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## USE OF GRAVITY MODELS IN THE DEVELOPMENT OF RECREATION AND BALNEOLOGY

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**Annotation:** This article draws relevant conclusions on the widespread use of recreation and balneology in the era of globalization, the rapid development of the industry and its future. Using gravitational models will be able to accelerate the development of tourism, recreation, balneology. This model is widely used to attract vacationers to tourist-recreational-balneological facilities. Finding solutions to the problems of development of tourism and recreation in the Republic of Uzbekistan, in particular, Namangan region, is the development of appropriate scientific proposals.

The results of the analysis of the attraction of vacationers to the sanatorium "Chartak" in Namangan region of the Republic of Uzbekistan were obtained through multi-factor gravitational-econometric modeling. The increase in the use of existing natural resources and the quality of services in the sanatorium will increase the number of visitors to the sanatorium by 9.8 and 11.9 units, respectively. According to the results developed during the study and the defined conditions ( $TIC (0.02) < 1$  and  $MAPE (2.94) < 10$ ), this model is reliable. According to these forecast criteria, the forecast accuracy is high, which means that the significance of the parameter has been determined.

**Keywords:** recreation, balneology, stresses, recreational potential, Covid -19 pandemic, physical, mental, psychological stresses, mineral water, mud, climate, recreation, sanatorium, landscape.

## 1. Introduction

The tourism industry today is one of the most specialized and lucrative sectors of the world economy. At the same time, it is expedient to comprehensively develop tourism, recreation and balneology, and launch promising projects. In the first quarter of 2020, due to the intensification of the Covid-19 coronavirus pandemic, which plunged the world economy into a deep crisis, the first blows of the crisis were taken by tourism, recreation and balneology. According to the World Tourism Organization (UNWTO), "... 100 and 120 million direct tourism jobs are at risk as a result of Covid 19's impact on tourism, with \$ 910 billion to \$ 1.2 trillion in lost revenue from tourist visits, It can lose 1.5 to 2.8% of global GDP." [1]. The basis of tourist and recreational potential is tourism and recreational resources. It will be necessary to identify the natural features of tourist and recreational resources that serve to relieve the various physical, mental, psychological stresses acquired during human labor. There are no clear boundaries in tourism and recreational activities, it is necessary to group the natural factors that affect it, and to increase the level of development of tourist infrastructure in the selected area, to pursue a policy of regional tourism and recreation development. Tourism and recreational potential, in turn, affects the activities of landscape diversity, climate change, hydromineral resources, natural and cultural-historical monuments, engineering-transport and social infrastructure, tourism and sanatoriums. Balneology (Latin *Balneum*-washing, bathing and Greek *therapeia*-treatment) is one of the specific treatments, which involves the purification of mineral waters and therapeutic mud. In the 1930s, military doctors were among the first in the Russian army to begin treatment with mineral water and mud at the wound site. In the 70s of the XIX century, the Odessa Balneological Society conducted research in the field of balneology, and through this research, the Black Sea resorts became known and popular in Europe. During the former Soviet era, resorts in the region became the health centers of the entire Union, began to play a strong role in the country's international relations, and were linked to world resort indicators and routes.

## 2. Critical analysis of the literature on the subject

"In the scientific literature, the term recreation was coined in the 1990s in the United States as a result of the need to regulate working days, second weekends, meaningful organization of summer vacations, to normalize production stress through recreation, reduce stress on the nervous system, work processes. The fatigue of the period has been eliminated. The scientific views of scientists conducting research in this area provide a number of definitions of recreation.

According to Yu.V. Kokina (2012), "... recreation can play a small role in a person's high standard of living today. Recreation normalizes human life, prevents various pressures and stresses, and restores a person's ability to work" [3]. According to VA Kvartalnov (2014), recreation is the process of expanding the use of human physical, mental, emotional strength, the restoration of physical and mental strength through any play - entertainment and recreational activities, and outdoor walks [4]. L.A. According to Akimov (2005), tourism is a diverse form of recreation, one of the most active forms of recreation, which refers to the process of restoring a person's ability to work through dating activities [5].

Z.I.Usmanova (2018) As a result of the analysis of different interpretations of the concept of recreation, it was necessary to understand it as the restoration of health and the workforce through recreation outside in nature, tourist trips, sanatoriums and health resorts. Recreational tourism is a classic form of tourism that includes wellness, dating and sports tourism. Recreation is a special type of activity that covers the process of satisfying the physical, intellectual and spiritual needs of the population through the purposeful organization of recreation, the acquisition and application of relevant knowledge and skills, participation in events as a spectator [6].

