ABSTRACT

Dissertation submitted for the degree of Doctor of Philosophy (PhD) in the specialty 6D110200 – Public Health

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"Improving the Organization of Rehabilitation Care for Stroke Patients in Almaty"

Relevance of the Research Topic

The prevalence of acute cerebral circulation disorders (ACCD) is increasing annually worldwide, in both economically developed and developing countries. Despite significant progress in medical management, ACCD remains one of the most critical global health challenges. Furthermore, ACCD is among the leading causes of disability and mortality worldwide. Currently, no other cause of death surpasses cardiovascular diseases in global impact; according to the Global Burden of Disease (GBD) 2019 study, ACCD is the second leading cause of death and ranks third in terms of the combined burden of mortality and disability.

According to official statistics from the Ministry of Health of the Republic of Kazakhstan, more than 40,000 cases of ACCD are registered annually in the country. Of these, approximately 5,000 deaths occur within the first 10 days, and an additional 5,000 deaths are recorded within the first month after discharge. ACCD is the primary cause of disability in Kazakhstan, with a rate of 104.6 per 100,000 population.

Rehabilitation is an integral component of universal health coverage—alongside health promotion, disease prevention, treatment, and palliative care. It is aimed at enabling stroke patients to achieve the highest possible level of autonomy and independence in their daily lives, both domestically and socially. Effective rehabilitation facilitates patients' return to education, employment, and leisure activities, as well as their ability to fulfill essential roles, such as family caregiving.

At present, the demand for rehabilitation services remains largely unmet. In some low- and middle-income countries, more than 50% of the population does not receive the necessary rehabilitation interventions.

Research Aim

To examine the status and organizational features of rehabilitation care for stroke patients in Almaty and to develop strategies for improving restorative treatment.

Research Objectives:

1. To study the key epidemiological aspects of ACCD and its consequences.
2. To assess the organization of rehabilitation care for patients after ACCD.
3. To evaluate the quality of life of patients after ACCD depending on the rehabilitation received.
4. To develop recommendations for improving the organization of rehabilitation care for patients after ACCD.

Research methods

The dissertation study comprised three main stages: 1) a theoretical part, which included an analytical review of current literature on the epidemiology of stroke and its consequences, the current state of rehabilitation service organization for patients with stroke, and the assessment of quality of life in post-stroke patients; 2) an empirical

part, which examined the epidemiological aspects of stroke at the population, regional, and organizational levels, assessed the organization of rehabilitation care for patients with stroke, and evaluated quality of life, stroke outcomes, and post-stroke consequences in relation to the rehabilitation interventions provided; 3) a final part, which summarized the main theoretical concepts and empirical findings of the study and included the formulation of conclusions and practical recommendations for improving rehabilitation services. The following research methods were used at different stages of the study:

- bibliographic and theoretical analysis of relevant literature;
- clinical method (neurological and rehabilitation status, standardized scales);
- survey of rehabilitation professionals (development of a questionnaire and conducting surveys);
- statistical data analysis.

Statistical data processing was performed using Microsoft Excel, IBM SPSS Statistics, and the R programming environment. Descriptive statistical methods were applied; the Shapiro–Wilk test; Student's t-test and Welch's test, the Mann–Whitney U test, Kruskal–Wallis test, and Wilcoxon test; Pearson's χ^2 test, Fisher's exact test, the likelihood ratio test (LR χ^2/G-test), and the Monte Carlo method; the Holm correction for multiple comparisons; survival analysis using life tables and the Kaplan–Meier method with the log-rank test; multivariable regression analysis (linear, binary logistic, ordinal logistic, and penalized logistic regression); ANCOVA adjusted for baseline values, with HC3 robust standard errors and estimated marginal means; and propensity score analysis using IPTW (ATE) and caliper matching, with covariate balance assessed using standardized mean differences (SMD). Differences and associations were considered statistically significant at $p<0.05$. The study was approved by the Local Ethics Committee of Al-Farabi Kazakh National University (IRB-A065).

