Original Article

Depression and fatigue among stroke survivors: a cross-sectional study in Kazakhstan

Akgul Baizullina[1], Ariel Shensa[4], Aigul Yermagambetova[1], Zinat Abdrakhmanova[3*], Zhanar Zhagiparova[2], Assel D. Sadykova[5,6], Karlygash N. Tazhibayeva[5,7], "Askar Aidarov[8], Faina Linkov[4*], Lazzat Zhamaliyeva[1]

ABSTRACT

Background

Depression and fatigue are frequent but underrecognized complications of stroke, particularly in low- and middle-income countries. Evidence from Central Asia is scarce.

Objective

To assess the prevalence and severity of depression and fatigue, and their associations with mental well-being among first-time and recurrent stroke survivors in Kazakhstan.

Methods

We conducted a cross-sectional study of 150 stroke survivors (127 first-ever, 23 recurrent) treated at a multidisciplinary hospital in Aktobe, Kazakhstan (February–July 2024). Depression, fatigue, and mental well-being were assessed using the Beck Depression Inventory-II (BDI-II), the Fatigue Assessment Scale (FAS), and the Mental Health Continuum–Short Form (MHC-SF). Group comparisons used chi-square tests, t-tests. Multivariable logistic regression models estimated adjusted odds ratios (AOR) with 95% confidence intervals (CI).

Results

Overall, 50.7% of patients reported depressive symptoms and 54.7% had clinically significant fatigue. Recurrent stroke survivors demonstrated higher depression scores than first-ever stroke patients (BDI-II: 15.0 ± 6.98 vs. 9.97 ± 7.99; p = 0.001). Fatigue and mental well-being did not differ significantly between groups. Regression analysis confirmed an independent association between recurrent stroke and depression (AOR = 0.30; 95% CI: 0.13–0.72). Depression and fatigue were moderately correlated (r = 0.45) and both were inversely correlated with mental well-being.

Conclusions

Depression is significantly more common among recurrent stroke survivors, while fatigue is highly prevalent regardless of stroke history. Integrated rehabilitation in Kazakhstan should include systematic screening and psychological support to address these complications.

Keywords

stroke; post-stroke depression; fatigue; mental well-being; Kazakhstan

INTRODUCTION

Stroke is one of the leading causes of disability and mortality worldwide. According to the World Health Organization, stroke ranks second among causes of death, surpassed only by ischemic heart disease[1]. Projections indicate that by 2030, the number of stroke-related deaths could reach 12 million, while the number of stroke survivors may exceed 70 million[2]. According to data from the Global Burden of Disease (GBD), more than 12.2 million new strokes are registered annually, and the total number of stroke survivors exceeds 101 million (3,4).

Previous research has indicated that certain Asian-specific characteristics, distinct from those in Western populations, contribute to a higher incidence of stroke—sometimes

1. Marat Ospanov West Kazakhstan Medical University, Department of general medical practice №2, Aktobe, Kazakhstan
2. Khoja Akhmet Yassawi International Kazakh-Turkish University
3. Al-Farabi Kazakh National University, Department of Epidemiology, Biostatistics and Evidence-Based Medicine, Almaty, Kazakhstan
4. Duquesne University, Department of Health Administration and Public Health, John G. Rangos Sr. School of Health Sciences, Pittsburgh, United States
5. Al-Farabi Kazakh National University, Almaty, Kazakhstan
6. Republican Blood Center, Almaty, Kazakhstan
7. Almaty Regional Multidisciplinary Clinic, Almaty, Kazakhstan
8. Kazakh Russian Medical University, Almaty, Kazakhstan

Correspondence

Zinat Abdrakhmanova, Al-Farabi Kazakh National University, Almaty, Kazakhstan, Almaty, Republic of Kazakhstan, 050040. E-mail: abdrakhmanova.z@kaznmu.kz

DOI: https://doi.org/10.3329/bjms.v25i1.86435

surpassing that of coronary artery disease in several Asian countries[5] [5]. Although stroke epidemiology has been studied in Asia, large-scale, population-based investigations examining stroke in Central Asian or Eurasian countries, including Kazakhstan, are still lacking[6] [6]. However, a recent population-based study by Zhakhina et al. (2022), which included over 177,000 cases from 2014 to 2019, provides valuable insight into national trend[7]. The study reported a slight decrease in the overall incidence of stroke during this period, but a significant increase in all-cause mortality among stroke patients[8]. Ischemic strokes accounted for the majority of cases, while intracerebral hemorrhage was associated with the highest mortality. These findings highlight critical gaps in stroke outcomes and underline the need for enhanced post-stroke care and prevention strategies in Kazakhstan[9].

Post-stroke fatigue (PSF) is a common and often underestimated symptom that can persist for a long time and significantly reduce patients' quality of life[10]Studies indicate that PSF is observed in 36–77% of stroke patients[11]. Cognitive impairments, such as deficits in executive function, are associated with higher levels of fatigue among stroke survivors. Emotional conditions, including depression and anxiety, are also frequently linked to increased fatigue levels[12]. There is limited research available on post stroke recovery among patients in Central Asia and Kazakhstan[13,14].

