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INFLUENCE OF THE ENVIRONMENT ON HUMAN HEALTH AND QUALITY OF LIFE (ON THE EXAMPLE OF THE GREATER CAUCASUS OF THE REPUBLIC OF AZERBAIJAN)

Abstract. Health occupies an important place in the system of indicators determining the quality of life. Issues of improving health indicators are especially relevant for the Greater Caucasus province, which plays an important role in the socio-economic development of the Azerbaijan Republic and has a high standard of living, demographic and labor potential. The territorial organization of health care in the Greater Caucasus province, environmental peculiarities and their impact on the quality of life have been studied. On the basis of statistical materials the indicators of disease spread among the population living in the region are studied.

Atmospheric air pollution is mainly responsible for the spread of infectious diseases, so the relationship between them has been studied. The relationship between the human development index and the environment and its impact on the quality of life has been studied. It is found that the amount of waste from stationary sources in the region has decreased. Air pollution directly affects the health of the population. Thus, the low amount of waste emitted into the atmosphere corresponds to high values of the Human Development Index. More precisely, the correlation between them is negative, and the coefficient of determination is equal to 0.857, i.e. the dependence is determined at the level of 85%.

Keywords: life quality, human health, healthcare, environment, pollutants released into the atmosphere, infectious diseases, Human Development Index.

Introduction. Protecting the health of the population, which is the main indicator of socio-economic development, is one of the most urgent problems of the modern era. The primary aim of this development is consist of creating a favourable environment for living long and healthy of the people. Diseases and their regional distribution depend on natural geographic conditions, environmental quality, and other factors [6]. Mankind has always depended on the natural environment throughout his life. Nature is one of the essential factors that constantly ensure human survival and development. Protection of the environment and conducting a policy aimed at improving the quality of life in these conditions is one of the important factors affecting the sustainability of socio-economic development and the improvement of the quality of life [7]. Human welfare and quality of life depend pretty much on the quality and quantity of water, food, energy, and biological resources getting today and in the coming days. In the research area, environmental degradation influences society in various ways. It has brought about the spread of various diseases by depriving people of the means necessary for living, having a negative effect on their health. Thus, the role of environmental pollution and environmental stress in the emergence of diseases is undeniable [9]. As a result of anthropogenic activity, changes in the thermal balance as a consequence of

deforestation, destruction of greenery, accumulation of dust particles and volatile gases creating a greenhouse effect in the atmosphere, the exacerbation of global warming, and other processes have led to the increase of diseases in modern times. In addition to these processes, the low quality of food products is also one of the important factors affecting the health of the population. All these mentioned factors, in turn, influence the quality of life of the population.

Research area. The Greater Caucasus province has a favourable economic and geographical position encapsulating the north, north-west and north-east parts of the Republic of Azerbaijan. Thus, the region has a complex hypsometric relief from the coastal plains of the Caspian Sea to the highest peak of the republic (Mount Bazarduzu, 4466 metres). Having 27,8 thousand km^2 area, the province covers 32,1% of the country's territory (figure 1).

