https://doi.org/10.55764/2957-9856/2026-1-116-126.11

IRSTI 39.25.23
UDC 911.3

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THE IMPACT OF GEOGRAPHICAL CONDITIONS ON POPULATION HEALTH IN THE REPUBLIC OF AZERBAIJAN

Abstract. The geographical conditions of a country's territory play a crucial role in determining the health of its population. The article investigates the relationship between the incidence of respiratory diseases and geographical factors across the natural regions of the Republic of Azerbaijan. The study found that the highest morbidity rate occurs in the Greater Caucasus (11.3%), while the lowest is observed in the Middle Araz region (5.7%). Regression analyses show that in the economic regions of Baku and Absheron-Khizi (R^2 = 0.7094), Mountainous Shirvan (R^2 = 0.653), and Shirvan-Salyan within the Kura Intermountain Depression (R^2 = 0.8098), the morbidity rate decreases with increasing average elevation above sea level. In particular, in the Shirvan-Salyan region, each 1-meter rise in elevation reduces the morbidity rate by an average of 16 cases per 10,000 people. In contrast, the Middle Araz region shows an opposite relationship (R^2 = 0.34). The influence of elevation is indirect and is shaped through such factors as precipitation, temperature, and hydrological conditions. These findings confirm that relief plays an important mediating role between ecological conditions and human health. The results of the study on the influence of geographical factors on the incidence of respiratory diseases – one of the leading causes of morbidity in Azerbaijan – showed that factors such as geographical location, elevation above sea level, relative humidity, precipitation levels, hydrological conditions, and both natural and anthropogenic air pollution determine the regional differences in the spread of these diseases.

Keywords: population health, disease incidence, respiratory diseases, geographical factors, relief, environmental conditions.

Introduction. The influence of physical, social, economic, and cultural factors on the causes and spread of diseases among people has been known since the 3rd century BCE. As early as 400 BCE, Hippocrates, in his treatise "Air, Water, and Places", discussed the direct relationship between geographical environment and human health. The diversity of geological, geomorphological, soil, climatic, hydrological, and other natural features makes the assessment of geographical conditions in terms of human health particularly relevant.

Major geological factors such as water sources, active faults, geophysical fields, mineral deposits, and geological processes including volcanism, earthquakes, and hydrothermal activity release microelements into the environment, increasing the concentration of chemical substances and thus affecting human health. People are exposed to minerals and elements transferred from rocks to soil, and from soil to plants, water, and air – through respiration or food consumption – leading to various diseases. For instance, studies have shown that the inhalation of volcanic ash containing silicon dioxide (SiO_2) and fibrous asbestos minerals in active volcanic areas is associated with respiratory diseases such as asthma, silicosis, and non-specific pneumoconiosis [1, 2].

The analysis of the geomorphological features of inhabited areas is essential for studying the geographical factors affecting human health. As altitude increases, air density and temperature decrease, atmospheric pressure drops in mountainous areas, and arid climates prevail in lowlands. Natural radiation from rocks and other such factors contribute to the spread of various diseases among populations. Both acute and chronic exposure to high altitude can cause respiratory disturbances. Beyond certain elevations, external influences intensify, making the environment uncomfortable or even hazardous for those unadapted to such conditions. These environments possess properties that can affect both healthy individuals and those with preexisting conditions. Above 1,000 m, fatigue and headaches commonly occur; at 1,500–3,500 m, shortness of breath increases; and at 3,500–5,500 m, the drop in partial oxygen pressure leads to hypoxia and altitude sickness. The rate of ascent also influences the development of

these conditions, while low air temperatures, intense solar radiation (including ultraviolet radiation), and wind exacerbate the pathological process [3, 4].

Soil has both positive and negative effects on human health, directly or indirectly. Although soil serves as a source of nutrition for all living organisms, in many areas natural or anthropogenic factors cause harmful levels of certain elements or chemical compounds, posing health risks upon exposure. Humans may be affected through three main pathways: ingestion, inhalation, and dermal contact [5].

Despite major advances in medicine, climatic conditions continue to influence human health directly and indirectly. Direct impacts arise from climatic and atmospheric factors, while indirect effects are related to the influence of climate on urban environments, drinking water, infectious diseases, and air pollution. Meteorological factors – such as solar radiation, air temperature and humidity, wind speed, and atmospheric pressure – contribute to numerous health problems. According to scientific sources, variations in temperature and humidity are key abiotic climatic factors affecting the human body. Fungal skin infections tend to worsen in warm and humid climates, while exposure to hot, dry, and dusty air can cause irritation and infection of the eyes and respiratory tract [6]. Low temperatures also pose health risks: research shows that diseases such as pneumonia, gangrene, bronchitis, and the common cold are more frequent in cold climates [7].

Hydrological bodies – such as oceans, seas, rivers, lakes, canals, reservoirs, groundwater, and glaciers – represent vital components of human health. Although water covers two-thirds of the Earth's surface, only 0.3% constitutes accessible freshwater sources [8]. In the 21st century, freshwater scarcity and water quality have become among the most pressing global health challenges. Currently, more than one-third of the world's population lacks access to safe drinking water, leading to severe health consequences. Furthermore, polluted water bodies expose humans to pathogens and toxic chemicals through direct contact [9, 10].

A review of the literature demonstrates that geographical factors exert a significant influence on the spread of respiratory diseases. This raises an important question: in Azerbaijan, across the five natural – economic regions (Greater Caucasus, Lesser Caucasus, Kura Intermountain Depression, Lankaran, and Middle Araz), what regional differences are observed in population morbidity, and which geographical factors contribute to these variations?

