 2020 and 2021, the number of confirmed cases of brucellosis among humans dropped sharply (by 2.8 times). This fact can be explained by quarantine measures during the COVID-19 pandemic in Azerbaijan and, accordingly, by the low rate of people applying to medical institutions. It can also be assumed that the promotion of veterinary vaccination, public education and other measures

have been effective in reducing the detection of new cases of brucellosis. The study of the epidemiological characteristics and dynamics of the incidence of brucellosis among people in Azerbaijan at the present stage is of interest. Identification of changes in the prevalence of this zoonotic disease in humans will allow a better assessment of the public health measures and management practices needed to address the current situation. Despite the downward trend observed in recent years, the geographical position of Azerbaijan and its proximity to countries endemic for brucellosis, such as Iran, Georgia, are important risk factors for the reappearance and spread of this infection. [4, 5]. Therefore, it is important to conduct continuous monitoring of this zoonosis both among humans and among animals.

**The purpose of the study:** To determine some epidemiological indicators

and dynamics of the incidence of brucellosis among people in Azerbaijan in 2017-2021.

**Material and methods.** The epidemiological descriptive assessment of brucellosis rates and dynamics included elements related to demographic and background characteristics such as age, sex, occupation, and area of residence. The data was obtained from the database of the Electronic Surveillance System for Infectious Diseases for 2017-2021. Inclusion criteria were human cases of newly reported brucellosis meeting the country's standard case definition, with a final classification of "Confirmed" by the date of final classification.

The standard definition of a suspected case includes a case with musculoskeletal pain and fever lasting more than 5 days and at least 5 of the following clinical features [2]:

- general signs of an infectious pro-

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cess: fever, sweating, chills, weakness, malaise, headache, lack of appetite, nausea;

- abdominal manifestations: hepatomegaly, splenomegaly, hepatitis;

- lesions of the musculoskeletal system: arthralgia, arthritis, myalgia, back pain, spondylitis, sacroiliitis, tendovaginitis, fibrositis;

- specific organ lesions: orchiepididymitis, miscarriages in women, endocarditis, neurological manifestations (meningoencephalitis, autonomic dysfunction, lesions of the peripheral nervous system).

**Probable case:** Signs of a suspected case and in addition one of the following: assisting in childbirth with an animal, contact with a sick animal, consumption of unpasteurized milk and dairy products from a sick animal; the use of meat subjected to insufficient heat treatment; epidemiological link to the outbreak; laboratory contact with material suspected of carrying the causative agent of brucellosis.

**Confirmed case:** Signs of a suspected or probable case and in addition one of the following: a positive result of a blood sample (serologically: Haddelson test, Rose Bengal test, Wright test, bacteriologically).

Study variables of interest to our analysis included age, gender, location, laboratory results (serological tests). Incidence rates per 100,000 population were calculated. Data were analyzed using descriptive statistical methods and presented by frequencies and percentages using Epi Info version 7.0 (Centers for Disease Control and Prevention, Atlanta, USA) and Microsoft Office Excel.

**Results and its discussion.** Figure 1 shows the absolute figures and the rate per 100 thousand of the population for 5 years (2017-2021). As can be seen from the graph over the past 5 years, there has been a steady downward trend in the incidence of brucellosis among humans. The linear trend line confirms this fact ( $R^2=0.625$ ). The number of cases of newly reported brucellosis in 2021 is 2.3 times less than in 2017.

An analysis of the incidence distribution among the urban (Baku and Sumgayit) and rural populations showed that the incidence of brucellosis among the rural population is significantly higher than among the urban population ( $p<0.005$ ). (Fig. 2) The same dependence is noted in the works of other authors [6].

The distribution of cases of brucellosis by district during the study period varied. So, in 2017, not a single case of brucellosis was registered in 8 districts (As-

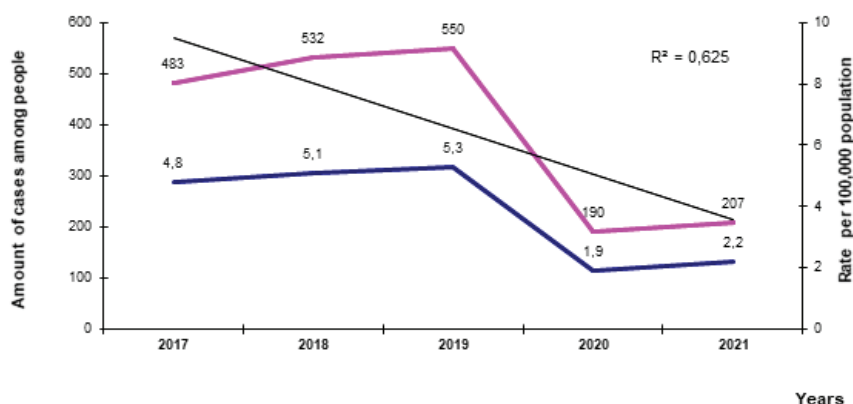


Fig 1. Number of cases of brucellosis among humans and rate per 100,000 population in Azerbaijan, 2012-2021

