



## Quality of Life of Patients Who Have Suffered from Acute Cerebrovascular Accident (Investigation Based on EQ-5D-5L)

Guljakhan Abilova<sup>1\*</sup> , Vitaly Kamkhen<sup>1</sup>, Zhanna Kalmatayeva<sup>1</sup>

Received: 16 Nov 2022

Published: 31 Jul 2023

### Abstract

**Background:** Acute cerebrovascular accident is known to be one of the main causes of morbidity, mortality, long-term disability, and disability in society.

To investigate the quality of life of patients who have suffered from acute cerebrovascular accident (hereinafter ACVA) in stratified groups by age, gender, diagnosis, type (primary or secondary), and severity of a stroke, as well as undergoing rehabilitation.

**Methods:** This research is a cross-sectional descriptive-analytical study. The main research method is a survey. Data collection was carried out in 2020 in Almaty of the Republic of Kazakhstan by inpatient doctors (City Clinical Hospital No. 5 of the Public Health Department of Almaty), engaged in the rehabilitation treatment of patients with acute cerebrovascular accident. The standardized questionnaire EQ-5D-5L was used to assess the quality of life due to health conditions. Data on the state of "mobility", "self-care", "daily activities", "pain", "anxiety", as well as data on self-assessment of health status (according to the EQ VAS scale) were analyzed using the Level Sum Scores (hereinafter LSS).

**Results:** The study involved 258 respondents who had a stroke. The survey was conducted 2 months after the respondents were discharged from the hospital. The average LSS index of patients who underwent ACVA was 10.2 (9.7±10.7). Significant differences in LSS levels ( $P \leq 0.001$ ) were revealed by the severity of stroke and by the fact of rehabilitation. Differences in LSS levels by age, gender, diagnosis, and type of ACVA are insignificant ( $P > 0.05$ ).

The difference in health indicators of patients with primary and repeated strokes indicates the fact of deterioration in the quality of life with each subsequent stroke. The quality of life of patients with ACVA is associated with the fact of rehabilitation: low values of EQ VAS in the group of patients who did not undergo rehabilitation and high values of EQ VAS in those who underwent rehabilitation.

**Conclusion:** After a stroke, the majority of patients tend to have a negative quality of life, mostly due to violations of the component "daily activities". The identified significant disparities in LSS and EQ VAS indicators further show that the quality of life varies among stratified groups. The kind (primary or secondary) and severity of the stroke, as well as the existence of rehabilitation, are indicators that impact the quality of life of patients who have had ACVA.

**Keywords:** Quality of Life, EQ-5D-5L, Acute Cerebrovascular Accident, Stroke, Rehabilitation, Kazakhstan

**Conflicts of Interest:** None declared

**Funding:** None

**\*This work has been published under CC BY-NC-SA 1.0 license.**

Copyright© Iran University of Medical Sciences

**Cite this article as:** Abilova G, Kamkhen V, Kalmatayeva Zh. Quality of Life of Patients Who Have Suffered from Acute Cerebrovascular Accident (Investigation Based on EQ-5D-5L). *Med J Islam Repub Iran*. 2023 (31 Jul);37:85. <https://doi.org/10.47176/mjiri.37.85>

### Introduction

Acute cerebrovascular accident or stroke is the most common condition that causes disability and deterioration

**Corresponding author:** Dr Guljakhan Abilova, [dr.abilova@mail.ru](mailto:dr.abilova@mail.ru)

<sup>1</sup> Department of Epidemiology, Biostatistics, and Evidence-based Medicine, Al-Farabi Kazakh National University, Almaty, Kazakhstan

#### ↑What is "already known" in this topic:

Acute cerebrovascular accident is known to be one of the main causes of morbidity, mortality, long-term disability, and disability in society. There are not many studies evaluating the quality of life of stroke patients using the EQ-5D-5L questionnaire.