Research methods and materials. In the study, demographic data on the population were obtained from official statistical sources. In addition to traditional geographical methods, regression analysis was used to examine the relationships.

To more accurately determine the effects of environmental changes on public health, the concept of disease incidence (morbidity rate, intensity) was applied. The purpose of calculating incidence is to determine the frequency of new cases of a disease in addition to existing cases. It is obtained by dividing the number of newly registered cases during the study period (patients recorded with a first-time diagnosis) by the total population residing in the area. Quantitatively, it is usually expressed as a ratio:

$$Incidence = a/(a + b) \times 10000\,, \quad (1)$$

where a is the number of patients registered with a first-time diagnosis; b is the number of individuals not exposed to the disease [11].

In this article, the incidence of respiratory diseases among the population was evaluated across five natural regions, and the morbidity rate for each region was calculated based on this formula.

To determine the effect of relief on morbidity, the average elevation above sea level of settlements within the regions was obtained through spatial analysis using ArcGIS 10.3 software. For this purpose, the DEM raster file of Azerbaijan and vector polygons of administrative districts were selected, and the commands **ArcToolbox → Spatial Analysis → Zonal → Zonal Statistics as Table** were executed.

Regression analysis was applied to statistically study the relationships between relief and human health. In this analysis, the average elevation of the area was considered as the factor (independent) variable, and the incidence of respiratory diseases among the population as the outcome (dependent) variable.

To mathematically describe the variation of the dependent variable based on the factor variable, a simple linear regression equation was used:

$$y = bx \pm a\,, \quad (2)$$

where y – ependent variable (outcome); x – independent variable (factor); b – regression coefficient, indicating how many units y changes when x changes by one unit; a – intercept, representing the point where the regression line crosses the y-axis [12].

Main results and discussions. The Republic of Azerbaijan is located in the South Caucasus region between 38°24' and 41°54' north latitudes and 44°46' and 50°50' east longitudes, covering an area of 86.6 thousand km². In the meridional direction, the country's maximum width is 390 km and minimum width is 175 km, while from west to east, its maximum length is 470 km and minimum length is 300 km. The administrative-territorial structure of the country includes the Nakhchivan Autonomous Republic, 63 districts, 79 cities, 262 settlements, and 4,246 villages. According to the State Statistical Committee, as of January 1, 2023, the estimated population was 10,127,100 [13, p.17]. The diversity of the area's geological, geomorphological, climatic, soil, and hydrological characteristics is observed to have certain effects on population health.

According to the State Statistical Committee, in 2023, 2,616,715 patients were registered in Azerbaijan with a first-time diagnosis (2,577 per 10,000 people). Due to the large population size, a significant share of patients nationwide (29%) was recorded in Baku city (765,636 people). In terms of morbidity, the Shaki-Zagatala economic region stood out, with 240,438 patients registered that year, corresponding to 38% of the region's population (3,846.3 per 10,000 people). Among the population, respiratory diseases were the most prevalent, accounting for 37% (963,610 people) of all major disease classes. The incidence of these diseases was 9.5% nationwide (949 per 10,000 people). The highest number of cases was recorded in Baku city (286,423 people). The highest morbidity rate for respiratory diseases among the population was observed in the Mountainous Shirvan economic region, with 1,653.2 cases per 10,000 people [14, pp. 100–111].

To address the research question, population data (as of June 1, 2023) and the number of cases of respiratory diseases in settlements located within the boundaries of the natural regions were obtained from the State Statistical Committee (patients registered with a first-time diagnosis in 2023). The morbidity rate for each region was calculated based on formula 1.1. The results are presented in the table, and a corresponding map was created using ArcGIS software (figure 1).

Morbidity of Respiratory Diseases among the Population in Natural Regions

Region	Republic of Azerbaijan Total	Greater Caucasus natural region	Kura Depression natural region	Lankaran natural region	Lesser Caucasus natural region*	Middle Araz natural region
01.06.2023 Population (thousand people)	10153.9	4705.8	2025.7	934.1	1353.3	467.1
Patients registered with a first-time diagnosis (in 2023)						
Per person	963 610	533 967	172 391	79 166	103 286	26 490
Per 10000 people	949	1134,6	851	847,5	763,2	567,1

Source: Based on Table "Healthcare, Social Protection, and Housing Conditions in Azerbaijan – 2023" [14, pp. 100–111], the morbidity rates were calculated by the author according to formula 1.

*Note: Data for the population of administrative districts within the Lesser Caucasus natural region that were under occupation from 1992 to 2020 were not included.

According to the map, when differentiating the regions by geographical location, it is evident that the incidence of respiratory diseases is significantly higher in the coastal Greater Caucasus (1,134.6 per 10,000 people), Kura Depression (851 per 10,000 people), and Lankaran natural regions (847.5 per 10,000 people) compared to the non-coastal Lesser Caucasus (763.2 per 10,000 people) and Middle Araz regions (567.1 per 10,000 people) (Figure 1). This difference is attributed to the higher relative humidity in coastal areas. It has been determined that people living in regions where relative humidity exceeds 75–80% have an estimated relative risk of respiratory diseases that is 1.5 times higher than those living in areas dominated by dry days [15].

In the **Greater Caucasus natural region**, 43.7% of Azerbaijan's population and 55.4% of respiratory disease cases are concentrated. Among the 4,705.8 thousand inhabitants of the region, 533,967 people were diagnosed with these diseases, corresponding to 11.3% of the regional population. The morbidity rate in this region is higher compared to other natural regions (1,134.6 per 10,000 people) (table).