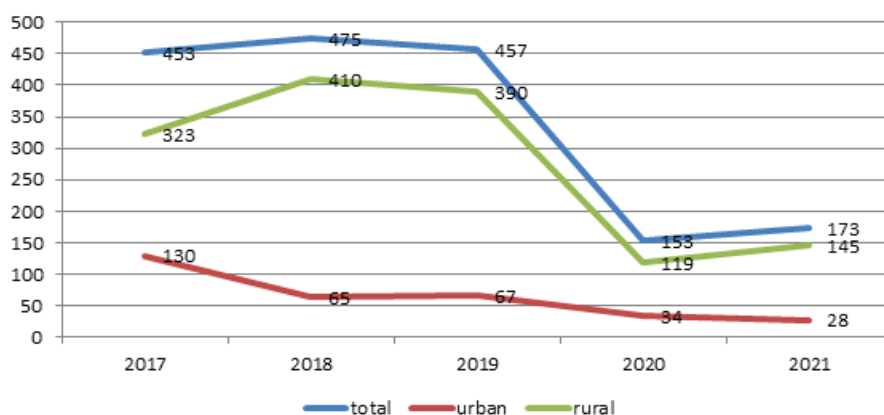


Fig. 2. Distribution of the incidence of brucellosis in large cities (Baku and Sumgayit) and regions of Azerbaijan, 2017-2021

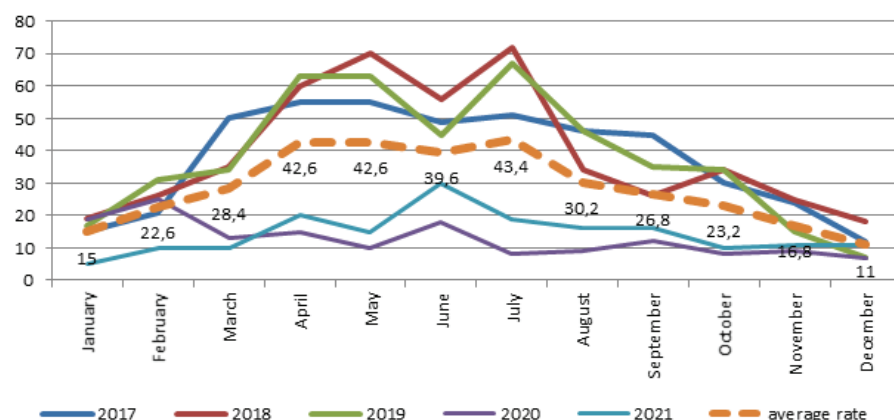


Fig.3. Seasonal distribution of cases of brucellosis in Azerbaijan, 2019-2021

tara, Balaken, Gusary, Kelbejar, Lachyn, Shusha, Siyazan, Zardob). Only 2 cases were registered in Balakan in 2019, and no cases have been registered in Gobustan and Shirvan regions since 2019. The largest number of cases over five years was registered in Baku and Nakh-

ichevan Autonomous Republic (an average of  $50.2 \pm 3.5$  cases per year). In the Siyazan region and Gusar, from 0 cases in 2017, up to 4-5 cases per year were recorded in subsequent years of observation. The areas with a high incidence of brucellosis among people include Ab-

sheron, Aghjabady, Beylagan, Barda, Gabala, Ganja, Imishli, Gadabay, Guba, Kurdemir, Shemkir.

Analysis of the seasonality of the incidence of brucellosis for 2017-2021 (see Figure 5) showed an increase in the registration of cases in the spring, summer-autumn period. The peak incidence in 2017 falls on April, in 2018-2019. - for April and June, in 2020-2021 - for the month of June. The average annual monthly rate for 5 years also indicates that the peak of the increase in the number of newly reported cases of brucellosis occurs in the spring (April - 42.6 cases) and summer (July - 43.4 cases) months.