Physical factors such as hypertension, diabetes, and arrhythmia occurring during stroke may contribute to elevated fatigue levels years after the event[15]. Biological factors, including high glucose levels and specific cytokines in the acute phase of stroke, may predict fatigue severity months after the stroke. The severity of the stroke affects fatigue levels through various mechanisms, including cognitive and physical impairments as well as emotional and social factors. More severe strokes can lead to more pronounced cognitive and physical deficits, which, in turn, increase fatigue levels[16,17].

Given the high prevalence and impact of PSF on recovery, it is crucial to develop effective treatment approaches and strategies for reducing fatigue in stroke survivors. Rehabilitation programs aimed at improving physical condition, cognitive function, and emotional well-being may help alleviate fatigue levels and enhance patients' quality of life[18].

The aim of this study is to conduct a cross-sectional analysis comparing first-time and recurrent stroke survivors using the Beck Depression Inventory (BDI), the Fatigue Assessment Scale (FAS), and the Mental

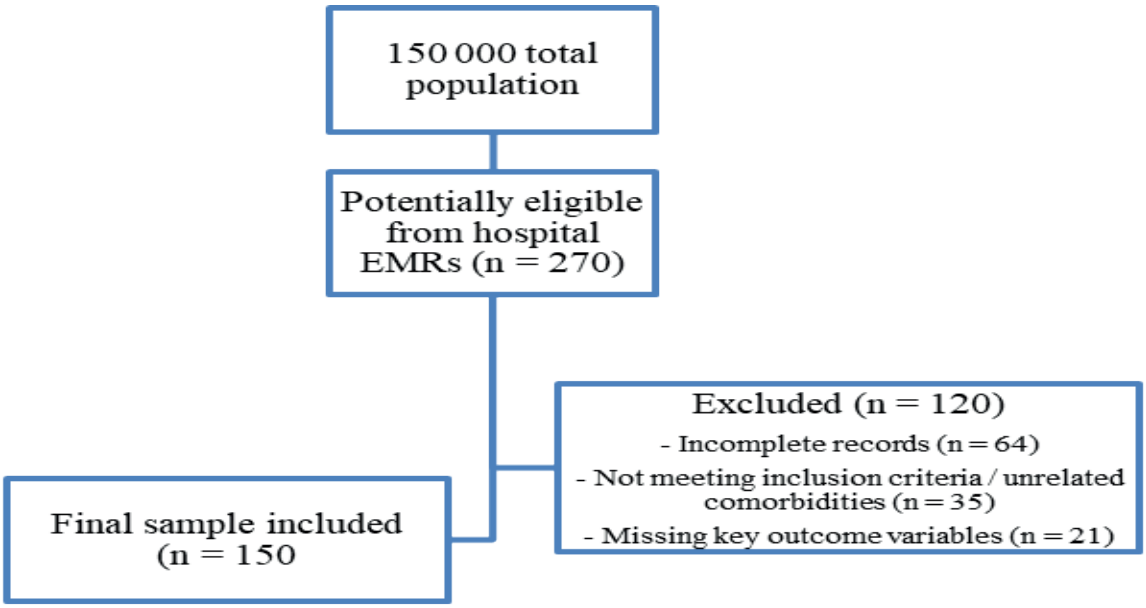

Figure 1 Random sampling of participants

Health Continuum-Short Form (MHC-SF) to evaluate depressive episodes and post-stroke fatigue in Aktobe, Kazakhstan.

METHODOLOGY

This study was conducted in a multidisciplinary hospital in Aktobe, Kazakhstan, which includes a primary health care (PHC) department serving an urban population of approximately 150,000 residents. From February 2024 to July 2024, electronic medical records (EMRs) of 270 patients with a history of ischemic or hemorrhagic stroke were screened for eligibility. Of these, 120 were excluded due to incomplete records (n = 64), not meeting inclusion criteria or having unrelated comorbidities (n = 35), or missing key outcome variables (n = 21). The final sample included 150 patients (Figure 1).

After obtaining informed consent, demographic and clinical data were collected, including age, sex, education level, smoking and alcohol habits, presence of diabetes, heart disease, blood pressure levels, stroke type, and lesion location. Data collection was conducted in a designated office within the PHC department. Assessments of fatigue, depression, and psychological well-being were carried out using the Beck Depression Inventory (BDI), the Fatigue Assessment Scale (FAS), and the Mental Health Continuum–Short Form (MHC-SF).

Study Design and Participants

This cross-sectional study included patients who had been previously hospitalized in the same facility due to a first or recurrent ischemic or hemorrhagic stroke and were subsequently followed up at the PHC level. Patients were included who had experienced their first or recurrent ischemic or hemorrhagic stroke, were aged ≥18 years, and had cognitive impairments with MoCA scores ≤ 22 (mild cognitive impairment).

Exclusion criteria were

- Severe aphasia or dysarthria, or severe cognitive impairments that could prevent questionnaire completion
- Patients who were medically unstable and/or deemed too critically ill to participate.
- History of previous psychiatric or neurological disorders.Age <18 years.

Instruments

All patients were surveyed using structured questionnaires: the Beck Depression Inventory II (BDI-II) was used to identify depression, fatigue was assessed using the Fatigue Assessment Scale (FAS), and psychological well-being was measured using the Mental Health Continuum-Short Form (MHC-SF). All measurements for each participant were completed on the same day.