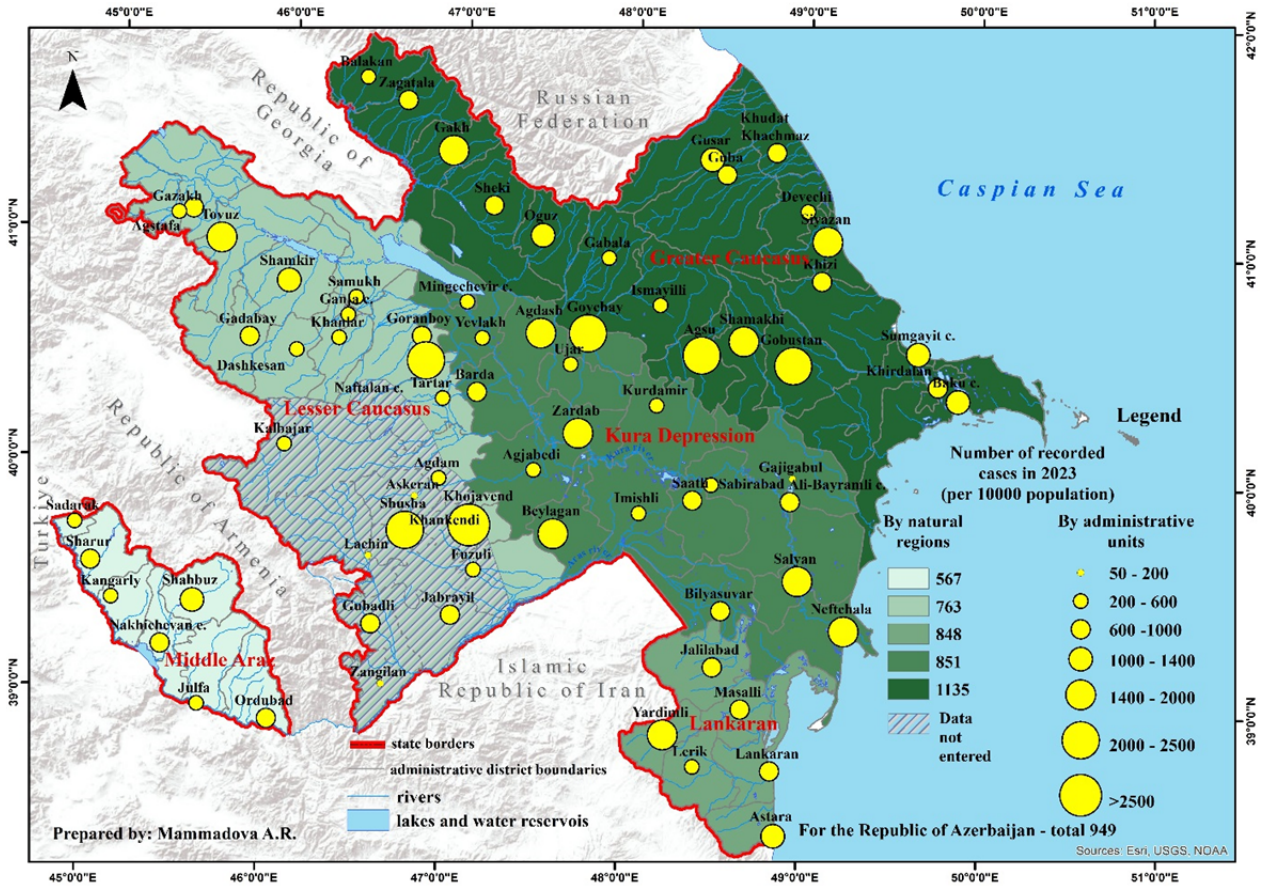

Figure 1 – Map of population morbidity due to respiratory diseases in natural regions

The health of the population is significantly influenced by the strained ecological situation resulting from the inclusion of large industrial cities such as Baku and Sumqayit in the region [16, 17]. The economic district with the highest morbidity rate in the region, Mountainous Shirvan (1,653.2 per 10,000 people) [14, pp. 100-111], is affected by its geographical location and natural conditions. Although the district is relatively underdeveloped industrially, it is located close to cities heavily exposed to anthropogenic pollution, such as Baku and Sumqayit, and rises from the south-east (Shirvan plain) to the north-west up to 3,000 m (Babadag) [18]. This topography allows pollutants transported by wind from the mountains to adversely affect the health of people in foothill districts.

Literature analysis shows that relief plays a significant role in the spread of respiratory diseases. In flat areas, wind reduces pollution near pollution sources but also disperses pollutants over the surrounding area. In contrast, mountainous and hilly terrain reduces wind speed, potentially increasing pollution levels locally. Increasing precipitation with altitude positively affects air quality by removing dust particles, provided that excessive soil moisture does not occur [19, 20].

Furthermore, in Gobustan – a region dominated by wind erosion – the airborne soil, sand, and other particulate matter create unfavorable conditions for respiratory health. The mud volcanoes in Gobustan also act as natural sources of air pollution. Geological factors contribute to atmospheric pollution as well. Studies indicate that in the seismically active Mountainous Shirvan area, high concentrations of radon – a toxic substance in soil air – are recorded. These studies also note that radon levels in enclosed spaces can reach values considered hazardous to human health [21-23]. In addition, stone quarries operating in the Shamakhi and Gobustan administrative districts contribute to the spread of coarse and fine dust particles in the atmosphere, which are harmful to the lungs and bronchi. Together, these factors highlight the exposure of the Mountainous Shirvan population to both natural and anthropogenic atmospheric pollution.