#### →What this article adds:

The EQ-5D-5L questionnaire was used in stroke patients who underwent rehabilitation and did not undergo rehabilitation. After a stroke, the majority of patients tend to have a negative quality of life, mostly due to violations of the component "daily activities". The obtained results indicate the urgency of undergoing timely rehabilitation after a stroke in order to restore lost functions, improve the quality of life of patients and return to life/working capacity.

of the quality of life (hereinafter QL) of patients worldwide (1-3). Various scales and questionnaires are widely used all over the world to identify the QL of patients after a stroke (4-6). However, this issue has not been sufficiently studied in Kazakhstan, which is confirmed by a relatively small number of scientific papers, and therefore, this study is relevant today. The Karnovsky index (scale) is a tool for assessing the quality of life of patients with stroke in the practice of medical workers in Kazakhstan, designed to assess the functional activity of an oncological patient. This tool is not adapted for a stroke patient, and does not fully disclose all aspects of functional insufficiency of a patient with ACVA, especially at the stages of rehabilitation treatment. Assessment of QL in stroke patients should be multifactorial and cover various areas – physical (motor deficiency, spasticity, ataxia, dysarthria, dysphagia, pain, sleep disorders, and fatigue), functional (mobility, self-care, hygiene, and basic activities), mental (mood, memory, satisfaction, and self-perception) and social (work, social activity, and social role) (7). Covering various areas of human functioning, QL assessment can be used to identify and estimate priorities in the most deteriorated aspects of patients with stroke. QL data helps the doctor to identify hidden problems and facilitate the process of making clinical decisions (8).

Among all available valid scales and questionnaires for assessing QL, we chose the EQ- 5D-5L questionnaire taking into account the following characteristics: convenience of use and understanding by patients and answers to questions do not take much time for patients, the main problematic issues related to the consequences of stroke and convenience in interpreting the results are taken into account (9-11).

The number of responses for the EQ-5D was increased from 3 to 5 levels (EQ-5D-5L) in order to boost the sensitivity for assessing the HRQoL in additional patient categories. Additionally, the availability of clear guidelines for its Web-based administration enables the use of EQ-5D-5L to track HRQoL in electronic health (eHealth) programs.

It was also demonstrated that the use of the 5-level system (5L) leads to a smaller effect compared to the 3-level system (3L) "statistical ceiling" and better measurement quality (12) in a direct parallel comparison of the EQ-5D-5L and EQ-5D-3L questionnaires, performed in the USA by obtaining estimations based on a common (identical) sample. According to another study, when comparing the EQ-5D-5L and EQ-5D-3L questionnaires, the descriptive system EQ-5D-5L was recognized as an acceptable general measure of health outcome in stroke patients with some psychometric advantages compared to EQ-5D-3L (13).

During the development of 5L, the five-dimensional structure of 3L was preserved, but the descriptors in each dimension were adapted to the 5-level system based on qualitative and quantitative studies carried out by the EuroQol group (14).

Therefore, the aim of the study is to investigate the quality of life of patients who have suffered from acute cerebrovascular accident (hereinafter ACVA) in stratified

groups by age, gender, diagnosis, type (primary or secondary), and severity of a stroke, as well as undergoing rehabilitation.

## Methods

The above determines the purpose of this study, which concludes the study of life quality (based on the questionnaire EQ-5D-5L) of patients who have undergone ACVA, including gender and age characteristics, diagnosis (ischemic or hemorrhagic), type (primary or secondary) and severity of stroke, as well as the fact of rehabilitation.

The design of the study is descriptive and analytical. The main research method is a survey. Data collection was carried out in 2020 in Almaty of the Republic of Kazakhstan by inpatient doctors (City Clinical Hospital No. 5 of the Public Health Department of Almaty) engaged in the rehabilitation treatment of patients with acute cerebrovascular disturbance. The study involved 258 respondents who had undergone ACVA. The survey was conducted 2 months after the respondents had been discharged from the hospital. 280 post-stroke patients were invited to the survey, according to patients received from the hospital for the 1st quarter of 2020, but 15 patients refused to fill out the questionnaire, without any reasons. 7 patients had severe cognitive impairment, which did not allow them to be included in the study. Only 258 patients agreed to participate in the survey, from which a sample of patients was formed.

The EQ-5D-5L questionnaire has been chosen in accordance with the following characteristics: convenience of use and understanding by patients and answers to questions do not take much time for patients, the main problematic issues related to the consequences of stroke, and convenience in interpreting the results.

The quality of life was studied using the EQ-5D-5L questionnaire (Russian version). The patients were asked to answer questions about the conditions of "mobility", "self-care", "daily activities", "pain", "anxiety" and generally assess their health on a scale from 0 to 100 (visual analog scale EQ VAS). The EQ-5D-5L questions included five levels: no problems, minor problems, moderate problems, serious problems, and extreme problems. The answers about the state of "mobility", "self-care", "daily activities", "pain", "anxiety" were combined into a five-digit number describing the respondent's state of health: from the state of "11111", meaning "no problems", to the state of "55555", meaning "extreme problems" in all five dimensions. The total score of the health status level (LSS) was also calculated, which ranged from 5 (the best) up to 25 (the worst).