Depression Assessment (BDI-II)

Depression was assessed using the Beck Depression Inventory (BDI), a 21-item self-report measure that evaluates the severity of depressive symptoms on a 0–3 scale, with total scores ranging from 0 to 63. Severity classification: mild (14–19 points), moderate (20–28 points), and severe (29–63 points).Importantly, the BDI-II has been validated in stroke populations and is recommended for screening post-stroke depression[19]

Fatigue Assessment (FAS)

Fatigue was measured using the Fatigue Assessment Scale (FAS), a 10-item questionnaire developed by Michielsen et al., designed to assess both physical and mental aspects of fatigue. Responses are rated on a 5-point Likert scale, and a total score of ≥22 indicates clinically significant fatigue. The FAS has been validated for use in stroke patients and is considered reliable for detecting post-stroke fatigue[20,21].

Mental Health Continuum-Short Form (MHC-SF)

The Mental Health Continuum–Short Form (MHC-SF) was used to measure emotional, social, and psychological well-being. Although the MHC-SF provides detailed scoring ranges (very high, above average, slightly above/below average, very low), for analytic purposes we categorized participants into three groups: **languishing (≤23), moderate (24–48), and flourishing (≥49)**. This classification is consistent with prior literature and allows comparison across groups in our sample.[22]

Statistical Data Analysis

Analyses were performed using SPSS version 26.0. Descriptive statistics summarized demographic and clinical characteristics. Group comparisons between

first-ever and recurrent stroke survivors used chi-square tests for categorical variables and t-tests for continuous variables.Logistic regression models were constructed separately for three outcomes: depression, fatigue, and well-being. Results were expressed as adjusted odds ratios (AOR) with 95% confidence intervals (CI).Spearman's correlation was applied to examine associations between depression (BDI-II), fatigue (FAS), and mental well-being (MHC-SF). A two-sided p-value <0.05 was considered statistically significant.

Ethical Clearence:s Statement

Ethical approval for this study was granted by the Local Ethics Committee (LEC) of Marat Ospanov West Kazakhstan Medical University on December 21, 2023 (Approval No. 23). The study utilized a cross-sectional design (retrospective) based on fully anonymized patient records, and the LEC waived the requirement for informed consent due to the de - identified nature of the data.

RESULTS

A total of 150 stroke survivors were included in the study (Table 1). The mean age was 60.5 years (SD = 9.2), ranging from 38 to 79 years, and the majority were women (58.7%). Most patients (55.3%) had ischemic strokes, followed by transient ischemic attack (34.7%), hemorrhagic stroke (9.3%), and subarachnoid hemorrhage (0.7%). First-ever strokes accounted for 84.6% of cases, while 15.4% were recurrent events.

Arterial hypertension was highly prevalent (98.7%), and 24.0% of patients had diabetes mellitus. With respect to behavioral risk factors, 40.6% were current or past smokers, and 26.7% reported current or previous alcohol use.

Depressive symptoms were present in more than half of the sample, with 31.3% showing moderate and 23.4% severe symptoms on the BDI. Recurrent stroke survivors had significantly higher rates of severe depression compared to first-ever stroke patients (47.8% vs. 18.9%, p = 0.003). Fatigue was reported by 54.7% of participants, but differences between first and recurrent stroke groups were not significant (p = 0.846). Regarding mental well-being, 10.7% were categorized as languishing, 62.7% as moderate, and 26.6% as flourishing, with no group differences (p = 0.928).

Table 1. Whole sample clinical and demographic characteristics and bivariable associations with stroke status

Independent Variable/ Covariates	Whole Sample (N = 150)	Stroke Status		*P* Value[1]
		First Event (84.6%)	Recurrent Event (15.4%)	
	n(Column %)			
Depression				0.003
None/Mild	68 (45.3)	62 (48.8)	6 (26.1)	
Moderate	47 (31.3)	41 (32.3)	6 (26.1)	
Severe	35 (23.4)	24 (18.9)	11 (47.8)	
Fatigue				0.85
No	68 (45.3)	58 (45.7)	10 (43.5)	
Yes	82 (54.7)	69 (54.3)	13 (56.5)	
Mental well-being				0.93
Languishing (≤ 23)	16 (10.7)	12 (9.5)	4 (17.4)	
Moderate (24–48)	94 (62.7)	80 (63.0)	14 (60.9)	
Flourishing (≥ 49)	40 (26.6)	35 (27.6)	5 (21.7)	
Age, mean (sd)	60.5 (9.2)	59.7 (9.7)	64.4 (6.8)	0.03
Sex				0.82
Female	88 (58.7)	75 (59.1)	13 (56.5)	
Male	62 (41.3)	52 (40.9)	10 (43.5)	
Smoking status				0.48
Non smoker	89 (59.3)	72 (56.7)	17 (73.9)	
Current smoker	35 (23.3)	33 (26.0)	2 (8.7)	
Past smoker	26 (17.3)	22 (17.3)	4 (17.4)	
Alcohol				0.38
Does not use	110 (73.3)	90 (70.9)	20 (87.0)	
Current user	24 (16.0)	24 (18.9)	0 (0.0)	
Previous use	16 (10.7)	13 (10.2)	3 (13.0)	
Arterial hypertension				0.55
Yes	148 (98.7)	125 (98.4)	23 (100.0)	
No	2 (1.3)	2 (1.6)	0 (0.0)	
Diabetes mellitus				0.191
Yes	36 (24.0)	28 (22.0)	8 (34.8)	
No	114 (76.0)	99 (78.0)	15 (65.2)	

[1]Significance derived from Chi-square tests for covariates measured on a categorical scale and t-tests for covariates measured on a continuous scale.