I.S. According to the definition given in the textbook "Fundamentals of Tourism" co-authored by Tukhliev (2014) and other scientists, recreational tourism - (recrecia - in the sense of recovery) as a form of tourism, with the purpose of health and physical rehabilitation [7]. In our opinion, it is expedient to develop recreation and recreational activities in a comprehensive manner. For this reason, the organization of recreational activities through recreational systems, districts, complexes, clusters, recreational facilities and bases is an effective process. And through this interconnected recreation facilities will be placed. Recreation is a place where a person can recover and relax in the natural environment (natural landscapes, high mountains and foothills, water bodies, streams, waterfalls, natural monuments and reserves, sanatoriums for treatment and recreation, socio-economic processes, including tourist bases, historical monuments, museums, various exhibitions, theaters, various cultural evenings and events). Alternative recreation - includes not only the restoration of the ability to work, but also mental relaxation, mental strength. A.E.Molodetsky and A.A.Pyshnaya conducted scientific research on the treatment and rehabilitation through balneological and balneo mud.

### **3. Research methodology**

Comparative analysis, monographic observations, and descriptive statistical methods were used in the research. However, scientific systematic analysis methods were used during the study of topical data and scientific regional theories. Also enriched on the basis of foreign experience in the use of recreation and bolneology in the era of globalization in scientific research.

### **4. Analysis and results**

In recent years, in the era of globalization in the world economy, attention is paid to the field of recreation and balneology as a separate sector. During the COVID-19 pandemic, which began in the early 20s of the XXI century, the first blow among the sectors of the economy was taken by the fields of recreation, tourism, recreation, balneology. This crisis has become one of the areas that has a significant impact on the global economy.

During this period, tourism and recreation have developed rapidly internationally. In particular, the field of recreation and balneology is gradually

developing. The Covid-19 pandemic caused three times as many economic shocks as the 2008 financial crisis. Europe and emerging markets have suffered severely from an economic point of view. While U.S. GDP fell 32% in the second quarter, it is expected to grow 30% in the third quarter, but is expected to decline 2.5% in the fourth quarter. According to the World Tourism Organization (UNWTO): "... The Covid-19 pandemic could take the global tourism industry back 20 years. Under its influence, 120 million jobs are at risk and economic losses are expected to exceed \$ 1 trillion by 2020 alone. UN Secretary-General Antonio Guterres also stressed the need to rebuild tourism so that it can re-establish its role in protecting decent jobs, sustainable incomes and the protection of our cultural and natural heritage." [8]

Tourism, recreation and balneology are not only a strong influence on the economic development of developed countries, but also one of the most important factors in achieving a level of sustainable development of developing countries. And this sector is the locomotive that ensures the development of the economies of countries and influences their progress. Today, tourism, recreation, balneology can develop the region's economy at a lower cost than other sectors of the economy. At the same time, although there are great opportunities in this area, the unsatisfactory state of its use is of concern to all.

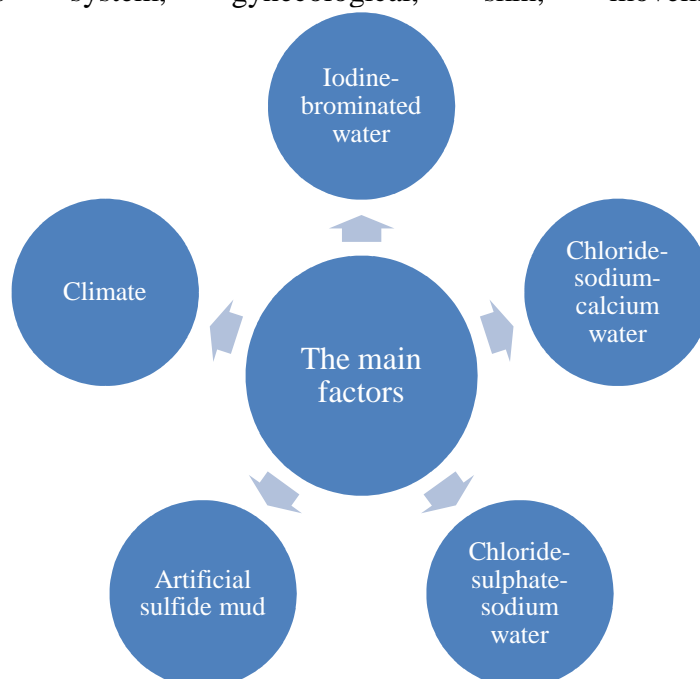
In determining the level of development of tourism, recreation, balneology in the world economy, the role and importance of the industry in determining the future state and level of development of the industry, it is necessary to conduct research on the specifics of the industry. In the research work of foreign and domestic scholars, definitions of terms and phrases related to the field are given and their essence is defined, as well as clear definitions are given by the author.