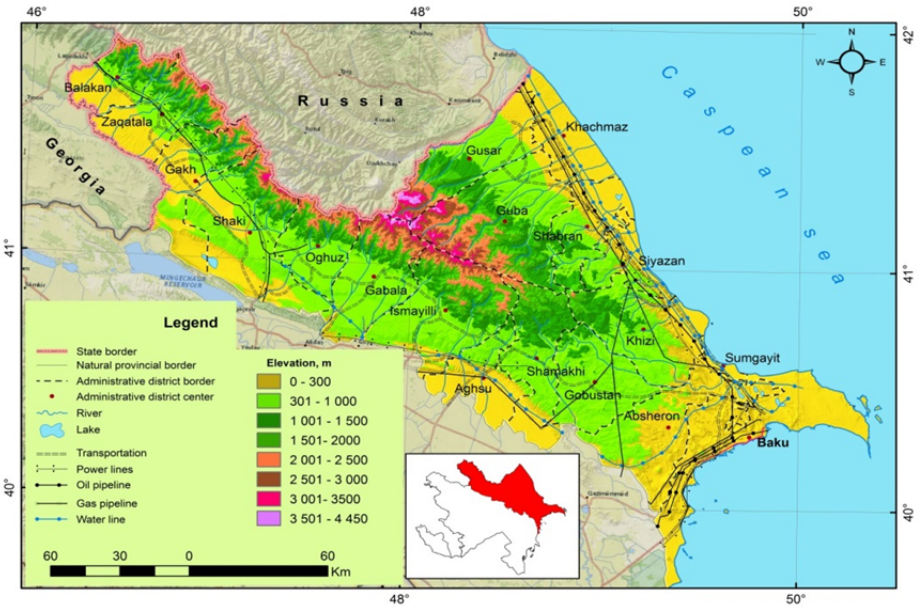

Figure 1 – Natural and geographical conditions of the Greater Caucasus Province

Conceptual framework və method. In order to apply the information to the region, the works of scientists who conducted research in this field were referred to in the research work. S. A. Vasnev (2001) used socio-economic indicators such as human health and average life expectancy in evaluating the concept of quality of life. M. Sh. Salimov (2004) investigated the characteristics of the quality of life, such as the development of human potential, medical and environmental characteristics, material welfare and employment characteristics, and parameters of the security field.

Among Azerbaijani scientists Sh. M. Muradov (2004), J. B. Guliyev (2011), R. S. Abdullayeva (2014), M. H. Rizayeva (2014), Z. N. Eminov (2022), S. I. Rzayeva (2022) and others have studied more widely changes occuring indicators of the life quality of population, the quality of the environment, medical-geographical problems, and their causes and consequences as a result of socio-political and economic processes taking place in the country, as well as in various economic regions. Although studies have been conducted in the field of the quality of life of the population in various regions, the problems of the influence of the geographical distribution of diseases on the quality of life have not been researched. Thereby, this research can be considered the first study of the impact of the geographical distribution of diseases on the quality of life of the population in the Greater Caucasus province of Azerbaijan.

All data utilised in the research work is procured from official sources published in recent years. The statistical, comparative analysis, system-structural, cartographic, SPSS statistics and other methods were used in the article.

The application of Geographical Information Systems (GIS) tools plays a key role in the large-scale assessment of the quality of life as well [18]. In the contemporary epoch, the leap in graphic capabilities of computer technology has led to the expansion of its use fields. GIS is a computer-aided technology that collects, stores, updates, analyses, models, and forecasts spatial and attributive data related to geographic

objects and events and is used in finding solutions to problems [13]. Corresponding information was carried out using the integrated tools of GIS.

Results and discussion. The Greater Caucasus province includes Baku, Absheron-Khizi, Shaki-Zagatala, Guba-Khachmaz and Daghlig (Mountainous) Shirvan economic regions [4]. According to the statistical data of 2022, constituting 46,5% of the country's population, the population of the Greater Caucasus province is 4676,1 thousand people. There are 20 cities and 1312 rural settlements in this province. The urban population of the Greater Caucasus province is 3550, 1 thousand people, and the rural population is 1126,0 thousand people [3]. In the Greater Caucasus province, 65,7% of the urban population is concentrated in Baku city, 21,1% in the Absheron-Khizi economic region. 3-5% of the urban population of the province falls to other economic regions' share. There were sharp differences between the city of Baku and other economic regions of the republic in the level of socio-economic development and the formation of demographic potential. The concentration of the majority of the industry and service areas in this province has led to the migration of the population from rural areas to the city. The concentration of most of the socio-cultural and demographic potential in Baku has led to the concentration of medical facilities in this area. Therefore, most of the healthcare facilities, doctors and paramedics are located in this place. In this regard, the essential medical-geographical processes such as the geographical distribution of diseases, their socio-economic problems and expected results were investigated as one of the indicators affecting the life quality of the population in the Greater Caucasus province of the Republic of Azerbaijan.

In the year 2021, 158 hospitals operated in Baku city, and they had 20,1 thousand hospital beds (pads). The number of doctors was 21,1 thousand, and the number of secondary medical workers was 22,7 thousand. It was observed that the healthcare indicators per 10,000 people of the population decreased during the 21-year period (table).