Multivariable logistic regression analyses are presented in Table 2. Recurrent stroke was independently associated with higher odds of depression (AOR = 0.30; 95% CI: 0.13–0.72), even after adjusting for age, sex, and other risk factors. Older age was also associated with increased odds of depression (AOR = 1.05; 95% CI: 1.01–1.09).

In contrast, stroke status was not associated with fatigue (AOR = 1.03; 95% CI: 0.39–2.70) or well-being (AOR = 1.08; 95% CI: 0.45–2.56). Diabetes mellitus showed borderline associations with worse fatigue (AOR = 0.43; 95% CI: 0.19–1.00) and higher odds of poor well-being (AOR = 1.95; 95% CI: 0.92–4.13). No other covariates demonstrated significant associations in the models.

Table 2. Multivariable associations between stroke status and depression, fatigue, and well-being[1]

Independent Variable/ Covariates	Depression	Fatigue	Well-being
	AOR (95% CI)[2]	AOR (95% CI)[2]	AOR (95% CI)[2]
Stroke status			
First event	Reference	Reference	Reference
Recurrent event	0.30 (0.13–0.72)	1.03 (0.39–2.70)	1.08 (0.45–2.56)
Age, mean (sd)	1.05 (1.01–1.09)	0.99 (0.95–1.03)	0.97 (0.93–1.00)
Sex			
Female	Reference	Reference	Reference
Male	0.62 (0.27–1.42)	1.56 (0.61–3.97)	1.04 (0.46–2.37)
Smoking status			
Non smoker	Reference	Reference	Reference
Current smoker	1.10 (0.66–1.84)	0.68 (0.38–1.22)	0.76 (0.47–1.22)
Past smoker	0.77 (0.34–1.74)	0.56 (0.24–1.31)	0.95 (0.46–1.98)
Alcohol			
Does not use	Reference	Reference	Reference
Current user	1.01 (0.59–1.73)	1.79 (0.97–3.30)	0.68 (0.41–1.12)
Previous use	0.69 (0.28–1.72)	0.46 (0.17–1.22)	0.61 (0.28–1.35)
Arterial hypertension			
No	Reference	Reference	Reference
Yes	1.25 (0.11–14.43)	0.54 (0.05–5.89)	0.73 (0.03–17.64)
Diabetes mellitus			
No	Reference	Reference	Reference
Yes	1.64(0.77–3.49)	0.43 (0.19–1.00)	1.95 (0.92–4.13)

[1]Associated data represents three different models for each of the three dependent variables.

[2] AOR = djusted odds ratio; CI = confidence interval

The figure 2 above presents a comparative analysis of mean scores on the FAS and BDI scales based on stroke type (first-ever vs. recurrent). On the left, it shows that the average fatigue level (FAS) was slightly higher among patients with recurrent stroke (24.74) compared to those with first-ever stroke (23.43); however, this difference was not statistically significant (p = 0.464). On the right, a comparison of depression scores (BDI) indicates that patients with recurrent stroke had significantly higher values (15.00 vs. 9.97, p = 0.001), suggesting more pronounced depressive symptoms in this group.