For the EQ VAS and LSS indicators, measures of the central trend were calculated (arithmetic mean, standard error of the average, and confidence interval for mean, median, mode, min, max, 25, and 75 percentages). The assessment of differences in groups (by age, gender, the diagnosis and type of ACVA, the severity of stroke (according to NIHSS), and the fact of rehabilitation) was carried out using the independent samples t-test or Mann-Whitney criteria and the Kraskel-Wallis test (taking into account the distribution of data). The null hypothesis

(without differences) was accepted at  $P > 0.05$ .

When analyzing the data of assessment of the state of health of respondents on a scale from 0 to 100, using the visual analogue scale EQ VAS, an average of 63 was found, which is equivalent to 63% of 100% of the total health of patients.

Microsoft Excel and the IBM SPSS Statistics package served as a tool for the statistical processing of the data obtained.

## Results

The quality of life according to EQ-5D-5L was assessed as a whole and in separate groups (Table 1). The main contingent of respondents is in the age group of 54 to 68 years (25 and 75 percentiles). The average age of the respondents was 60 years. The most common age among respondents was the age of 56 (fashion). The median age was 61 years. The number of respondents aged "under 60" was 128 people (or 49.6±3.11%), and those aged "over 60" – 130 people (or 50.4±3.11%). Of the total number of respondents, the percentage of women was 43.0±3.08% (or 111 people), and the percentage of men was 57.0±3.08% (or 147 people). Among the respondents, a significant proportion were respondents with ischemic stroke (224 respondents or 86.8±2.11%) and a small proportion were respondents with hemorrhagic stroke (34 respondents or 13.2±2.11%). Primary ACVA was observed in 172 respondents (or 66.7±2.93%), and secondary ACVA – in 86 respondents (or 33.3±2.93). Depending on the severity of the stroke (according to NIHHS), respondents were divided into three groups: mild disorders were found in the main proportion of respondents (226 respondents or 87.6±2.05%), moderate disorders – in 26 respondents (or 10.1±1.87%), severe and extreme disorders – in 6 respondents (or 2.3±0.94%). The share of respondents who underwent rehabilitation was 42.6±3.08% (or 110 people), and the share of respondents who did not undergo rehabilitation was 57.4±3.08% (or 148 people).

It was found that the most frequent impairments were in the "daily activity" component (in 83.7±2.30% of respondents), and the most rare were impairments in the "pain" component (in 39.9±3.05% of respondents). The frequency of impairments of "daily activities" in respondents with hemorrhagic stroke was 91.2±4.86%, and in respondents with ischemic stroke – 82.6±2.53%, without statistically significant differences ( $P = 0.054$ ). There is a significant difference ( $P \leq 0.001$ ) in the frequency of impairments of "daily activities" among respondents who have undergone and failed rehabilitation (91.2±2.33% vs. 73.6±4.20%).

The health condition profile is analyzed. Table 2 shows the most common combinations of levels. The three dominant combinations are represented by the health conditions "11111" (observed in 9.30±1.81% of respondents), the condition of health "21211" (observed in 4.65±1.31% of respondents), and the condition of health "22212" (observed in 4.26±1.26% of respondents).

The health condition profile (total LSS score) is summed up. The average LSS score was 10.2±0.25 (CI 9.7÷10.7), the median LSS was 9 points, the LSS mode

**Table 1.** Distribution of patients taking into account age, gender, type, and severity of stroke, who underwent and did not undergo rehabilitation

Variable	Abs. Numbers	%±se
Total	258	100%
Age groups		
under 60 years old	128	49.6±3.11
over 60 years old	130	50.4±3.11
Sex		
Male	147	57.0±3.08
Female	111	43.0±3.08
Diagnosis		
ischemic stroke	224	86.8±2.11
hemorrhagic stroke	34	13.2±2.11
Type of stroke		
primary stroke	172	66.7±2.93
secondary stroke	86	33.3±2.93
Severity of the stroke (NIHHS)		
Mild	226	87.6±2.05
Moderate	26	10.1±1.87
Severe	6	2.3±0.94
The fact of rehabilitation		
did not undergo rehabilitation	148	57.4±3.08
underwent rehabilitation	110	42.6±3.08