Object of the study: Adult stroke patients and rehabilitation professionals in Almaty.

Subject of the study: Epidemiological aspects of ACCD, features of rehabilitation organization, and quality of life depending on rehabilitation.

Provisions Submitted for Defense

The epidemiological significance of stroke is associated with patterns of prevalence, mortality, survival and post-stroke consequences; absence of rehabilitation is associated with higher odds of death, whereas recurrent stroke is associated with adverse consequences.

Staffing shortages in rehabilitation services result in insufficient levels of patient awareness following a stroke.

The timely initiation and duration of medical rehabilitation are positively associated with improvements in patients' quality of life and its dynamics.

Improving rehabilitation care for patients following a stroke entails ensuring full staffing of the rehabilitation service, increasing patient awareness of the need for early and continued rehabilitation, ensuring the continuity and coordination of the rehabilitation care pathway, and dynamic assessment of patients' quality of life.

Research results

The prevalence of stroke in Almaty averaged 49.3% among the working-age population, with a gender distribution of 60.9% male and 39.1% female. The average inpatient mortality rate was 10.6%, while the 30-day mortality rate reached 16.5%, and at-home mortality stood at 25.8%. The absence of rehabilitation is associated with a 3.830-fold increase in the odds of a fatal outcome. Furthermore, a delay in the initiation of rehabilitation increases the probability of adverse outcomes: by 6% with a 1-month delay, 8% with a 2-month delay, and 10% for delays of 3 months or more. Recurrent stroke was significantly associated with 30.3-fold higher odds of anxiety, 7.17-fold higher odds of cognitive impairment, 10.5-fold higher odds of requiring assistance, and 3.25-fold higher odds of requiring mobility aids ($p<0.05$).

A significant staffing shortage was identified among psychologists (58.3%), occupational therapists (46.7%), speech therapists (38.8%), physical therapy (PT) instructors (35.0%), and social workers (34.5%), as well as among physical therapy physicians (31.2%), rehabilitation specialists (16.3%), and physiotherapists (7.2%). Patient awareness regarding rehabilitation access stands at 71.0% and is significantly associated with the presence and severity of motor impairments, assessment by a rehabilitation specialist during Stage 1 of rehabilitation, and the accuracy of patient contact information ($p<0.05$).

Rehabilitation of patients leads to a statistically significant improvement in their quality of life compared to those who do not undergo rehabilitation. This is evidenced by a lower prevalence of impairments across key domains: activities of daily living (73.6% vs. 91.2%), mobility (60.0% vs. 77.7%), self-care (50.0% vs. 69.6%), and pain syndrome (29.1% vs. 48.0%) ($p\leq0.01$). Furthermore, continuous rehabilitation was associated with a lower probability of disability compared to cases where rehabilitation was discontinued (OR=3.1; OR=5.2, $p<0.05$).

Recommendations for improving the organization of rehabilitation care for patients after stroke were developed, taking into account the identified organizational problems and potential points of disruption in the continuity of the rehabilitation care pathway. Based on these recommendations, an algorithm was developed to ensure the continuity and coordination of medical rehabilitation at all stages of care.

The scientific novelty

For the first time, a comprehensive assessment was conducted of the impact of clinical and functional factors (age, sex, stroke type, primary stroke status, and rehabilitation) as well as early rehabilitation on stroke outcomes and patient survival.

For the first time in Kazakhstan, a comprehensive assessment of the organization of rehabilitation care for post-stroke patients in Almaty was conducted, revealing workforce shortages and an insufficient level of patient awareness.

For the first time in Kazakhstan, the quality of life of patients following an acute cerebrovascular accident was evaluated using the EQ-5D-5L questionnaire. The study revealed that timely and continuous rehabilitation is significantly associated with an improvement in this metric and a reduction in the risk of disability.