## 5. Discussion of research results

Physical and geographical conditions are taken into account as a key factor in the use of recreation and balneology. The development of recreation and balneology requires a separate study of the characteristics of the regions. It is necessary to identify recreational and balneological potential to ensure sustainable development of the regions. At the same time, the mountainous terrain of the region, mild climate, increase the availability of balneological resources. According to the international agreement adopted by UNESCO, the goal is to pursue a new recreational policy, ensuring meaningful recreation of the population in the long run. It is necessary to study the interests of the local population through the development of mountainous areas in recreation and balneology. The study of treatment-rehabilitation is a complex process. It requires a systematic approach. High-precision research strategy development is required. The sanatorium-resort system is a complex system in which natural resources are used in a complex way and developed under the influence of many factors (natural resources - mineral water, mud, climate, social shell - recreational, service and management personnel, the interaction of environmental factors). Under the influence of the above factors, the regions specialize in resort areas [9]. Rehabilitation - is the treatment of mental, physical, mental stress during the human labor activity through the natural environment. In the natural environment, the central nervous system of humans rests. The time, place, duration of rest have a positive effect on the recovery process of the human body. In recreational activities, the health-therapeutic type of recreation plays the largest role. Different types of mineral waters are widespread in the territory of Uzbekistan, and many people visit more than 300 healing groundwater sources in

the country. Currently, 121 of these sources are operational. This type of recreation includes sanatoriums, sanatoriums, boarding houses, rest homes, recreation centers. There are sanatoriums, sanatoriums, health resorts, as well as spa clinics in the health-improving types of recreation. The spa clinics provide water, mud treatments and excellent medical care.

In order to restore and improve the health of the population in Namangan region, there are many sanatoriums in the field of recreation and health. One of such sanatoriums is Chartak Sanatorium LLC. Chartak Sanatorium is located in the southern foothills of Chatkal Mountain in the Chartak River oasis at an altitude of 623 meters above sea level. The oasis is bounded on the east and west by long hills, on the north by the Chatkal mountain ranges, and on the south by high and low plains. Chartak Sanatorium in Chartak district of Namangan region of the Republic of Uzbekistan operates as a sanatorium for rehabilitation of the musculoskeletal system, peripheral nervous system, gastrointestinal, cardiovascular diseases and myocardial infarction. The natural factors of the sanatorium are hyperthermic, iodine-bromine water with high mineralization and Na-SI-sulphate water for gastrointestinal diseases with low mineralization, which serve to restore human health. Mineral water baths with iodine-bromine and chloride-sodium-calcium compounds, artificial sulfide muds are widely used in the sanatorium on the basis of modern medicine in the treatment of patients. "Mineral waters, sunlight, and the healing properties of the climate have long been used in the treatment of various diseases." [11] Waters containing copper and iron are useful in the treatment of back, joint and leg pain. They accelerate the healing of fractures, help to heal bruises and various wounds. Therapeutic factors Highly mineralized mineral water, healing mud, paraffin, mineral water on the basis of physiotherapy treatments cure diseases of the gastrointestinal tract, nervous system, gynecological, skin, movement-base.