The revealed seasonality in the incidence of brucellosis in people can be explained by intensive human economic activity, namely: care for domestic animals, mainly for small cattle. Since brucellosis is mainly an occupational disease, infection occurs through direct contact with animals during childbirth. [1,6] Our results can be used to plan and evaluate interventions based on risk groups.

A study of the distribution of cases of brucellosis by sex showed that, on average, the proportion of newly reported cases of brucellosis among men is 2.37 times higher than among women.

An analysis of the distribution of cases by age group showed differences by year. So, for example, in 2017, the largest proportion of cases occurred in the age group of 6-10 years (16%), the smallest - in people over the age of 70 (0.7%) (Fig. 4). However, among men in the age group of 6-10 years, 15.8% of cases were noted. In 2018, a large proportion of cases of brucellosis incidence occurs in the age group of 26-30 years (12.8%). However, among men in the age group of 16-20 years, the percentage of cases is higher than in the rest - 11.4%. In 2019, the age of patients increases again, showing the maximum value in the age groups of 26-30 and 31-35 years (11.6% each). In 2020, the age groups 11-15 and 41-45 account for 11.1% of all registered. However, among men, a high proportion of cases occurs in the age group of 16-20 years (15.5%), among women - in the age group of 41-45 years (12%). In 2021, the largest number of cases were in the age group of 11-15 years (12.1% of all newly reported cases). By gender, the proportion of people with brucellosis differs - 11.2% of men aged 16-20 years and 12.5% for the age groups of 6-10 and 31-35 years among women.

The average age of people with newly reported brucellosis ranged from 28.4 years in 2017 to 33.9 years in 2019.

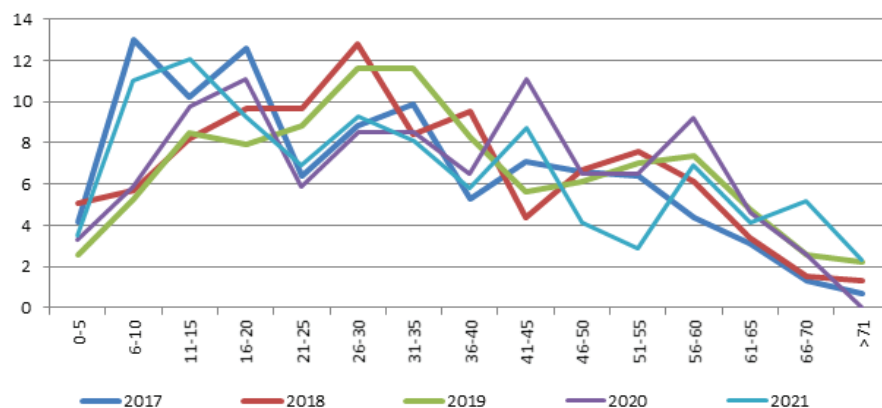


Fig 4. Distribution of cases of brucellosis by age groups in Azerbaijan for 5 years (2017-2021)

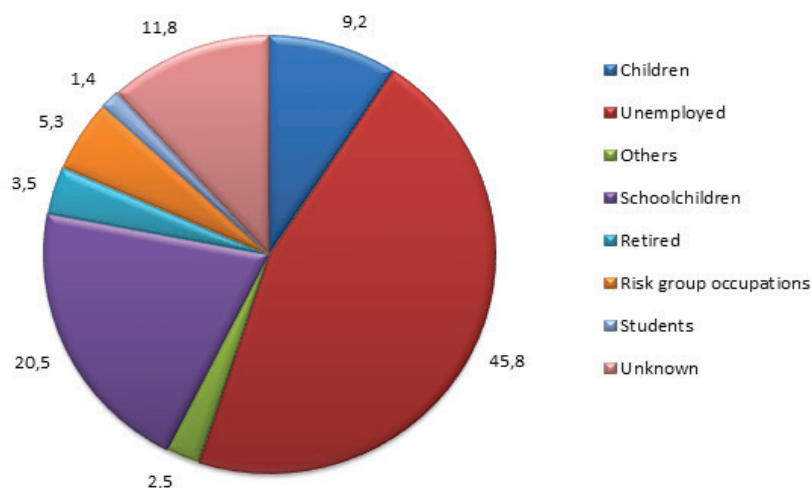


Fig 5. Distribution of cases of initially notified brucellosis by employment (2017-2021)

Young and working age people may have more contact with livestock and animal products, especially in rural areas. [2, 5].

An analysis of the distribution of cases of initially reported brucellosis by employment for the study period (2017-2021) showed that up to 45.8% of cases are the unemployed population (Fig. 5). One fifth of all cases are schoolchildren (20.5%).