Healthcare indicators per 10,000 of the population

Economic regions	The number of doctors			The number of paramedics			The number of hospital beds (pads)			The power of ambulator care and polyclinic facilities		
	2000	2010	2021	2000	2010	2021	2000	2010	2021	2000	2010	2021
Baku city	84,4	89,7	91,7	108,1	106,0	98,4	115,0	91,2	87,3	182,4	146,1	165,1
Absheron-Khizi	33,9	38,2	30,1	82,4	67,8	47,9	79,3	53,4	37,3	94,2	70,6	63,6
Shaki-Zagatala	19,9	22,2	15,8	68,8	65,0	52,9	83,4	28,5	22,6	140,8	127,7	102,0
Guba-Khachmaz	14,1	16,6	13,7	47,0	43,3	34,8	58,3	29,2	19,0	99,5	98,8	100,3
Daghlig (Mountainous) Shirvan	13,1	15,0	9,9	50,1	43,4	29,0	57,5	25,1	27,1	106,7	87,4	73,4
Province	33,1	36,3	32,2	71,3	65,1	52,6	78,7	45,5	38,7	124,7	106,1	100,9

Source: Regions of Azerbaijan, 2005, 2022 [1, 2].

During the research period, a significant decrease (50-60%) was observed in both the number of hospitals and the number of hospital beds in the economic regions. In addition, the number of qualified doctors in the regions is inadequate, there is a shortage of doctors in different specialties. Therefore, patients from the regions come to Baku. Healthcare indicators per 10,000 people in Baku are 2-3 times higher than the average provincial indicators. The relative indicators of other economic regions are in most cases close to the average indicators of the province.

Research indicates that in 2021, 1303,9 thousand patients (2,664 per 10,000 people) were registered in the Greater Caucasus province, which is 1,5 times more than in 2000. One of the most widespread diseases among the population is respiratory diseases. The relative rate of people suffering from this disease in the province is 1045,1 per 10,000 people. The highest indicator for economic regions was observed in Daghlig (Mountainous) Shirvan (1386,2) and Baku (1205,8). The second widespread disease is infectious and parasitic diseases. 303,9 patients per 10,000 people were registered in the province. Absheron-Khizi has the highest rate with 570,6 people, in other economic regions, it varies between 150-300 people per 10,000 people. Diseases of the nervous system, digestive system and circulatory system are

the third on the list. In 2021, 290,3, 191,6, and 170,7 patients per 10,000 people were registered in the province, respectively. Neurological diseases were mostly observed in Baku (539,2), Shaki-Zagatala (306,3) and Absheron-Khizi (301,7). Digestive system diseases were recorded in Baku (273,7) and Shaki-Zagatala (260,5), and circulatory diseases were recorded more in Shaki-Zagatala (291,7). Compared to 2015, there was a 25,3% increase in the total number of patients in the Greater Caucasus province in 2022. However, a sharp increase in the development of diseases related to infectious and parasitic, neoplasms, neuropathy, and circulatory diseases was observed. The occurrence of such cases in the last 3 years was directly related to the negative effects of the "isolation" brought by the coronavirus pandemic on the population (figure 2).