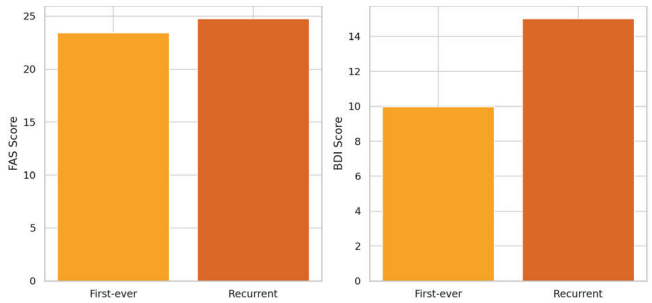

Figure 2. FAS Score and BDI Score by Stroke History

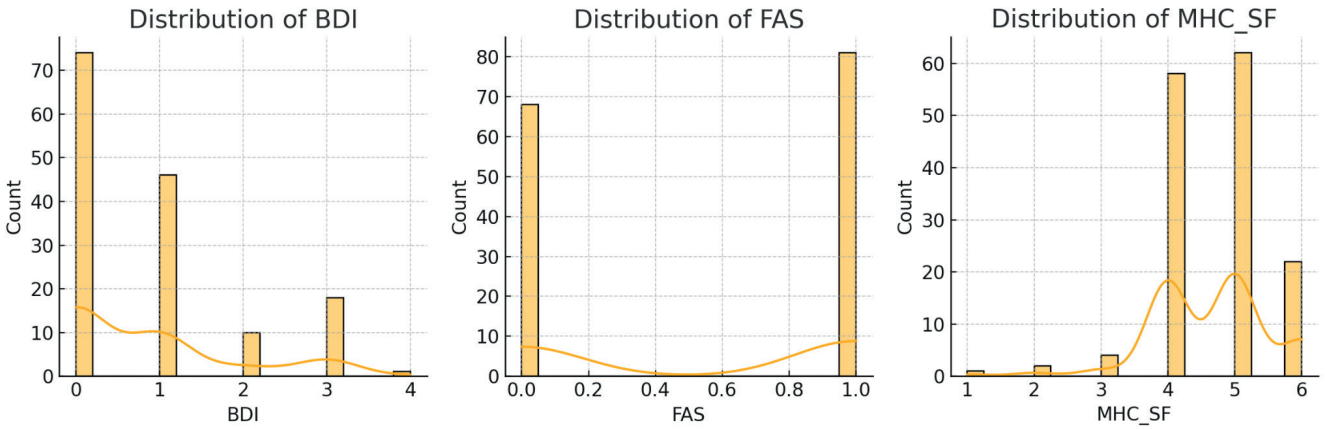

Figure 3. Spearman Correlation Between BDI, FAS, and MHC-SF

The relationships between the FAS fatigue scale, the MHC-SF psychological well-being scale and the Beck scale were assessed. The results are presented as correlation coefficients: the Beck scale and the psychological well-being scale (MHC-SF) correlate positively (r = 0.579, indicating a significant relationship between low levels of depression (according to the Beck scale) and high levels of psychological well-being, the Beck scale and the FAS fatigue scale correlate negatively (r = -0.375), indicating that higher levels of depression are associated with increased levels of fatigue, the FAS fatigue scale and the psychological well-being scale (MHC-SF) correlate negatively (r = -0.192), indicating that high levels of fatigue are associated with lower levels of psychological well-being.

DISCUSSION

This study provides new insights into the psychological outcomes of stroke survivors in Kazakhstan by examining depression, fatigue, and psychological well-being using validated instruments (BDI-II, FAS, MHC-SF). Our findings align with the growing global evidence on the burden of post-stroke depression and fatigue, highlighting the need for their systematic assessment and management in rehabilitation care[23].

One of the significant baseline differences between groups was age: patients with recurrent stroke were significantly older than those experiencing a first-ever stroke (64.4 vs. 59.7 years; p = 0.03). This finding is consistent with the well-established relationship between aging and vascular risk accumulation, which increases susceptibility to recurrent cerebrovascular events[2,3]. Older age has also been linked to higher vulnerability to depressive symptoms post-stroke due to multimorbidity, neuroinflammation, and reduced physiological resilience[19,24].

A major finding of the study was that survivors of recurrent strokes exhibited significantly higher levels of depressive symptoms compared to those experiencing their first stroke. In our sample, nearly half of the recurrent stroke patients were classified as having severe depression, whereas most first-ever stroke patients reported no or only mild symptoms (p = 0.003). Additionally, mean depression scores were notably higher among recurrent stroke cases (15.0 vs. 9.97; p = 0.001) [25][25].This pattern is consistent with prior studies reporting that recurrent stroke survivors are at elevated risk for major depressive disorder, often due to cumulative physical disability, reduced autonomy, and fear of future episodes[24,26]. The distribution of BDI-II categories in our sample supports this, with nearly half of recurrent stroke patients falling into the moderate or marked depression range, while over 50% of first-ever stroke survivors reported no depressive symptoms[27,28].

These findings are in line with the international literature. A meta-analysis by Hackett and Pickles (2014) found the prevalence of post-stroke depression to range between 29% and 36% in community-dwelling stroke survivors, with higher rates in those with prior stroke events[29]. The elevated depression burden in recurrent stroke survivors may also reflect limited psychosocial resources, more extensive neurological damage, and greater disruption of daily living[30].

In multivariable regression, recurrent stroke remained

an independent predictor of depressive symptoms (AOR = 0.30; 95% CI: 0.13–0.72), even after adjustment for demographic and clinical covariates. Increasing age also independently predicted depression (AOR = 1.05; 95% CI: 1.01–1.09). These findings highlight the dual importance of both stroke history and aging in shaping mental health trajectories after stroke, which is consistent with prior systematic reviews showing older age as a robust risk factor for post-stroke depression.

Fatigue was highly prevalent, reported by 54.7% of participants, but did not differ significantly between first-ever and recurrent stroke survivors (p = 0.846). This supports previous research indicating that post-stroke fatigue (PSF) is pervasive across stroke subtypes and severities[30]. Importantly, we found a significant positive correlation between depressive symptoms and fatigue (r = 0.45), confirming earlier reports that depression is one of the most consistent predictors of PSF[31,32]. This finding emphasizes the bidirectional relationship between mood and energy regulation in stroke recovery.