Our research identified an inverse relationship in the Mountainous Shirvan economic district between population morbidity due to respiratory diseases and the area's average elevation above sea level and mean annual precipitation. The highest morbidity rate in this economic district was observed in Agsu

(2,150 per 10,000 people; average elevation 249.9 m), while the lowest rate was in Ismayilli (569.7 per 10,000 people; average elevation 1,160 m, annual precipitation 750 mm). Similarly, in Gobustan, which receives the lowest annual precipitation (300 mm), the morbidity rate reached 2,136.4 per 10,000 people, indicating that approximately 1 in 5 residents in both Gobustan and Agsu suffers from respiratory diseases.

Statistical analyses were conducted to quantify the existence and direction of this relationship, as well as to characterize the form and strength of the factor variable's effect on the outcome variable. From an analytical perspective, inverse relationships were identified. Based on the coefficient of determination (R^2 = 0.653), it can be stated that changes in the area's average elevation explain 65% of the variation in respiratory disease incidence across administrative districts. A similar level of dependence was observed for mean annual precipitation within the districts (figure 2).

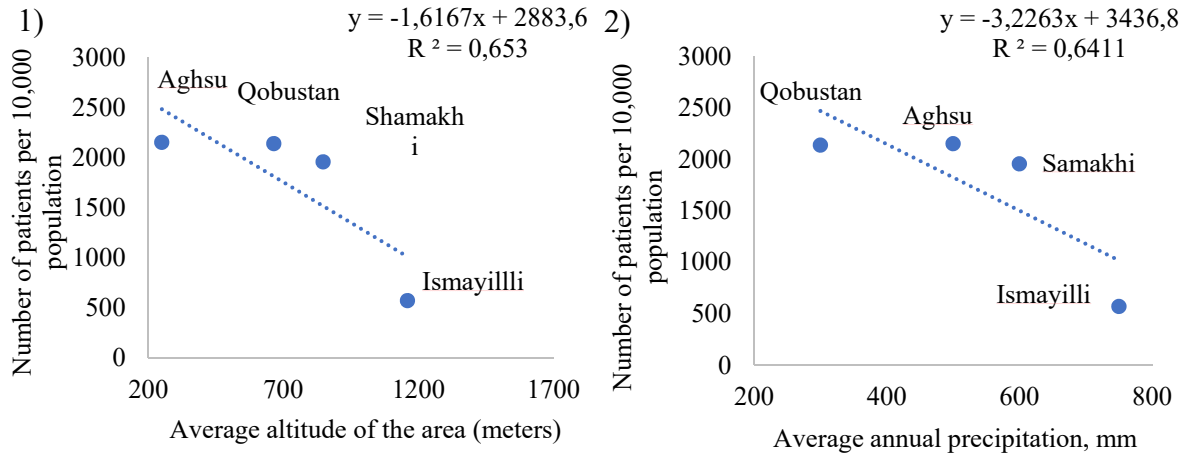

Figure 2 – Graph showing the relationship in the Mountainous Shirvan economic district between population morbidity due to respiratory diseases and (1) average elevation above sea level and (2) mean annual precipitation.

Source: Data of the State Statistics Committee of the Republic of Azerbaijan, Hajiyev G. A. [14, pp. 100-111; 24]

Analytically, inverse relationships were also observed for the Baku and Absheron-Khizi economic districts. Based on the coefficients of determination (R^2 = 0.7094, R^2 = 0.6297), it can be stated that changes in the average elevation explain 71% of the variation in respiratory disease incidence, while the corresponding increase in precipitation with elevation explains 63% of the variation.

Consequently, in the Baku, Absheron-Khizi, and Mountainous Shirvan economic districts, increased elevation and the associated precipitation contribute to improving air quality, thereby playing a significant role in reducing respiratory diseases linked to environmental pollution (figure 3).

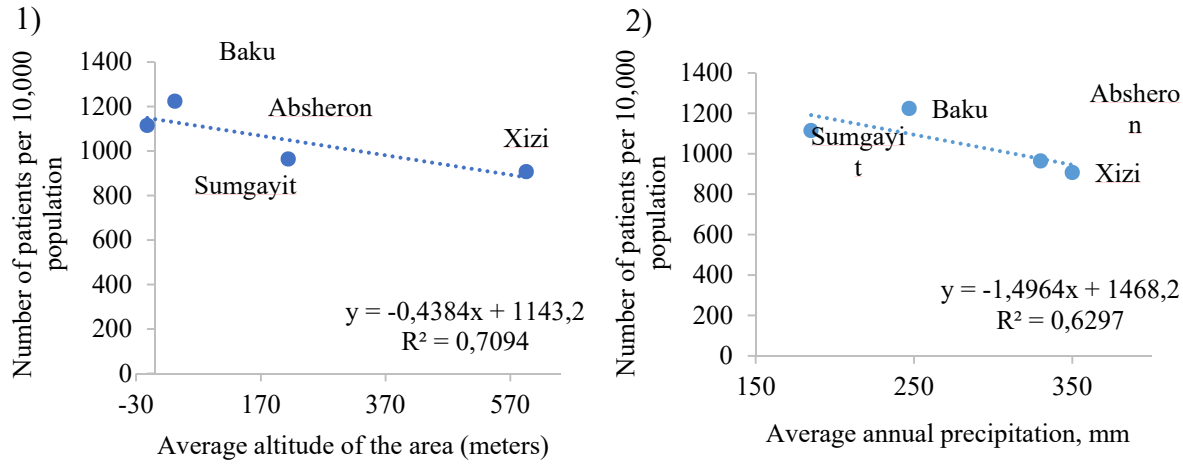

Figure 3 – Graph showing the relationship in the Baku and Absheron-Khizi economic districts between population morbidity due to respiratory diseases and (1) average elevation above sea level and (2) mean annual precipitation.