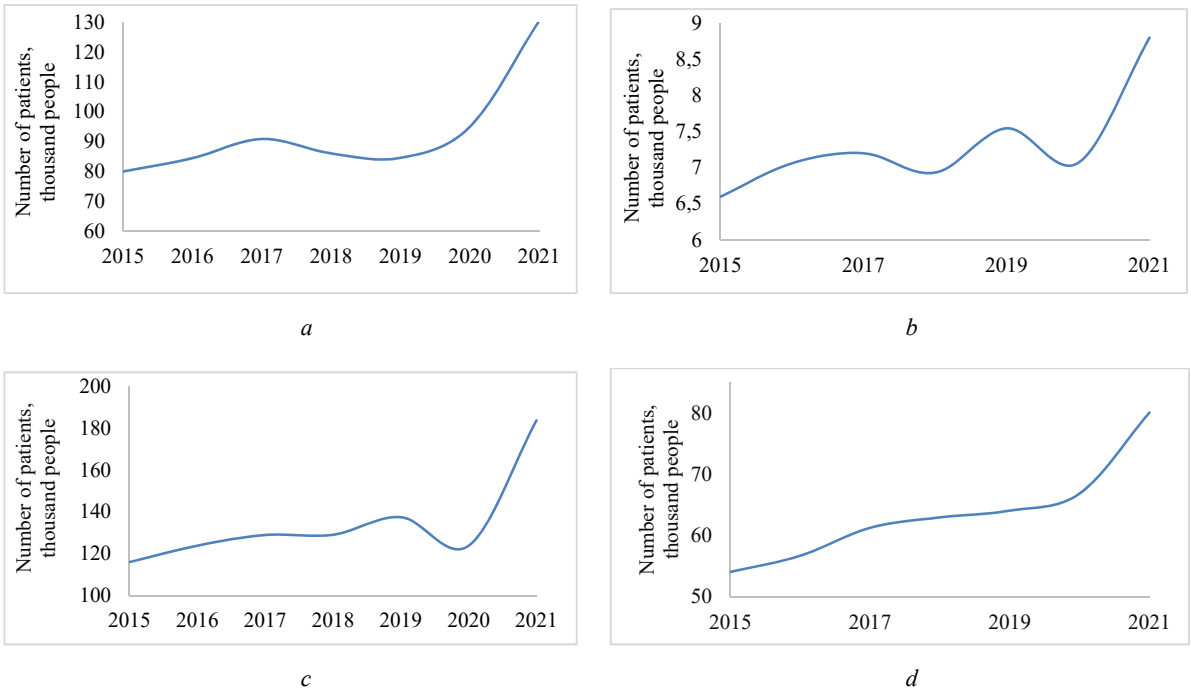

Figure 2 – Infectious and parasitic (*a*), neoplasms (*b*), neuropathy (*c*), circulatory disease's (*d*) perennial dynamics

Thus, there are serious differences in the regional organisation of healthcare services, the number of healthcare facilities, and the coverage of the population with these facilities. The sparseness of hospitals in the regions, low salaries, and poor organisation of the social protection system have led to the lack of personnel and the inability of services to meet modern requirements. It is fairly important to solve these problems and improve the medical services provided to the population [5].

The quality of the environment for a person is determined by his health. The environment is a set of components that affect the quality of life, living conditions and human health [16]. Extreme heat, sudden changes in temperature, poor air quality, and extreme weather conditions adversely affect health. The increased risk of heart attack and stroke, suicide, mental problems, asthma, allergies, and some infectious diseases is especially noticeable. Atmospheric pollution is one of the necessary factors that cause climate changes, which are considered environmental problems in the Greater Caucasus province, and indirectly affect the quality of life and human health. Air pollution and violation of its transparency and gas concentration pose not only climate changes but also a threat to the health of the population in the area [9, 16]. As can be seen from the analysis, the majority of polluting substances released into the atmosphere in 2021 fall on the share of Baku city (94.2%). The Greater Caucasus region also plays an important (88,3%) role in air pollution across the republic. This is also related to the location of Baku city in the province. In other economic regions, the amount of pollutants released into the atmosphere was 0,1-3,7 thousand tons. Compared to 2005, a sharp decrease in these indicators was witnessed in the Absheron-Khizi economic region, as well as Baku city. Accordingly, there was a decrease of 3,6 times compared to 2005 in the province. During the years 2000-2021, a total of 2,880,000 tons of pollutants were released into the atmosphere from stationary sources in various economic regions located in the Greater Caucasus province.

The primary part of this falls to Baku city's share (2726 thousand tons) [1, 2]. Although the share of pollutants emitted into the atmosphere increased slightly in the Daghlig (Mountainous) Shirvan, Guba-Khachmaz and Shaki-Zagatala economic regions in the years 2000 and 2021, a decrease was observed in the Baku and Absheron-Khizi economic regions. The amount of waste thrown into the environment is one of the most important factors affecting human health. In order to visually observe the geographical distribution of the amount of waste and diseases, the relevant data were visualised using the ArcGIS software (igure 3). Based on the analysis, it can be enunciated that the number of patients is also high in the areas where the amount of waste is high. These indicators depend on each other.