Directions for improving the organization of rehabilitation care for patients after stroke were scientifically substantiated, and an algorithm for ensuring its continuity and coordination was proposed, including optimization of the rehabilitation care pathway, staffing, and patient information.

Theoretical Significance:

The study results supplement existing scientific data on the prevalence and early mortality following stroke and expand scientific knowledge on the association between the timing of rehabilitation initiation and stroke outcomes, as well as between undergoing rehabilitation and patient survival. The findings supplement existing scientific understanding of staffing in rehabilitation services and patient awareness, while the developed questionnaire expands the possibilities for a comprehensive assessment of the organization of rehabilitation care. The study results confirm the importance of early and continuous rehabilitation care for restoring functional independence and quality of life in patients after stroke. Furthermore, they demonstrate the role of quality of life assessment (EQ-5D-5L) as a tool for monitoring the effectiveness of rehabilitation interventions, thereby expanding theoretical approaches to the organization of post-stroke rehabilitation. The theoretical significance of the study lies in substantiating the role of a coordinated, continuous, and multidisciplinary approach to the rehabilitation of patients after stroke, as well as in clarifying the association of early and continued rehabilitation with clinical and functional outcomes and quality of life, thereby expanding existing understanding of recovery patterns in this patient population.

Practical Significance

The observed level of early mortality underscores the need to strengthen follow-up care and ensure the timely initiation of rehabilitation for patients after stroke. Data on factors associated with post-stroke outcomes, including recurrent stroke and the degree of disability, may be used to predict functional outcomes and plan individualized rehabilitation programs. The practical significance of the study lies in identifying organizational challenges and substantiating directions for improving the rehabilitation care system for patients following an acute cerebrovascular accident, including strengthening staffing and enhancing information support for patients. The use of the EQ-5D-5L questionnaire enables objective assessment of patients' quality of life, identification of clinical, functional, and psychological impairments, and dynamic assessment of rehabilitation outcomes depending on whether rehabilitation was undertaken. The developed recommendations may be used to improve the organization of rehabilitation care for patients after stroke, optimize coordination between the stages of rehabilitation, and support consistent decision-making in patient routing and follow-up.

Implementation:

The EQ-5D-5L Quality of Life Questionnaire has been implemented in such medical organizations as the "Newest Technologies of Rehabilitation" center and the "Keruen-medicus on Sharipov" medical center. A Certificate of State Registration of Copyright No. 65827, dated December 26, 2025, was obtained for the "Questionnaire for Assessing the Organization of Rehabilitation Care for Patients Following Acute Cerebral Circulation Disorders".

The personal contribution of the doctoral candidate

The dissertation candidate personally participated in all stages of the research process, including the planning of the study, preparation of regulatory documentation, development of statistical accounting forms, and the collection and processing of data.

In collaboration with scientific advisors, the candidate helped define the research goals and objectives, conducted statistical analysis of the obtained data, and developed practical recommendations based on the study findings. The candidate independently reviewed and analyzed over 240 domestic and international scientific sources on the research topic, interpreted the collected data, prepared reports, published results in national and international scientific journals, and wrote all sections of the dissertation.

Approbation of the dissertation results

The research results were presented at the international scientific conference "VI International Farabi Readings" (Almaty, 2019) and at the international congress "Global Health" (Almaty, 2023).

Published works based on the dissertation research

A total of 8 scientific works have been published based on the research materials, including: 1 article in a peer-reviewed journal indexed in the Scopus international database; 4 articles published in journals recommended by the Committee for Control in the Sphere of Science and Higher Education of the Ministry of Science and Higher Education of the Republic of Kazakhstan; 1 article in an international peer-reviewed publication and 2 abstracts in the proceedings of international and foreign conferences.

The volume and structure of the dissertation:

The total volume of the dissertation is 186 pages. Structurally, the work comprises an introduction, a literature review, a main body (including materials and methods, and chapters on original research results), a conclusion with findings, practical recommendations, 46 tables, 47 figures, a list of references including 240 sources, and 9 appendices.