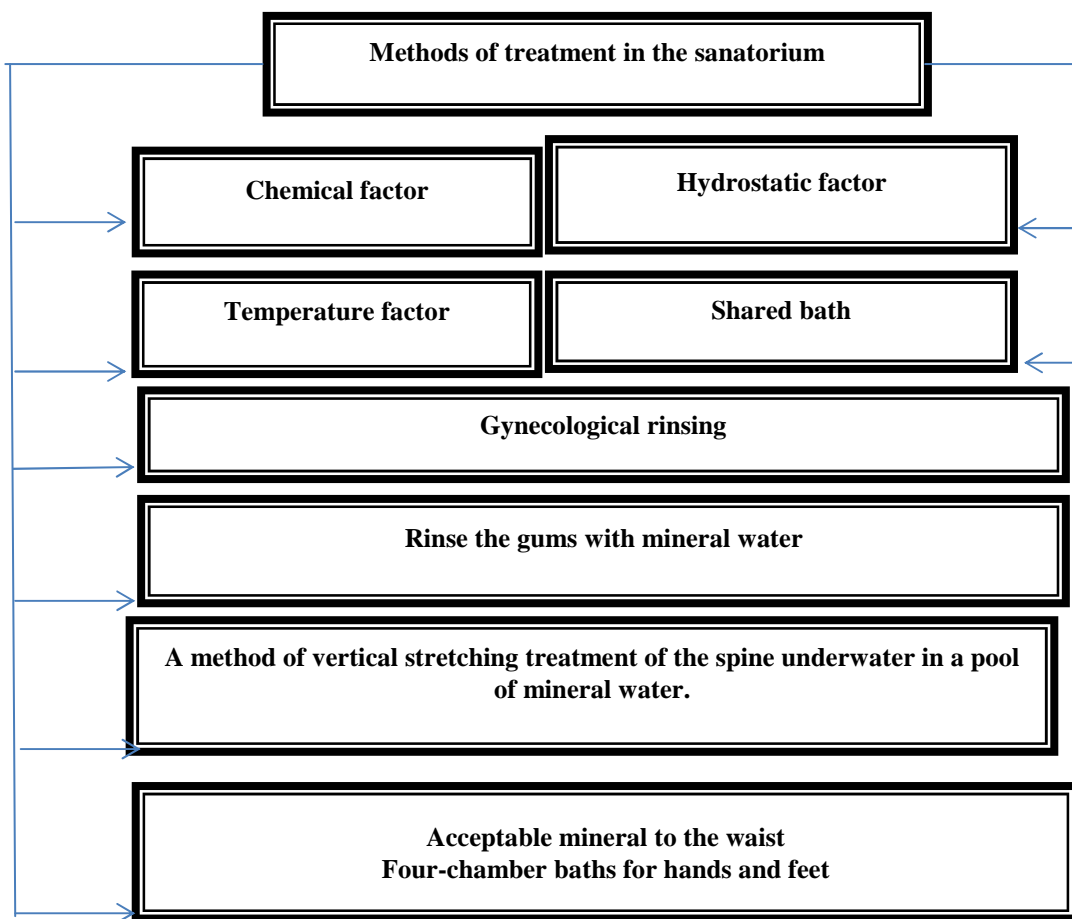


**Figure 1. The main healing factors of Chartak sanatorium<sup>1</sup>**

As can be seen from the data in Figure 1, the main healing factors of Chartak sanatorium are shown, which include iodine-bromine water, chloride-sodium-calcium mineral water, chloride-sulfate-sodium water, as well as

<sup>1</sup>Source: "Chartak Sanatorium" LLC, prepared by the author

artificial sulfide mud, climate. As a result of hydrogeological research in Uzbekistan, more than 20 artesian basins of groundwater have been identified. "Chartak mineral water belongs to the Fergana artesian basin with a total area of about 20,000 km<sup>2</sup>. As a result of deep drilling (up to 4000 meters) more than 10 layers of hot water (subthermal) and boiling water (thermal) were found in the basin. The surface thermal aquifer is located at a depth of 350-900 meters, the water is low in minerals, and the layer at a depth of 1000 m to 3000 m is rich in mineral water. Deeper there are layers of boiling water rich in minerals. Hydrogeological observations are carried out in Chartak sanatorium, equipped for therapeutic use of mineral water from wells 1,2,4,5,32. From well 2, the mixed mineral water of the III-IV aquifers, located at a depth of 1248-1262 and 1540-1546 m, is released to the surface with strong pressure "[11]. According to engineer B.A. Beder, the highest layer of highly mineralized water passes through the ground at a depth of 1000-3000 meters. Even deeper, there are layers with higher temperatures and levels of mineralization. Bathing in the mineral water of the sanatorium develops the bioelectrical activity of the human brain, relieves nervous fatigue, improves blood circulation in the brain, increases the capacity of the cerebral cortex, normalizes blood pressure, regulates metabolism, restores blood vessels and supplies blood to diseased organs. the pain in the inflamed limbs, muscle and vascular contractions disappear. Consumption of mineral water has a positive effect on the biological and chemical processes in the digestive tract, regulates the metabolism of protein, carbohydrates, fats, water, salt, improves the activity of enzymes, cleanses the urinary tract. In addition, the idea of artificially preparing medicinal muds using the mineral water of Chartak was put forward in 1960 by Professor RA Katzenovich. By 1979, such muds began to be prepared in the sanatorium. These clays contain mineral water, hydrogen sulfide, iron oxide, carbon dioxide and other substances. The healing muds prepared in the sanatorium are similar in their effective power, natural and chemical composition to the muds of the famous Crimean sanatorium Sochi and Moynak. After such a treatment, a number of positive changes occur in humans. Blood vessels dilate, blood circulation improves.