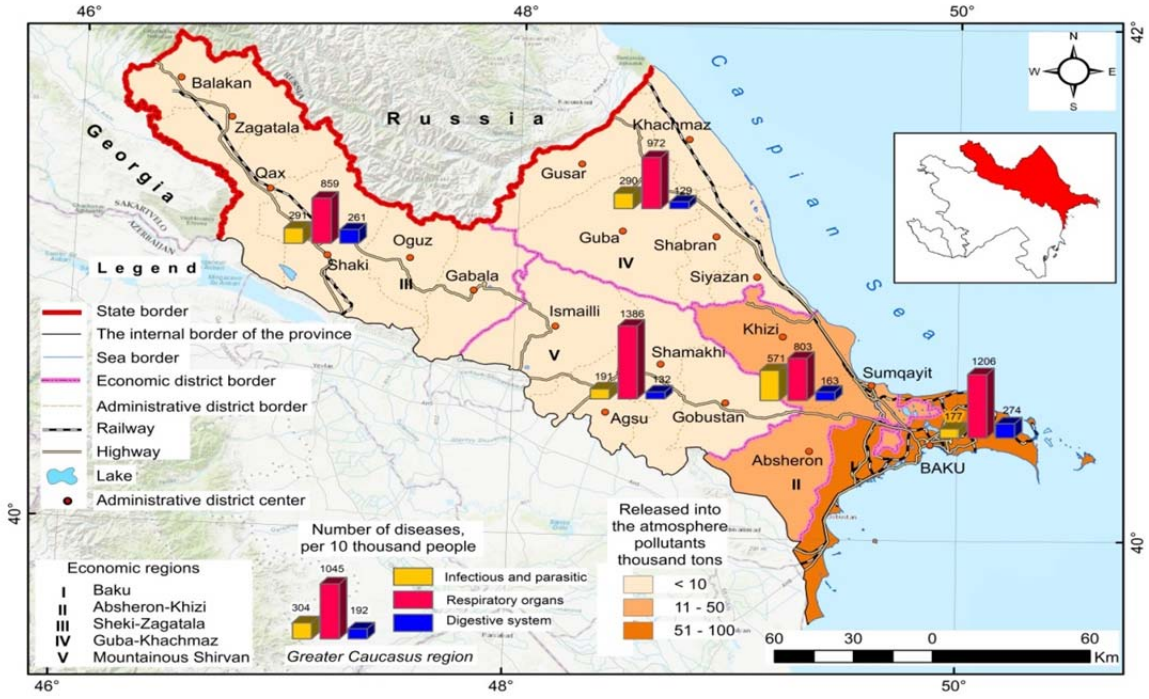

Figure 3 – The number of air pollutants emitted into the atmosphere and the geographical distribution of diseases in the Greater Caucasus province, 2021.

Source. Data of the State Statistics Committee of the Republic of Azerbaijan [20, 21]

The reduction of pollutants released into the atmosphere is the result of the closure of some enterprises and the recent reforms in the field of environmental protection. After the waste is collected, it is neutralised by the state institutions by means of disposal, selection, decomposition, recycling and other methods. The average annual amount of household waste in economic regions such as Guba-Khachmaz, Shaki-Zagatala, and Daghlig (Mountainous) Shirvan was 364 thousand m^3 compared to 5354 thousand m^3 in Absheron and Baku. It is 1000 m^3 daily in mountainous regions, and close to 15 thousand m^3 in Absheron and Baku [1, 2]. Observations indicate that the uncontrolled and untimely collection of household waste in residential areas has caused the spread of harmful waste to the surrounding areas through air and rainwater, causing the emergence and spread of several diseases. Based on the analysis, it can be enunciated that as the amount of household waste increases, so does the number of infectious patients. These indicators depend on each other. The result of the linear correlation coefficient is 0,863. The relationship between indicators is intense. Assuming that the coefficient of determination (R^2) is 0,617, it can be concluded that the obtained regression model is significant and useful for forecasting based on the data of the database (figure 4).

Natural and environmental factors have a serious impact on the human health. Several natural-geographical, socio-economic and anthropogenic factors directly or indirectly affect the health status of people. Economic, social, natural, biological and demographic factors of the environment are considered the most important among them. Along with being closely related to each other, these factors' influence is complex. In this case, certain diseases appear in the human body, and natural-ecological factors play an important role in the occurrence of these diseases [6].