**Table 2.** The most common combinations of health profile levels

Health condition profile	Abs. Numbers	%±se
State 11111	24	9.30±1.81
State 21211	12	4.65±1.31
State 22212	11	4.26±1.26
State 21212	10	3.88±1.20
State 11212	7	2.71±1.01
State 21213	7	2.71±1.01
State 22211	7	2.71±1.01
State 23212	7	2.71±1.01
State 44433	6	2.33±0.94
State 11112	5	1.94±0.86
State 11211	5	1.94±0.86
State 22213	5	1.94±0.86

was 10 points, the minimum LSS was 5 points, the maximum was 23 points, the 25th percentile was 7 points, and the 75th percentile was 12 points.

Differences in LSS levels by age ( $P = 0.059$ ), by sex ( $P = 0.621$ ), by diagnosis ( $P = 0.675$ ), and by type of ACVA ( $P = 0.101$ ) are statistically insignificant. There are significant differences in LSS levels by stroke severity ( $P \leq 0.001$ ) and by rehabilitation ( $P \leq 0.001$ ) (Table 2).

The EQ VAS indicator was also evaluated (Table 3). According to the averaged data, the total EQ VAS index was 63.0±1.31 (CI 60.4÷65.6) units, median EQ VAS – 60 units, mode EQ VAS – 50 units, min EQ VAS – 20 units, max – 100 units, 25 percentile – 50 units and 75 percentile – 80 units.

In the respondents in the age groups "under 60" and "over 60", the average EQ VAS index was 64.6 (61.2–68.0) and 61.4 (57.5–65.3) units, respectively, without significant differences ( $P = 0.281$ ).

In male and female aggregates, slight differences in the average EQ VAS were determined: 62.5 (59.1–65.9) versus 63.6 (59.7–67.6) ( $P = 0.706$ ).

Also, the average EQ VAS index did not differ significantly in respondents with hemorrhagic stroke and respondents with ischemic stroke (60.7 (54.0–67.5) vs. 63.3 (60.5–66.1);  $P = 0.483$ ).

**Table 3.** Data of EQ VAS and LSS, taking into account age, gender, type, and severity of stroke, who underwent and did not undergo rehabilitation

variable	EQ VAS (mean [ 95%CI])	LSS (mean [95% CI])
Total	63.0 [60.4-65.6]	10.2 [9.7-10.7]
Age groups		
under 60 years	64.6 [61.2-68.0]	9.6 [8.9-10.3]
over 60 years of age	61.4 [57.5-65.3]	10.7 [9.9-11.5]
Sex		
Male	62.5 [59.1-65.9]	10.1 [9.4-10.8]
Female	63.6 [59.7-67.6]	10.2 [9.5-11.0]
Diagnosis		
ischemic stroke	63.3 [60.5-66.1]	10.2 [9.6-10.7]
hemorrhagic stroke	60.7 [54.0-67.5]	1.2 [8.9-11.5]
Type of stroke		
Primary stroke	65.4 [62.3-68.6]	9.8 [9.2-10.3]
Secondary stroke	58.1 [53.8-62.4]	11.0 [10.0-11.9]
Severity of stroke (NIHSS)		
Mild	66.2 [63.6-68.7]	9.3 [8.9-9.7]
Moderate	41.2 [33.9-48.4]	15.7 [14.1-17.4]
Severe	36.7 [17.1-56.2]	18.0 [13.7-22.3]
The fact of rehabilitation		
did not undergo rehabilitation	57.0 [53.9-60.1]	11.1 [10.4-11.8]
underwent rehabilitation	71.1 [67.1-75.0]	8.9 [8.3-9.6]

95% CI: 95% Confidence Interval

Significantly ( $P = 0.010$ ), the EQ VAS index is higher in respondents with newly diagnosed ACVA, compared with respondents with repeated manifestation of ACVA: 65.4 (62.3–68.6) and 58.1 (53.8–62.4), respectively.

Attention is paid to the levels of the EQ VAS indicator in respondents with different stroke rates (according to NIHSS). With an increase in the severity of the stroke, a decrease in the EQ VAS index is characteristic: in respondents with mild disorders, the EQ VAS index was 66.2 (63.6–68.7), with moderate disorders – 41.2 (33.9–48.4), with severe and extreme disorders - 36.7 (17.1–56.2).  $P$  value of the Kruskal-Wallis test was equal,  $P \leq 0.001$ .