Over the years, the distribution of the noted forms of employment differed greatly. Moreover, the share of the "unknown" field gradually increased (from 9.9% in 2017 to 16.8% in 2021). The proportion of preschool children ranged from 16.2% (in 2019) to 25.6% (in 2017). Over the years, there is a noticeable increase among the first reported cases of brucellosis in patients employed in risk group professions. Yes, in 2017. share was 2%, then in 2021. increased by 2 times - 4.1%.

Contact transmission may be related to occupation. It is not clear what duties housewives performed that put them at risk of contracting brucellosis; they may

have been directly involved in activities such as cow milking and food preparation, during which they were likely to come into direct contact with brucella-contaminated milk or meat.

An assessment of the percentage distribution of newly reported cases of brucellosis by place of residence and employment showed some regularities. For example, in 2021, the proportion of children with brucellosis in the cities of Baku and Sumgayit increased significantly (17.9%). The same trend was also typical for pensioners in the cities of Baku and Sumgayit (4.5 times in 2021 the proportion of cases is higher than in previous years of observation).

**Conclusions and recommendations.** For the first reported brucellosis among humans in Azerbaijan in 2017-2021. the following epidemiological characteristics were inherent:

- 70.6% - the proportion of men infected with brucellosis;
- 10.7% - the share attributable to the age group of 26-30 years;

- 45.8% of all reported cases are unemployed and housewives;
- 81.6% - the share of residents of districts and villages.

Given the high incidence of the disease among males, as well as the unemployed, teaching these people how to prevent disease when in contact with animals can help control the disease. Measures such as educating about the importance of proper handwashing with soap and water, using gloves and face masks when dealing with infected livestock and when cleaning pens for affected livestock, and proper air conditioning

can prevent infection in these categories of people.

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## FEATURES OF THE ELEMENTAL COMPOSITION OF THE HAIR OF CHILDREN LIVING IN AREAS WITH DIFFERENT ANTHROPOGENIC LOAD

Biological environments of the body serve as a reliable bioindicator reflecting the state of human health and its environment. The aim of the study was to study the accumulation of trace elements in the hair of children from birth to 6 years old, living in areas with different types and degrees of anthropogenic pressure. The content of (Ca, Mg, Fe, Zn, Cu, Cr, Ni, Mn, Pb, Cd) in the hair of newborns was determined by atomic absorption spectrometry; the dynamics of the content of heavy metals in the hair of children from birth to six years of age was assessed; a comparative analysis of the level of trace elements in the hair of preschool children living in different regions of the Republic of Bashkortostan was carried out. By the age of six, the hair of Ufa children revealed a reduced content of essential elements: Fe, Mn and Zn; toxic metals: Pb and Cd; conditionally essential: Ni and Cr compared with the average physiological level. In the hair of children living in a region with a developed mining industry, on the contrary, there is an accumulation of essential elements: Fe and Mn; conditionally essential element - Cu and Ni and toxic - Pb.

**Keywords:** heavy metals, biological media, children's hair, macroelements, microelements.

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**Introduction.** One of the key characteristics of society is the state of health of the population, which depends on the adverse effects of the environment [7, 8]. Every year, millions of tons of pollutants enter the atmosphere of settlements from various sources of emissions. The leading place among ecotoxins belongs to heavy metals: lead, cadmium, chromium. Potential sources of environmental pollution with chemical elements are oil refineries, mining and processing plants, ore deposits, the industrial development of which contributes to environmental pollution and their accumulation in toxic concentrations in biological media [9].

The organism of children is most susceptible to adverse environmental influences, it has an increased sensitivity to insufficient or excessive intake of chemical elements, both toxic and essential, from outside [2, 5]. The routes of entry of chemical elements into the child's body

are diverse, mainly metals are supplied with food and water, less with inhaled air and through the skin [14].

To assess the impact of a habitat with a high content of heavy metals on the human body, elemental analysis of hair is used [1, 4, 6, 10]. A characteristic feature of the child population is a more pronounced reaction to harmful environmental factors due to the low threshold of sensitivity to the effects of heavy metals, low mobility and greater attachment to a particular area.

**Purpose of the work:** to study the accumulation of elements, both essential and toxic, in the hair of children from birth to 6 years old, living in the Republic of Bashkortostan in areas with different ecological and natural geochemical situations.

**Materials and methods.** 834 samples of children's hair were analyzed by atomic absorption spectrometry, and a