Our data showed that fatigue was prevalent in both groups, affecting more than half of all patients. Although recurrent stroke patients had slightly higher mean FAS scores (24.74 vs. 23.43), the difference was not statistically significant. This result aligns with previous reports suggesting that post-stroke fatigue (PSF) is a pervasive condition regardless of stroke type or severity[31]. Studies indicate that PSF is multifactorial, involving physical, cognitive, emotional, and biological dimensions[32]. In our study, the presence of fatigue was significantly correlated with depressive symptoms (r = 0.45), confirming earlier findings that depression is one of the most consistent predictors of PSF [33]

Unlike depression and fatigue, the psychological well-being of stroke survivors as assessed by the MHC-SF did not significantly differ between first-ever and recurrent stroke patients. Most participants in both groups reported average to high levels of well-being. This could reflect the adaptation and resilience of many patients over time, as well as the role of social and familial support [8]. However, the observed negative correlation between well-being and both fatigue (r = –0.19) and depression (r = –0.35) highlights the interconnectedness of psychological domains in stroke recovery[34].

It is notable that, despite the prevalence of depression and fatigue, many patients still reported relatively preserved mental well-being. This underscores the importance of adopting a multidimensional approach to recovery that supports not only symptom reduction but also positive psychological functioning[35].

Our results underscore the critical need for integrated post-stroke rehabilitation strategies in Kazakhstan that address not only physical but also emotional and mental health. Screening for depressive symptoms and fatigue should be incorporated into routine clinical practice. Moreover, psychological interventions such as cognitive-behavioral therapy (CBT), fatigue management training, and psychoeducation could help mitigate these burdens and improve outcomes[35,36].

Given the strong association between recurrent strokes and depression, patients with a history of stroke should receive early psychological support and long-term monitoring.

Strengths and limitations

This study has several limitations. First, the cross-sectional design prevents causal inference. Second, the relatively small number of recurrent stroke survivors (n = 23) reduces statistical power in subgroup analyses. Third, the use of self-reported measures introduces the possibility of recall bias and reduced validity in patients with cognitive impairment.

Despite these limitations, our study has notable strengths. It is the first, to our knowledge, to simultaneously examine depression, fatigue, and well-being in Kazakhstani stroke survivors using validated international instruments (BDI-II, FAS, MHC-SF). The use of standardized tools and multivariable models enhances the reliability of our findings. Moreover, the convergence of results across bivariate and multivariable analyses strengthens confidence in the observed associations. These strengths highlight the novelty and value of our study for understanding the psychological dimensions of stroke recovery in Central Asia.

CONCLUSIONS

In conclusion, this study highlights the considerable psychological burden faced by stroke survivors in Kazakhstan. Depression was significantly more common among those with recurrent strokes, while fatigue affected large percent of patients regardless of stroke history. Mental well-being was moderately preserved, although it was inversely correlated with fatigue and depression. These findings support the need

for integrated, mental health-focused rehabilitation services to improve quality of life and functional outcomes in post-stroke populations.

Source of fund: (if any). No Funding

Conflict of Interest: The authors declare no conflict of interest.

Ethical clearence: This study was conducted in accordance with ethical standards. Ethical approval was obtained from the appropriate institutional review board, and informed consent was secured from all participants prior to data collection.

Source of fund: (if any)

Conflict of Interest

Ethical clearence

Authors's contribution

Data gathering and idea owner of this study: Aigul Yermagambetova, Assel D. Sadykova

Study design: Karlygash N. Tazhibayeva, Askar Aidarov

Data gathering: Ariel Shensa, Faina Linkov

Writing and submitting manuscript: Zhanar Zhagiparova, Lazzat Zhamaliyeva

Editing and approval of final draft: Akgul Baizullina, Zinat Abdrakhmanova

REFERENCES

1. W. 1. Johnson, O. Onuma, M. Owolabi, and S. Sachdev, "Stroke: a global response is n eeded," Bull. *World Health Organ*. Sept. 2016;**94**(, no. 9):, pp. 634-634A, Sept. 2016, doi: 10.2471/BLT.16.181636.
2. V. L. Feigin, B. Norrving, and G. A. Mensah, "Global Burden of Stroke," Circulation Research, Feb. 2017;**120**(, no. 3):, pp. 439–448, Feb. 2017, doi: 10.1161/CIRCRESAHA.116.308413.
3. G. J. Hankey, "Stroke," *The Lancet*, Feb. 2017;**389** (no. 10069):, pp. 641–654, Feb. 2017, doi: 10.1016/S0140-6736(16)30962-X.
4. A. Sadykova et al., "Metabolic syndrome and its components in southern Kazakhstan: a cross-sectional study," *International Health*, July 2018;**10**(, no. 4):, pp. 268–276, July 2018, doi: 10.1093/inthealth/ihy027.
5. Y. Turana et al., "Hypertension and stroke in Asia: A comprehensive review from HOPE Asia," *J of Clinical Hypertension, Mar*. 2021;**23:**, no. 3, pp. 513–521, Mar. 2021, doi: 10.1111/jch.14099.
6. G. Zhakhina et al., "Incidence and mortality rates of strokes in Kazakhstan in 2014–2019," *Sci Rep*, vol. Sept. 2022;**12**(, no. 1):, p. 16041, Sept. 2022, doi: 10.1038/s41598-022-20302-8.
7. S. Kulbayeva et al., "The Recent Advances of Mobile Healthcare in Cardiology Practice," *Acta Inform Med*, 2022;**30**(,no. 3):, p. 236, 2022, doi: 10.5455/aim.2022.30.236-250.
8. F. Iskakova et al., "The Impact of COVID-19 on Education: A Cross-Sectional Study of Distance Learning among Medical Students," *MJIRI,* Oct. 2023, doi: 10.47176/mjiri.37.112.
9. G. Zhakhina et al., "Incidence and mortality rates of strokes in Kazakhstan in 2014–2019," *Sci Rep*,**12**(, no. 1):, p. 16041, Sept. 2022, doi: 10.1038/s41598-022-20302-8.
10. T. B. Cummi2019;ng, M. Packer, S. F. Kramer, and C. English, "The prevalence of fatigue after stroke: A systematic review and meta-analysis," *International Journal of Stroke*, Dec. 2016;**11**:, no. 9, pp. 968–977, Dec. 2016, doi: 10.1177/1747493016669861.
11. S. Choi-Kwon, S. W. Han, S. U. Kwon, and J. S. Kim, "Poststroke Fatigue: Characteristics and Related Factors," Cerebrovasc Dis, vol. 19, no. 2, pp. 84–90, 2005, doi: 10.1159/000082784.
12. L. Snaphaan, S. Van Der Werf, and F.-E. De Leeuw, "Time course and risk factors of post-stroke fatigue: a prospective cohort study: Time course for post-stroke fatigue," *European Journal of Neurology*, Apr. 2011;**18**:, no. 4, pp. 611–617, Apr. 2011, doi: 10.1111/j.1468-1331.2010.03217.x.