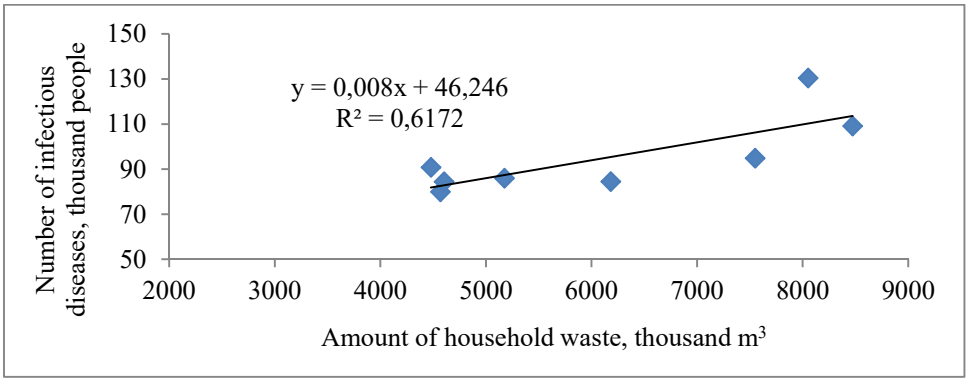

Figure 4 – Regression relationship between household waste and infectious diseases, 2015-2021.
Source. Data of the State Statistics Committee of the Republic of Azerbaijan [20, 21]

It is important to evaluate the Human Development Index (HDI) in the region since the indicators that shape the quality of life and the problems that arise are ultimately directed to the development of the human factor [8]. Nominately, the environment is considered one of the main factors affecting the quality of life of the population. This affects the assessment of the quality of life of the population in areas with serious environmental problems. However, when determining the level of development of countries, the environmental factor is not taken into account and is not directly included in the calculation of HDI. Nevertheless, environmental sustainability is recognized as an important aspect of human development. Sustainable development has become the new goal of world development, and the restoration of a quality environment is an important issue. The environment is a set of components that affect the quality of life, living conditions and human health. The purpose of the research is to learn the effects of the quality of the environment on the quality of life of the population. It is known that the health of the population is one of the indicators of the HDI. Health is the greatest blessing for mankind, and its indicators are one of the urgent factors characterizing human development. Depending on the goals of calculating the coefficients characterizing sustainable human development and the calculated coefficient, different health indicators are used. Using of various indicators characterising health depends, first of all, on determining the level of development of the countries, on the health problems faced by the country in question, formed in a certain period and how to overcome them [19]. When calculating the Human Development Index, special indices adopted by the UN are used. They include health, education and income indices [17]. When calculating the indices, the health index refers to the life expectancy at birth. Thus, the level of development of countries depends on income and education, as well as on human health, that is, on average life expectancy. As the health index increases, so does the Human Development Index. The interdependence of these indicators was analysed. The result of the linear correlation coefficient is 0,967. The coefficient of determination (R^2) 0,935 indicates that 94% of the random variables lie on the trend line. The relationship between the indicators is intense (figure 5).

Our life expectancy - the number of years we are expected to live from the time we are born — is an important measure of the health of any society. Simply put, longer life expectancy is a sign of a healthier population. Many factors can lead to poor health and can reduce life expectancy; air pollution is one of them [17]. The other most important factor affecting human health is the environmental factor. Inadequate waste disposal methods can lead to pollution, contamination of soil and water sources, spread of diseases, and ultimately adversely affect the quality of life. In order to clearly observe this, the relationship between the amount of pollutants released into the atmosphere from stationary sources and the HDI was analyzed and presented in the form of a linear regression equation (figure 6). The result of the correlation coefficient is -0,939. This indicates that there is a negative correlation between the amount of waste and HDI. The coefficient of determination is 0,857. Analysis of the linear equation shows that the lower values of polluting substances emitted from stationary substances are matched by the higher values of the HDI or vice versa is observed. Subsequently, there is a relationship between the environmental factor and HDI. Therefore, it is important to consider environmental factors when measuring the level of development of countries.