Source: Data of the State Statistics Committee of the Republic of Azerbaijan, Hajiyev G. A. [14, pp. 100-111; 24]

According to our study, in the Kura Depression natural region, which is home to 20% of the country's population, 172,391 people out of 2,025.7 thousand were diagnosed with respiratory diseases, corresponding to 8.5% of the regional population. In terms of disease incidence, this region ranks second compared to other natural regions. In the Shirvan-Salyan economic district, 50,715 patients were registered in 2023, making it the district with the highest prevalence of respiratory diseases in the region (1,028.7 per 10,000 people) [14, pp. 100-111] (table).

The region covers the central and eastern parts of the country. In the eastern part, the Kura-Araz lowland is located mainly below sea level along the lower reaches of the transboundary Kura and Araz rivers, which are exposed to ecological pollution. The absolute elevation of the Salyan accumulative plain, the youngest part of the lowland, ranges from –20 m to –27 m.

Regression analysis results show that in the Shirvan-Salyan economic district, the district with the highest disease prevalence, changes in the average elevation of administrative districts explain 81% of the variation in respiratory disease incidence ($R^2 = 0.8098$, $p < 0.005$). The statistically significant relationship is inverse: for every 1-meter increase in elevation, the incidence decreases by 16 cases per 10,000 people. In the low-lying Neftchala (1,728.3 per 10,000) and Salyan (1,467.9 per 10,000) districts, residents are more frequently exposed to respiratory diseases, confirming that ecological impacts are stronger in the lower reaches of the rivers (figure 4).

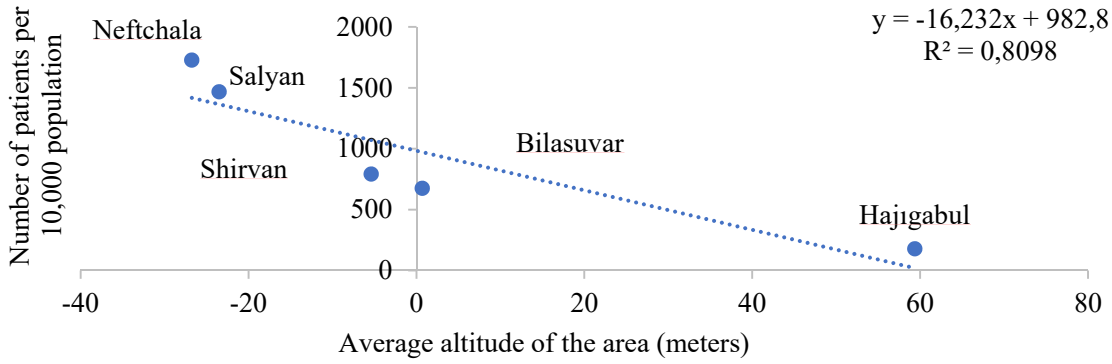

Figure 4 – Graph showing the relationship between population morbidity due to respiratory diseases and average elevation in the Shirvan-Salyan economic district.

Source: Data of the State Statistics Committee of the Republic of Azerbaijan [14, pp. 100-111]

In the Kura-Aras lowland, in the depression areas of the terrain, the depth of groundwater, which generally ranges between 40–50 cm and 0.8–1.0 m, can even reach the soil surface during the winter. Factors contributing to the rise of groundwater include river floods, irrigation activities, the condition of collector-drainage networks, leakage from irrigation systems, and others. The combination of high groundwater levels and excessive soil moisture in these areas leads to the formation of hydromorphic landscapes such as marsh-grassland, marsh-lake, and marsh-lagoon types.

In alluvial-grassland soils with weakly alkaline and alkaline reactions, where salinization signs are absent [18, pp. 242–259], conditions are favorable for the development of hydrofilic microorganisms such as mold fungi. These microorganisms spread in human settlements and on building walls, negatively affecting human health. Their spores enter the body through the respiratory system, causing headaches, nausea, vomiting, and, through allergenic effects, can lead to chronic respiratory diseases, asthma, allergic rhinitis, and other complications [25].

According to our study, the Lesser Caucasus natural region (excluding populations of districts under occupation from 1992 to 2020) is home to 1,353.3 thousand people. In 2023, 103,286 people were diagnosed with respiratory diseases for the first time, representing 7.6% of the regional population. This accounts for 10.7% of total infections in the country, making it the second-lowest among all regions (table).

The large elevation range of the region (3,500 m) creates varied conditions for settlement. The sloping plains between the right bank of the Kura River and the northeastern foothills of the Lesser Caucasus mountains (Ganja-Gazakh slope plains) concentrate most of the population, economic resources, and social infrastructure. The flat terrain, favorable soil-climate conditions, and mild winters positively

affect human health. No statistically significant relationship between elevation and disease incidence was identified in this region.