13. A. D. Sadykova et al., "ASSESSMENT OF THE ROLE OF SELECTED COMORBIDITIES ON OVERALL -AND CARDIOVASCULAR MORTALITY IN SOUTHERN KAZAKHSTAN: A 12-YEARS FOLLOW-UP STUDY," Ekologiya cheloveka (*Human Ecology)*, vol. 23, no. 11, pp. 42–49, Nov. 2016;**23:**, doi: 10.33396/1728-0869-2016-11-42-49.

14. S. A. Joya, K. G. Medeubaevna, S. A. Dauletbayevna, T. K. Nartbayevna, B. E. Nurlanovich, and M. R. Abdurazakovna, "Liver manifestation associated with COVID-19 (Literature review)," July 2021, doi: 10.5281/ZENODO.5110307.

15. H. Yatsuya, A. R. Folsom, K. Yamagishi, K. E. North, F. L. Brancati, and J. Stevens, "Race- and Sex-Specific Associations of Obesity Measures With Ischemic Stroke Incidence in the Atherosclerosis Risk in Communities (ARIC) Study," Stroke, Mar. 2010;**41**:, no. 3, pp. 417–425, Mar. 2010, doi: 10.1161/STROKEAHA.109.566299.

16. D. Christensen, S. P. Johnsen, T. Watt, I. Harder, M. Kirkevold, and G. Andersen, "Dimensions of Post-Stroke Fatigue: *A Two-Year Follow-Up Study," Cerebrovasc Dis*, vol. 2008;**26**(no. 2):, pp. 134–141, 2008, doi: 10.1159/000139660.

17. V 17. . P. Schepers, A. M. Visser-Meily, M. Ketelaar, and E. Lindeman, "Poststroke Fatigue: Course and Its Relation to Personal and Stroke-Related Factors," *Archives of Physical Medicine and Rehabilitation*, 2006;**87**(no. 2):, pp. 184–188, Feb. 2006, doi: 10.1016/j.apmr.2005.10.005.

18. J. L. Ingles, G. A. Eskes, and S. J. Phillips, "Fatigue after stroke," *Archives of Physical Medicine and Rehabilitation*, Feb. 1999;**80** (no. 2):, pp. 173–178, Feb. 1999, doi: 10.1016/S0003-9993(99)90116-8.

19. M. L. Hackett, C. Yapa, V. Parag, and C. S. Anderson, "Frequency of Depression After Stroke: A Systematic Review of Observational Studies," *Stroke*, June 2005;**36** (no. 6):, pp. 1330–1340, June 2005, doi: 10.1161/01.STR.0000165928.19135.35.

20. H. Naess, L. Lunde, J. Brogger, and U. Waje-Andreassen, "Fatigue among stroke patients on 20. long-term follow-up. The Bergen Stroke Study," *Journal of the Neurological Sciences*, **312**:, no. 1–2, pp. 138–141, Jan. 2012, doi: 10.1016/j.jns.2011.08.002.

21. H. J. Michielsen, J. De Vries, and G. L. Van Heck, "Psychometric qualities of a brief self-rated fatigue measure," *Journal of Psychosomatic Research*, Apr. 2003;**54**, no.(4):, pp. 345–352, Apr. 2003, doi: 10.1016/S0022-3999(02)00392-6.

22. C. L. M. Keyes, "The Mental Health Continuum: From Languishing to Flourishing in Life," *Journal of Health and Social Behavior,* June 2002; **43**(, no. 2):, p. 207, June 2002, doi: 10.2307/3090197.