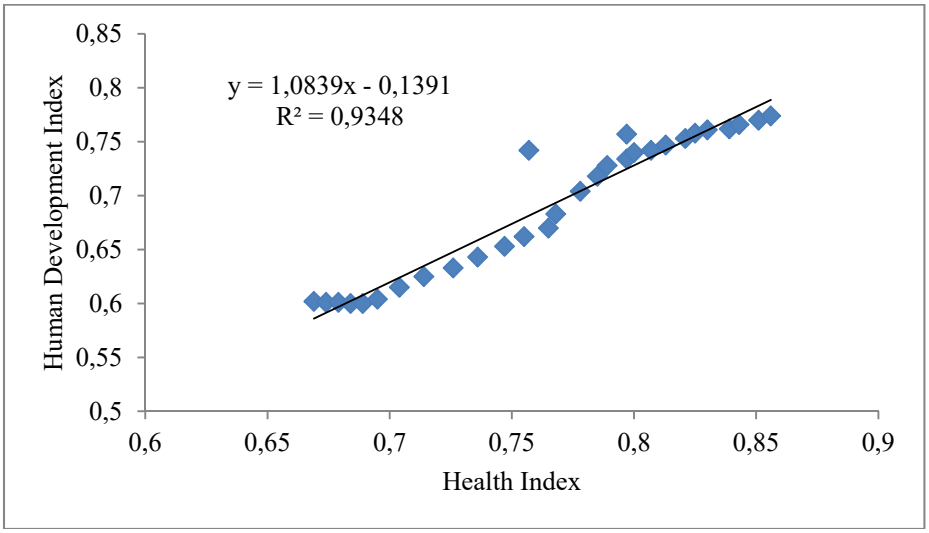

Figure 5 – Relationship between the Health Index and Human Development Index, 1995-2021.
Source. Data from the Global Data Lab [22]

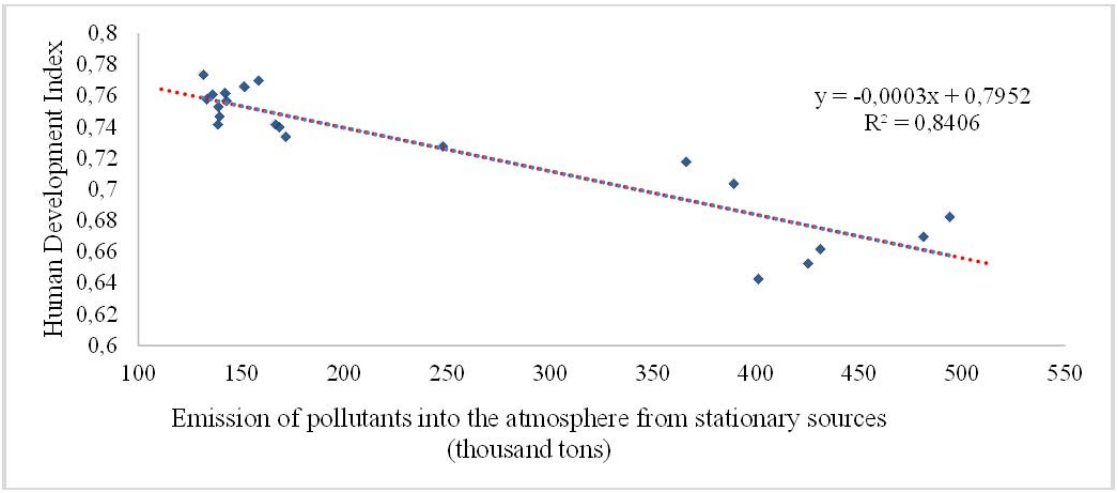

Figure 6 – Dependence between the amount of waste and the Human Development Index, 1995-2021.
Source. Data of the State Statistics Committee of the Republic of Azerbaijan, Data from the Global Data Lab [20, 22]

Hereby, improving the environment is considered a very important factor for human health. Thus, while ensuring the development of individual industrial and agricultural sectors in the country, it is very important to take environmental factors into account. Regional and international cooperation is always necessary for the successful solution of extremely important ecological problems, such as the reduction of harmful substances released into the atmosphere and prevention of river water pollution.

Conclusion. The impact of health problems on the quality of life of the population in the Greater Caucasus province can be seen primarily in the regional differences in the territorial organization of healthcare facilities. Most of the healthcare facilities and most of the medical services are located in Baku city. The distribution of diseases by region is also different according to urban and rural areas within the province. Thus, the prevalence of diseases in cities is 1,5 times higher than in villages. The primary reasons for this are air and water quality, low physical activity, high population density, and other factors. Medical care in rural areas is inadequate. Villagers have to come to the city centre for routine medical care. Because there are only paramedics in the villages. These stations are also very poorly provided with material and technical base.