The Jeyranchol hilly plain, located between the left bank of the Kura and the state border with Georgia and belonging to the Gazakh-Tovuz economic district (covering Shamkir, Tovuz, and Agstafa districts), consists of extensive unused lands. In this area, semi-desert, dry-steppe climate and wind erosion of soils contribute to an increase in respiratory disease incidence among the population. In these districts, agriculture predominates in economic activity, exposing the population further to the negative effects of the soil. Additionally, the operation of stone quarries in Tovuz and Shamkir contributes to the wider spread of diseases. The incidence rates in Tovuz and Shamkir are 1,569.2 and 1,211.7 per 10,000 people, respectively, which is 2 and 1.6 times higher than the regional average.

In Naftalan city, the high incidence of respiratory diseases (2,351.7 per 10,000) is linked to the city's specific characteristics. Naftalan is known for its therapeutic oil deposits and as a resort city. Although Naftalan oil has therapeutic properties for skin, musculoskeletal, and nervous system diseases, chemicals released into the air during extraction, storage, and use (including aromatic and sulfur compounds) can be harmful to the respiratory system. In treatment facilities, poor ventilation during indoor oil baths can lead to high concentrations of oil vapors. Prolonged exposure, especially among facility workers and local residents, can contribute to the development of chronic bronchitis and other respiratory diseases, increasing the risk of disease occurrence among the population (Figure 1).

Lankaran Natural Region. In the Lankaran natural region, 9.2% of Azerbaijan's population resides, and 8.2% of respiratory disease cases were recorded (as of 01.06.2023). In 2023, out of 934.1 thousand residents, 79,166 people were diagnosed with these diseases. In terms of incidence rate per 10,000 people (847.5), the region ranks third in the country (table).

Within the region, the highest incidence rates were observed in Yardimli (1,912.7 per 10,000) and Astara (1,388.4 per 10,000) districts, while Lerik district had the lowest incidence (379.9 per 10,000) (Figure 1). To identify the influence of natural conditions on these differences, an analysis was conducted examining the relationship between population morbidity, average district elevation, and mean annual precipitation.

The analysis revealed a clear pattern regarding precipitation and elevation: rainfall increases up to a certain altitude and then decreases. For instance, the highest precipitation (1,400–1,700 mm) occurs at elevations of 200–600 m in the Talysh Mountains (Astara district). Above this, precipitation declines, reaching 300–400 mm at elevations of 2,000–2,200 m in Lerik and Yardimli districts [18, pp. 291-295; 24]. Correspondingly, disease incidence decreases with declining precipitation.

However, despite similar elevations (Lerik: 1,261.3 m; Yardimli: 1,200 m) and lower mean annual precipitation, disease incidence decreases in Lerik but increases in Yardimli. This discrepancy is likely due to local environmental factors in Yardimli, such as the extensive area of the Vilesh River valley, frequent mountain-valley winds, severe soil erosion (91% of lands, 45% severe), and inadequate protection of forests and shrubs [18, pp. 322; 24], all of which negatively affect population health.

Consequently, within the region (except for Yardimli), a positive linear relationship between precipitation and respiratory disease incidence was identified. Regression analysis shows that changes in mean annual precipitation explain 60% ($R^2 = 0.5905$) of the variation in disease incidence. The relationship is positive, indicating that as precipitation increases, respiratory disease incidence also rises.

Additionally, in districts along the Caspian Sea coast, disease incidence increases southward with rising relative humidity and precipitation. Specifically, incidence rates in Masalli, Lankaran, and Astara districts are 674.4, 762.3, and 1,388.4 per 10,000, respectively. This study confirms that in areas where high precipitation leads to excessive soil moisture, negative effects on human health can occur (figure 5).

In the **Middle Aras Natural region**, 5.6% of Azerbaijan's population resides, while only 2.7% of respiratory disease cases were recorded. Among the 467.1 thousand residents, 26,490 were diagnosed with these diseases, corresponding to 5.7% of the region's population. Compared to other natural regions, Middle Aras has the lowest incidence of respiratory diseases (567.1 per 10,000), largely due to its arid climate [15].

Middle Aras is located on the southwestern edge of the Lesser Caucasus mountain system. Most of its territory is occupied by the Zangezur and Darelegyez ranges, while approximately one-third consists of the Arazboyu plains (Sadarak, Sharur, Boyukduz, Kangarli, Nakhchivan, Culfa, Ordubad plains) with an average elevation of 600–800 m. The majority of the population in Nakhchivan city, Babek, Culfa,

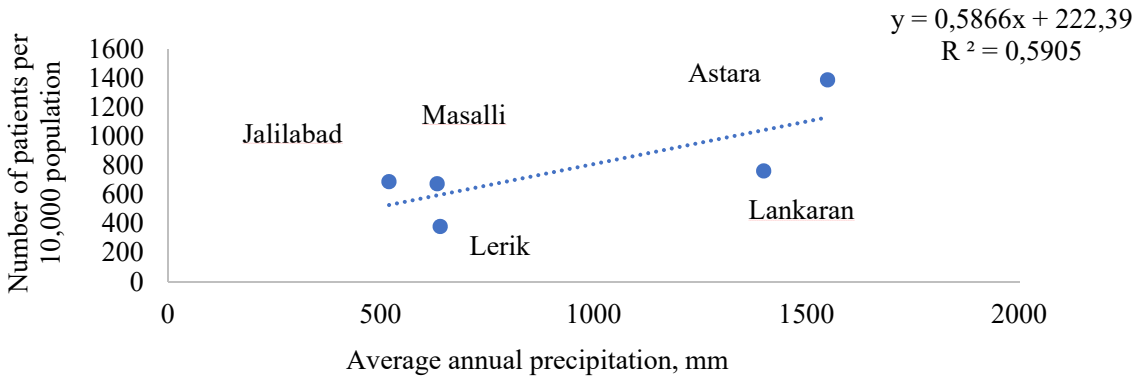

Figure 5 – Relationship Between Respiratory Disease Incidence and Average Annual Precipitation in the Lankaran Natural Region.