Also, the results of a comparative assessment of the EQ VAS indicator in groups, taking into account the fact of rehabilitation, are very interesting. The results obtained indicate that the respondents who did not undergo rehabilitation have a significantly lower average level of EQ VAS in comparison with the respondents who underwent rehabilitation: 57.0 (53.9–60.1) and 71.1 (67.1–75.0), respectively.  $P$  value of the Mann-Whitney test was  $P \leq 0.001$ .

### Discussion

ACVA is the most important problem of medicine and public health due to high mortality and long-term disability of patients, with a possible decrease in the quality of life.

Finding the degree of quality of life indicators in stratified groups of patients after ACVA (by age, by gender, taking into consideration the diagnosis and type of ACVA, the severity of the stroke, and the fact that rehabilitation is occurring) is the major question that the findings of our study address.

According to the results of the study, it was found that in the studied population, the average age of patients who

underwent ACVA was 60. The results obtained by us coincide with the previously published data that the development of ACVA prevails in the age group older than 50–60 (15). The results of the analysis indicate that more than half of the patients in the study population are of working age, and therefore, in our opinion, this study in the context of studying the quality of life is of particular scientific and practical interest. Another argument for the significance of the study is the fact that about a third of patients have recurrent development of ACVA, which also dictates the need to study the characteristics of the quality of life due to the condition of health.

According to the results of the study, the majority of respondents had certain disorders in such components of health (according to EQ-5D-5L) as "mobility" (more than 70%), "self-care" (more than 60%), "daily activities" (more than 80%) and "anxiety" (more than 60%). This is a fairly high percentage of the impairment, indicating a deterioration in the quality of life after a stroke. Although pain syndrome was the rarest disorder, according to the results of the study, it is about 40%.

The study revealed significant differences in the health of patients who underwent and did not undergo rehabilitation in such components as: "daily activity", "mobility", "self-care" and "pain". Mobility impairment, according to the questionnaire, is associated with the function of the lower limb, and the violation of self-care is associated with the function of the upper limb. And as you know, daily activity includes mobility, taking care of oneself, and self-care.

The obtained results indicate the urgency of undergoing timely rehabilitation after a stroke in order to restore lost functions, improve the quality of life of patients and return to life/working capacity.

The LSS indicator describing the health condition profile of patients who underwent ACVA was varied, so it



was not possible to verify this characteristic in the studied population. However, it was found that the differences in LSS levels are significant ( $P \leq 0.001$ ) in terms of the severity of stroke and the fact of rehabilitation, and insignificant ( $P > 0.05$ ) in age, gender, diagnosis, and type of ACVA. The highest average LSS index is characteristic of patients who have not undergone rehabilitation, which indicates that there are fewer health problems in patients who have received a course of rehabilitation treatment.

Patients with ACVA assessed their health condition on the visual analog scale EQ VAS above the threshold 50% level. In most stratified groups, this level was more than 60%, and in some – less than 40%. Groups in which the self-assessment of health significantly differs are of interest: patients with newly diagnosed and repeated ACVA ( $P = 0.010$ ), patients with varying degrees of stroke severity ( $P \leq 0.001$ ), and patients who have undergone and failed rehabilitation ( $P \leq 0.001$ ). The difference in health indicators (according to respondents' self-assessment) of patients with primary and repeated strokes indicates the fact of deterioration in the quality of life with each subsequent stroke.

The tendency to decrease the EQ VAS index of patients with mild, moderate, and severe ACVA also indicates a deterioration in the quality of life of patients with a more malignant stroke. And, in our opinion, an important result of the analysis indicates that the quality of life of patients with ACVA is associated with the fact of rehabilitation, namely, low values of EQ VAS in the group of patients who did not undergo rehabilitation and high values of EQ VAS in those who underwent rehabilitation.

## Conclusion

After a stroke, the majority of patients tend to have a negative quality of life, mostly due to violations of the component "daily activities". The identified significant disparities in LSS and EQ VAS indicators further show that the quality of life varies among stratified groups. The kind (primary or secondary) and severity of the stroke, as well as the existence of rehabilitation, are indicators that impact the quality of life of patients who have had ACVA.