**Figure 2. Methods of treatment in the "Chartak sanatorium"<sup>2</sup>**

Figure 2 shows information on treatment methods at Chartak Sanatorium LLC. Iodine-bromine mineral waters of Chartak, which are used in the treatment of patients by therapeutic baths, are similar in their chemical composition and therapeutic effect to the iodine-bromine water of Ust-Kachka, Maykop, Anapa, Sochi in the Commonwealth, Bat-Tyolts in Germany, Hot-Springs in the USA. similar to the mineral water of the Tshaltubo resort with the presence of nitrogen and radon. Well 32 water is subtermal (warm) chloride-sulfate-sodium, mineralization 2.7-3.0 g / l temperature 300S, PH-7.8. The depth of the well is 507 meters. The healing drinking water of the well No. 32 is the medicinal drinking mineral water of the well No. 7, which is used in the treatment of diseases of the gastrointestinal tract, liver, biliary tract, diabetes in the famous Truskovets resort.

In the system of economic and mathematical models of recreation and recreational processes, demand models for the use of recreation play an important role. This in turn increases the effectiveness of the use of recreation. There are many scientific approaches, directions, and models for identifying and studying the demand for recreation for recreation. The study examined the potential of internationally recognized tourism and recreation systems, based on common gravitational models in forecasting the number of visitors, and applied the process to the specifics of the region.

The origin of the name "gravitational model" is based on the assumption that, according to the laws of universal gravitation, the attraction of the population to recreational areas and the development of the relationship between

<sup>2</sup>Source: "Chartak Sanatorium" LLC, prepared by the author

them. In the study, first of all, based on gravitational rings, recreational systems are divided according to the distance of current visitors, and the following are the parameters that participate in the classical model of model classes for groups of 100-150 km and more:

$$K_{ij} = k \frac{m_i^\alpha n_j^\beta}{r_{ij}^\gamma} \tag{1}$$

Here:  $K_{ij}$  -  $j$ in recreational systems and the number of vacationers visited on the basis of the demand for recreation in the settlement.

$n_j$  -  $j$ - the volume of places of the maximum level of tourist and recreational systems;

$\beta$  - coefficient of change of volume of places in recreational systems;

$m_i$  -  $i$ - population on demand;

$\alpha$  - attractiveness coefficient of recreational systems;

$r_{ij}$  -  $i$ - the distance between the settlement and the  $j$ -tourism and recreation systems;

$\gamma$  –convenience factor (travel, relocation and fare).

$\alpha, \beta, \gamma$  – the coefficients were calculated using quantitative indicators determined on the basis of the survey.

It is expedient to consider the sanatorium "Chartak" for medical and recreational rehabilitation in Namangan region. Because in this context, the use of mountain and medical recreation in Namangan region was studied on the example of two objects, which allows to fully reveal the efforts to study the tourist and recreational potential of the region and the tourist and recreational potential.

**Table 1**  
**Information on the area from 100-150 km from the sanatorium "Chartak"<sup>3</sup>**

Fergana Valley	Namangan-87 km, population-2699.0 thousand	Fergana - 132 km, population - 3620.1 thousand	Andijan - 82 km, population - 3011.6 thousand.
Neighboring countries	Kyrgyz Republic, Jalal-Abad region. Ola-buqa- 75 km, population-1201.7 thousand.		

Therefore, first of all, according to the above model (1), the calculation is determined on the basis of the distance from the area where the visitors live to the area where the sanatorium "Chartak" is located and the population of this area (Table 2.3.6). Using the (1) -gravitational model, the gravitational force of each relative to the regions is determined by attracting vacationers to the sanatorium "Chartak". It takes into account the specific features of the system that encourages the visitor to visit, including its attractiveness, ease of arrival and departure (Table 2).