The quality of the environment has a significant impact on the human health. On average, 192,000 tons of pollutants are released into the atmosphere every year and 526 tons per day in the territory of the province. The relationship between the amount of household waste and the spread of infectious

diseases was determined. The relationship between pollutants released into the atmosphere from stationary sources and the Human Development Index (HDI) was researched and the result of the correlation coefficient was -0,939, and the dependence coefficient was 85%. The possibility of an increase in the quality of the environment due to the reduction of substances released into the atmosphere from stationary sources in the study area gives reason to predict that the number of registered patients will also decrease.

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АДАМ ДЕНСАУЛЫҒЫНА ЖӘНЕ ӨМІР САПАСЫНА ҚОРШАҒАН ОРТА ӘСЕРІ (ӘЗІРБАЙДЖАН РЕСПУБЛИКАСЫ ҮЛКЕН КАВКАЗ МЫСАЛЫ НЕГІЗІНДЕ)

Аннотация. Өмір сүру сапасын анықтайтын көрсеткіштер жүйесінде денсаулық маңызды орын алады. Денсаулық сақтау көрсеткіштерін жақсарту мәселелері әсіресе Әзірбайжан Республикасының әлеуметтік-экономикалық дамуында маңызды рөл атқаратын және өмір сүру деңгейі, демографиялық және еңбек әлеуеті жоғары Үлкен Кавказ провинциясы үшін өзекті болып табылады. Үлкен Кавказ аймағындағы денсаулық сақтаудың аумақтық ұйымдастырылуы, қоршаған ортаның ерекшеліктері және олардың өмір сүру сапасына әсері зерттелді. Статистикалық материалдар негізінде облыста тұратын халық арасында аурулардың таралу көрсеткіштері зерттелді.

Жұқпалы аурулардың таралуына негізінен атмосфералық ауаның ластануы әсер етеді, сондықтан олардың арасындағы байланыс зерттелді. Адам дамуының индексі мен қоршаған орта арасындағы байланыс және оның өмір сүру сапасына әсері зерттелді. Облыста стационарлық көздерден шығатын қалдықтардың көлемі азайғаны анықталды. Ауаның ластануы халықтың денсаулығына тікелей әсер етеді. Осылайша, атмосфераға шығарылатын қалдықтардың аз мөлшері адам дамуы индексінің жоғары мәндеріне сәйкес келеді. Дәлірек айтқанда, олардың арасындағы корреляция теріс, ал детерминация коэффициенті 0,857, яғни тәуелділік 85% деңгейінде анықталады.

Түйін сөздер: өмір сапасы, адам денсаулығы, денсаулық сақтау, қоршаған орта, атмосфераға шығарылатын ластаушы заттар, жұқпалы аурулар, Адам дамуы индексі.

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ВЛИЯНИЕ ОКРУЖАЮЩЕЙ СРЕДЫ НА ЗДОРОВЬЕ И КАЧЕСТВО ЖИЗНИ ЧЕЛОВЕКА (НА ПРИМЕРЕ БОЛЬШОГО КАВКАЗА АЗЕРБАЙДЖАНСКОЙ РЕСПУБЛИКИ)

Аннотация. Здоровье занимает важное место в системе показателей, определяющих качество жизни. Вопросы улучшения показателей здоровья особенно актуальны для провинции Большого Кавказа, играющей важную роль в социально-экономическом развитии Азербайджанской Республики и имеющей высокий уровень жизни, демографический и трудовой потенциал. Изучена территориальная организация здравоохранения в Большом Кавказском крае, особенности окружающей среды и их влияние на качество жизни. На основе статистических материалов исследованы показатели распространения заболеваний среди населения, проживающего в области.

Загрязнение атмосферного воздуха в основном является причиной распространения инфекционных заболеваний, поэтому изучена связь между ними. Исследована связь индекса человеческого развития с окружающей средой и ее влияние на качество жизни. Установлено, что количество отходов от стационарных источников в области уменьшилось. Загрязнение воздуха напрямую влияет на здоровье населения. Таким образом, низкое количество отходов, выбрасываемых в атмосферу, соответствует высоким значениям индекса человеческого развития. Точнее, корреляция между ними отрицательная, и коэффициент детерминации равен 0,857, то есть зависимость определена на уровне 85%.

Ключевые слова: качество жизни, здоровье человека, здравоохранение, окружающая среда, загрязняющие вещества, выбрасываемые в атмосферу, инфекционные заболевания, индекс человеческого развития.