## Ethics approval and consent to participate

The study was granted approval from the Health Research Ethics Committee at Al-Farabi Kazakh National University (ref. no 12/2020).

## Consent for publication

All authors agree to the publication of the manuscript in "The medical journal of The Islamic Republic of Iran".

Availability of data and materials: The data that support the findings of this study are available from the corresponding author A.G.

## Authors' contributions

All authors made significant contributions to this article. G.A. was responsible for the data collection and write-up. V.K. was responsible for the initial draft of the manuscript. Zh.K. was responsible for the critical analysis of

the article.

## Acknowledgments

The authors would like to acknowledge Dilnoza Kahhara's helpful comments on the initial draft of the article.

## Conflict of Interests

The authors declare that they have no competing interests.

## References

- Feigin VL, Stark BA, Johnson CO, Roth GA, Bisignano C, Abady GG, et al. Global, regional, and national burden of stroke and its risk factors, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. GBD 2019 Stroke Collaborators. *Lancet Neurol*. 2021;20:795–820.
- Mozaffarian D, Benjamin EJ, Go AS, Arnett DK, Blaha MJ, Cushman M, et al. Heart Disease and Stroke Statistics-2016 Update: A Report from the American Heart Association. *Circulation*. 2016 Jan 26;133(4):e38–360.
- Kovalchuk VV. Therapeutic possibilities of improvement of cognitive functions, psychoemotional condition, and quality of life in post-stroke patients. *Zh Nevrol Psikhiatr Im S S Korsakova*. 2015;115(12):92–97.
- Janssen MF, Pickard AS, Golicki D, Gudex C, Niewada M, Scalone L, et al. Measurement properties of the EQ-5D-5L compared to the EQ-5D-3L across eight patient groups: a multi-country study. *Qual Life Res*. 2013;22(7):1717–27.
- Hunger M, Sabariego C, Stollenwerk B, Cieza A, Leidl R. Validity, reliability, and responsiveness of the EQ-5D in German stroke patients undergoing rehabilitation. *Qual Life Res*. 2012 Sep;21(7):1205–16.
- Kislitsyn YuV, Borisov DN. Quality of life of the patients who had an atherothrombotic stroke in the carotid artery territory. *Zh Nevrol Psikhiatr Im S S Korsakova*. 2015;115(9 Pt 2):20–22.
- Winstein CJ, Stein J, Arena R, Bates B, Cherney LR, Cramer SC, et al. Guidelines for Adult Stroke Rehabilitation and Recovery. *J Stroke*. 2016;47(6):98–169.
- Donkor ES. Stroke in the 21st Century: A Snapshot of the Burden, Epidemiology, and Quality of Life. *Stroke Res Treat*. 2018;3238165.
- EQ-5D-5L | Valuation: Standard value sets. [Internet]. 2021 [cited 2021 Feb 16]. Available from: <https://euroqol.org/eq-5d-instruments/eq-5d-5l-about/valuation-standard-value-sets/>
- Xie F, Pullenayegum E, Gaebel K, Bansback N, Bryan S, Ohinmaa A, et al. A Time Trade-off-derived Value Set of the EQ-5D-5L for Canada. *Med Care*. 2016 Jan;54(1):98–105.
- Devlin NJ, Shah KK, Feng Y, Mulhern B, van Hout B. Valuing health-related quality of life: An EQ-5D-5L value set for England. *Health Econ*. 2018 Jan;27(1):7–22.
- Law EH, Pickard AS, Xie F, Walton SM, Lee TA, Schwartz A. Parallel Valuation: A Direct Comparison of EQ-5D-3L and EQ-5D-5L Societal Value Sets. *Med Decis Making*. 2018 Nov;38(8):968–982.
- Golicki D, Niewada M, Buczek J, Karlińska A, Kobayashi A, Janssen MF, et al. Validity of EQ-5D-5L in stroke. *Qual Life Res*. 2015;24(4):845–50.
- Herdman M, Gudex C, Lloyd A, Janssen MF, Kind P, Parkin D, et al. Development and preliminary testing of the new five-level version of EQ-5D (EQ-5D-5L). *Qual Life Res*. 2011;20(10):1727–36.
- Abilova GT, Malik Sh, Mukhitova MR, Kapanova GZh, Kalmatayeva ZhA. Epidemiological data of acute infringement of brain blood circulation in the city of Almaty. *J Life Health Sci*. 2020;1:70–75.