**Table 2**  
**The power of attracting the sanatorium "Chartak" from the regions in response to the needs of the population<sup>4</sup>**

No	Regions	Gravity
1	F <sub>Namangan</sub>	0,00118962
2	F <sub>Fergana</sub>	0,000613602
3	F <sub>Andijon</sub>	0,001071487

<sup>3</sup>Source: <https://flagma.uz/ru/rasstoyanie-dzhizak>- author's work based on information from the pope

<sup>4</sup>Source: Author's calculation based on research



4	$F_{\text{Jalalabadregion}}$	0,000121225
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According to the table, the closer the distance, the higher the gravitational force. Sanatorium "Chartak" is located in Chartak district of Namangan region,  $F_{\text{Namangan}} = 0.0012$ , the gravity of the sanatorium in Jalal-Abad region of Kyrgyzstan is much slower than in other regions, which is explained by a number of functions, including the presence of a border post .

**Table 3**

**The number of visitors to the sanatorium "Chartak" from 100 to 150 km<sup>5</sup>**

Regions	Number on demand of the population	Distance	Number of visitors
Namangan	12146	87	3211
Fergana	10860	132	2221
Andijon	10541	82	3227
Jalalabad region	3966	75	146

<sup>5</sup>Source: Author's calculation based on research

The results obtained from the study and calculations are reflected in the table below. (Table 3) It should be noted that currently only 26.4% (3211 people) of the total population of Namangan region wishing to rest and receive treatment in 12,146 sanatoriums, 20.5% of the total population of Fergana and Andijan regions and 30, respectively. , 6% visited the Chartak sanatorium for rest and treatment.

**Table 4**  
**It was more than 150 km from Chartak sanatorium information on regions<sup>6</sup>**

Across the country	Tashkent - 330 km, population - 5326.9 thousand.	Samarkand-Syrdarya 596 km, population- 5860.2 thousand.	Republic of Karakalpakstan - Navoi region 1383 km, population - 6474.9 thousand
Neighboring countries	Khojand region of Tajikistan - 297 km, population - 1120.8 thousand.		

If we look at the neighboring countries, we can see that 146 residents of Jalal-Abad region of the Kyrgyz Republic visited. Calculations are made on the basis of data determined from the model and distance and population given in Model (2).

The results of the calculations are shown in Table 5. Since the inertia in model (2) depends mainly on the value of  $a$ :  $r_{ij} < a$ ,  $\ln(r_{ij} / a)$ , the negative effect of distance on demand was observed, but it should be noted that this model is directly proportional to population. the increase in the number of visitors from this region has led to an increase (Table 5).

**Table 5**  
**Information on visitors from the area of more than 150 km to the sanatorium "Chartak"<sup>7</sup>**

Regions	Number of population on demand (people)	Distance, km	Number of visitors (people)
Tashkent	15987	330	628
Samarkand-Syrdarya	20511	596	552
Republic of Karakalpakstan - Navoi region	155373	1300	1021
Khojand region of the Republic of Tajikistan	16812	305	138

According to Table 5, 3% of the total population of Tashkent city and region (15987 people), 0.4% of the population from Samarkand region to Syrdarya region (20511 people) and 2.6% of the population of the Republic of Karakalpakstan-Navoi region i (155,373 people), of which only 628, 552 and 1021 were treated at the Chartak sanatorium, respectively. It should be borne in mind that the simplicity of gravitational models in such activities is their main positive feature. In this context, this model is often used in the study of socio-economic processes. However, it should be noted that the information about the attractiveness and competitiveness of the existing services in the sanatorium, as

<sup>6</sup>Source: <https://flagma.uz/ru/rasstoyanie-dzhizak>- author's work based on information from the pope

<sup>7</sup>Source: Author's calculation based on research

well as the expansion of the issue of space may provide an opportunity to increase the number of visitors in the future.

Today, they specialize in recreation and balneology, mainly in the field of health, and their activities also take into account the landscape of the region. Each type of recreation and balneology has a specific specialization and determines the recreational-balneological appearance of the area.

## 6. Conclusions and suggestions

Given the growing importance and role of recreation and balneology in the world economic system, it is necessary to take into account the specific features of the regions in the rapid development of the industry. The expected result of recreation and balneology is the organization of recreation, the elimination of various stresses that people have accumulated during their work through recreation. The rapid development of the industry leads to the formation of new directions in the country's economy, the intensification of the process of diversification of recreational activities in the service sector and the rapid development of many other industries and sectors under the influence of recreational activities.

In conclusion, it is expedient to develop recreational and balneological activities in the regions, and to organize the work of facilities without long breaks, the seasonality will disappear.

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