Source: Data of the State Statistics Committee of the Republic of Azerbaijan, Hajiyev G. A. [14, pp. 100-111; 24]

Kangarli, Ordubad, Sadarak, and Sharur districts resides at 600–1000 m, whereas Shahbuz district's population mainly lives at 1,000–1,500 m. The lowland areas in the south feature a cold semi-desert and dry steppe climate in winter, while the mountainous north experiences cold, dry summers [18, 24, 26].

Our study identified a direct proportional relationship between respiratory disease incidence and the mean elevation of settlements. The highest incidence was recorded in Shahbuz district (1,273.4 per 10,000), located on the southern slopes of the Darelegyez range and western slopes of the Zangezur range, with an average elevation of 1,834.7 m – the highest in Middle Aras. In contrast, Babek district, where most residents live below 1,000 m (average elevation 1,094.9 m), had the lowest incidence (51.7 per 10,000) (figure 6).

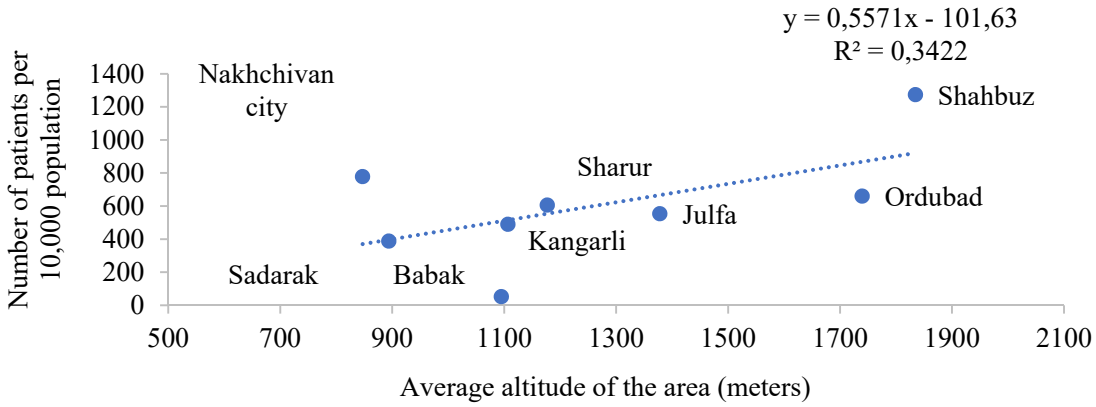

Figure 6 – Graph showing the relationship between population morbidity due to respiratory diseases and average elevation in the Middle Aras Natural Region.

Source: Data of the State Statistics Committee of the Republic of Azerbaijan [14, pp. 100-111]

Research shows that in mountainous areas, particularly above 1000 meters in altitude, the oxygen supply to hemoglobin cells in the blood decreases. As altitude increases, the accompanying decrease in atmospheric pressure and temperature contributes to the higher incidence of respiratory diseases such as bronchitis, pneumonia, pleurisy, and others [4, 27, 28]. Based on our analysis, it can be concluded that the population of Shahbuz District in the Middle Aras region is more exposed to the adverse effects of altitude. It has been determined that in Shahbuz District, the incidence of diseases such as chronic pharyngitis, nasopharyngitis, sinusitis, pneumonia, chronic and unspecified bronchitis, emphysema, allergic rhinitis, etc., is 2–3 times higher compared to the overall average for the Nakhchivan Autonomous Republic.

At the same time, air pollution also affects the population's morbidity in this region. Studies show that in Nakhchivan city, located mainly on the Aras lowland (at an average elevation of 847.2 m), the morbidity rate is 778 cases per 10,000 people – approximately twice as high as in Sadarak District, which

has a similar elevation. In 2023, 11.3 thousand tons of pollutants were emitted into the city's atmosphere from stationary sources, a figure significantly higher than that of other administrative districts. In the same year, 20.9 thousand tons of pollutants were released into the atmosphere of the Nakhchivan Autonomous Republic from motor vehicles, with the majority originating from Nakhchivan city, which serves as the capital. The higher level of air pollution in the city compared to other districts is one of the main factors explaining the observed differences in morbidity rates.

Conclusions. As a result of the study, the following conclusions can be drawn:

1. It was determined that among the natural regions of the republic, the highest incidence rate from these diseases was recorded in the Greater Caucasus natural region – 11.3% (1,134.6 cases per 10,000 people) – while the lowest was observed in the Middle Aras region – 5.7% (567.1 cases per 10,000 people). According to regression analysis, in the economic regions of Baku and Absheron–Khizi ($R^2 = 0.7094$), Mountainous Shirvan ($R^2 = 0.653$) within the Greater Caucasus, and Shirvan–Salyan ($R^2 = 0.8098$) within the Kura Intermountain Depression, the incidence rate decreases as the average elevation above sea level increases. In contrast, in the Middle Aras region ($R^2 = 0.3422$), morbidity increases with elevation. Based on the coefficients of determination obtained, the variables show dependencies of 71%, 65%, 81%, and 34%, respectively.