23. A. Sadykova et al., "Comparative analysis of clinical and anthropometric parameters depending on risk factors for cardiovascular disease in overweight individuals," *Bangladesh J Med Sci*, **24**(, no. 1):, pp. 119–135, Jan. 2025, doi: 10.3329/bjms.v24i1.78717.

24. L. Ayerbe, S. Ayis, C. D. A. Wolfe, and A. G. Rudd, "Natural history, predictors and outcomes of depression after stroke: systematic review and meta-analysis," *Br J Psychiatry*, **202** (, no. 1):, pp. 14–21, Jan. 2013, doi: 10.1192/bjp.bp.111.107664.

25. A. C. Akbulut et al., "Blood Coagulation and Beyond: Position Paper from the Fourth Maastricht Consensus Conference on Thrombosis," *Thromb Haemost*, Aug. 2023;**123**(, no. 08):, pp. 808–839, Aug. 2023, doi: 10.1055/a-2052-9175.

26. R. G. Robinson and R. E. Jorge, "*Post-Stroke Depression: A Review," AJP*, Mar. 2016;**173** (, no. 3):, pp. 221–231, Mar. 2016, doi: 10.1176/appi.ajp.2015.15030363.

27. K. Kemelbekov et al., "Comparative Results of Treatment and Complications: Pedea in Open Ductus Arteriosus in Premature Infants," *Journal of Cardiovascular Pharmacology*, Nov. 2021;**78**:, no. 5, pp. e722–e728, Nov. 2021, doi: 10.1097/FJC.0000000000001094.

28. O. S. Abdigapparkyzy et al., "Scientific Justification of A Personalized Approach To The Management of Patients with Terminal Renal Failure," *Bangladesh J Med Sci, v July* 2024;**23**(, no. 3):, pp. 851–863, July 2024, doi: 10.3329/bjms.v23i3.75119.

29. M. L. Hackett and K. Pickles, "Part I: Frequency of Depression after Stroke: An Updated Systematic Review and Meta-Analysis of Observational Studies," *International Journal of Stroke,* Dec. 2014;**9**(, no. 80:, pp. 1017–1025, Dec. 2014, doi: 10.1111/ijs.12357.

30. G. E. Mead et al., "Fatigue after Stroke: Baseline Predictors and Influence on Survival. Analysis of Data from UK Patients Recruited in the International Stroke Trial," *PLoS ONE,* Mar. 2011;**6**(, no. 3):, p. e16988, Mar. 2011, doi: 10.1371/journal.pone.0016988.

31. T. B. Cumming, M. Packer, S. F. Kramer, and C. English, "The prevalence of fatigue after stroke: A systematic review and meta-analysis*," International Journal of Stroke*, Dec. 201;**11**, no. 9, pp. 968–977, Dec. 2016, doi: 10.1177/1747493016669861.

32. M. H. De Groot, S. J. Phillips, and G. A. Eskes, "Fatigue associated with stroke and other neurologic conditions: implications for stroke rehabilitation11No commercial party having a direct financial interest in the results of the research supporting this article has or will confer a benefit upon the author(s) or upon any organization with which the author(s)

is/are associated.," *Archives of Physical Medicine and Rehabilitation*, Nov. 2003;**84**(, no. 11):1, pp. 1714–1720, Nov. 2003, doi: 10.1053/S0003-9993(03)00346-0.

33. V. P. Schepers, A. M. Visser-Meily, M. Ketelaar, and E. Lindeman, "Poststroke Fatigue: Course and Its Relation to Personal and Stroke-Related Factors," *Archives of Physical Medicine and Rehabilitation*, vol.Feb 2006;**87**:, no. 2, pp. 184–188, Feb. 2006, doi: 10.1016/j.apmr.2005.10.005.

34. F. J. Carod-Artal and J. A. Egido, "Quality of Life after Stroke: The Importance of a Good Recovery," *Cerebrovasc Dis,***27**:, no. Suppl. 1, pp. 204–214, 2009, doi: 10.1159/000200461.

35. I. I. Kneebone and N. B. Lincoln, "Psychological Problems after Stroke and Their Management: *State of Knowledge*," NM, **03**:, no. 01, pp. 83–89, 2012, doi: 10.4236/nm.2012.31013.

36. A. Lerdal et al., "Poststroke Fatigue—A Review," *Journal of Pain and Symptom Management*, vol. Dec. 2009; **38**:, no. 6, pp. 928–949, Dec. 2009, doi: 10.1016/j.jpainsymman.2009.04.028.

37. Zainulabid, U. A., Md Jalil, M. A., Jaafar, K. A., & Yunus, R. M. (2022). Resilience and Health-Related Quality of Life among Hepatitis C Patients in Pahang, Malaysia. *Bangladesh Journal of Medical Science*, 2020;**21**(1):, 165–170. https://doi.org/10.3329/bjms.v21i1.56344

38. Khanam, A., Akhtar, G., Rahman, M. A., & Chowdhury, N. N. (2022). Efficacy of Mometasone Furoate Nasal Spray with Oral Montelukast in the treatment of Otitis Media with Effusion with or without Adenoid Hypertrophy and Atopic diseases. *Bangladesh Journal of Medical Science*, 2020;**21**(4):, 836–841. https://doi.org/10.3329/bjms.v21i4.60282