2. The effect of altitude on morbidity is not direct; it is mediated by the indirect influence of relief on various geographical factors such as precipitation, hydrological conditions, and temperature. For instance, in economic regions like Baku, Absheron–Khizi, and Mountainous Shirvan, where the atmosphere is exposed to both natural and anthropogenic pollution, analytical assessments revealed an inverse relationship between annual precipitation levels and incidence rates across administrative districts. This indicates that as the average elevation above sea level increases, the amount of precipitation also rises, thereby improving air quality and playing a significant role in preventing respiratory diseases associated with environmental impacts.

In the Shirvan–Salyan economic region, located within the Kura depression, analysis shows that for every 1-meter increase in elevation, the morbidity rate per 10,000 people decreases by an average of 16 cases. This relationship is linked to the influence of relief on groundwater levels and the ecological impact of water in the area. In contrast, in the Middle Aras region, the effect of relief is observed in the opposite direction: as elevation increases, the population becomes more exposed to colder climatic conditions, leading to a higher incidence of respiratory diseases.

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ӘЗІРБАЙЖАН РЕСПУБЛИКАСЫ ХАЛҚЫНЫҢ ДЕНСАУЛЫҒЫНА ГЕОГРАФИЯЛЫҚ ЖАҒДАЙЛАРДЫҢ ӘСЕРІ

Аннотация. Ел аумағының географиялық жағдайлары оның халқының денсаулық жағдайын анықтауда шешуші рөл атқарады. Бұл мақалада Әзірбайжан Республикасының табиғи аймақтарындағы тыныс алу жолдарының ауруларының пайда болуы мен географиялық факторлар арасындағы байланыс қарастырылады. Зерттеу көрсеткендей, ең жоғары аурушаңдық деңгейі Үлкен Кавказда (11,3%), ал ең төмені Орта Араз аймағында (5,7%) байқалады. Регрессиялық талдау нәтижелері Курайн тауаралық ойпатында орналасқан Баку және Абшерон-Хызы (R^2=0.7094), Даглиг Ширван (R^2=0.653) және Ширван-Сальян экономикалық аймақтарында (R^2=0.8098) орташа биіктіктің жоғарылауымен аурушаңдық деңгейі төмендейтінін көрсетеді. Нақтырақ айтқанда, Ширван-Сальян аймағында биіктіктің 1 метрге жоғарылауы аурушаңдық деңгейін 10 000 адамға шаққанда орта есеппен 16 жағдайға төмендетеді. Орта Араз аймағында кері байланыс байқалады (R^2=0.34). Биіктіктің әсері жанама болып табылады және жауын-шашын, температура және гидрологиялық жағдайлар сияқты факторлар арқылы қалыптасады. Нәтижелер топографияның қоршаған орта жағдайлары мен адам денсаулығы арасындағы маңызды делдалдық рөлін растайды. Әзірбайжандағы аурушаңдықтың негізгі себептерінің бірі болып табылатын тыныс алу жолдарының ауруларының пайда болуына географиялық факторлардың әсерін зерттейтін зерттеу географиялық орналасуы, биіктік, салыстырмалы ылғалдылық, жауын-шашын, гидрологиялық жағдайлар және табиғи және антропогендік ауа ластануы сияқты факторлардың бұл аурулардың таралуындағы аймақтық айырмашылықтарды анықтайтынын көрсетті.

Түйін сөздер: халық денсаулығы, тыныс алу жолдарының аурулары, аурушаңдық, географиялық факторлар, топография, қоршаған орта жағдайлары.

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ВЛИЯНИЕ ГЕОГРАФИЧЕСКИХ УСЛОВИЙ НА ЗДОРОВЬЕ НАСЕЛЕНИЯ АЗЕРБАЙДЖАНСКОЙ РЕСПУБЛИКИ

Аннотация. Географические условия территории страны играют решающую роль в определении состояния здоровья ее населения. Исследуется взаимосвязь между заболеваемостью болезнями органов дыхания и географическими факторами по природным районам Азербайджанской Республики. Установлено, что наибольшая частота заболеваемости наблюдается в Большом Кавказе (11,3%), а наименьшая – в Средне-Аразском районе (5,7%). Результаты регрессионного анализа показывают, что в экономических районах Баку и Абшерон-Хызы ($R^2 = 0,7094$), Горный Ширван ($R^2 = 0,653$) и Ширван-Сальян, расположенном в Кураинской межгорной впадине ($R^2 = 0,8098$), с увеличением средней высоты над уровнем моря уровень заболеваемости снижается. В частности, в Ширван-Сальянском районе повышение высоты на 1 м снижает уровень заболеваемости в среднем на 16 случаев на 10 000 человек. В Средне-Аразском регионе наблюдается обратная зависимость ($R^2 = 0,34$). Влияние высоты является косвенным и формируется через такие факторы, как количество осадков, температура и гидрологические условия. Полученные результаты подтверждают важную посредническую роль рельефа между экологическими условиями и здоровьем человека. Результаты исследования влияния географических факторов на заболеваемость респираторными заболеваниями, являющимися одной из ведущих причин заболеваемости в Азербайджане, показали, что такие факторы, как географическое положение, высота над уровнем моря, относительная влажность, уровень осадков, гидрологические условия, а также природное и антропогенное загрязнение воздуха, определяют региональные различия в распространении этих заболеваний.

Ключевые слова: здоровье населения, заболевания органов дыхания, заболеваемость, географические факторы, рельеф, экологические условия.