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URDU VERSION OF STROKE IMPACT SCALE (PROXY VERSION), VALIDITY AND RELIABILITY STUDY

Original Research

Dania Junaid[1], Nafeesa Ishfaq[2], M Behzad Ali[3]*, Aqsa Lakhani[4], Iqra Khan[5], Zonera Khalid[6], Muhammad Waqas[7], Sana Muneeb[3]
[1]Kohat University of Science and Technology, Kohat, Pakistan.
[2]Khyber Medical University, Peshawar, Pakistan.
[3]Health Physio Clinic, Multan, Pakistan.
[4]Centre of Autism Training & Rehabilitation, Sindh, Pakistan.
[5]Mian Fazal Rehman Hospital, Multan, Pakistan.
[6]Bolan University of Medical and Health Sciences (BUMHS), Quetta, Pakistan; Sajid Hospital, Quetta, Pakistan.
[7]University of South Asia, Pakistan.
Corresponding Author: M Behzad Ali, Health Physio Clinic, Multan, Pakistan, behzadali3232@gmail.com
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ABSTRACT

Background: Disease-specific outcome measures are increasingly used in clinical and research settings to evaluate health-related quality of life in specific populations. The Stroke Impact Scale (SIS) is a widely recognized tool for assessing the impact of stroke on patients' daily functioning. Initially developed in English, the SIS has been translated into several languages worldwide. However, no validated Urdu version currently exists for use in Pakistan, where Urdu is the national language and stroke prevalence is steadily increasing.

Objective: To translate the Stroke Impact Scale (proxy version) into Urdu and to determine its validity and reliability among Pakistani stroke patients.

Methods: This descriptive tool translation study was conducted in two phases. In Phase 1, the SIS-proxy was forward-translated into Urdu and then back-translated into English, following the World Health Organization (WHO) translation and adaptation guidelines. Expert consensus was used to finalize the culturally adapted version. In Phase 2, psychometric testing was conducted on a sample of 200 stroke patients. Test-retest reliability was assessed by administering SIS-U twice to 50 participants with a 3-day interval. Construct validity was examined by correlating SIS-U with the Barthel Index. Internal consistency was determined using Cronbach's alpha, while exploratory factor analysis identified underlying domains based on Eigenvalues >1. Floor and ceiling effects were also evaluated.

Results: The Urdu version of SIS demonstrated excellent test-retest reliability with an ICC value of 0.892 and strong construct validity through a significant correlation with the Barthel Index ($r = 0.88$, $p = 0.000$). Internal consistency was high, with a Cronbach's alpha of 0.892. Factor analysis extracted seven components explaining 82.25% cumulative variance. No floor or ceiling effects were observed in the total score distribution.

Conclusion: The Urdu version of the Stroke Impact Scale (proxy) is a valid and reliable instrument for evaluating the impact of stroke on daily activities in Pakistani patients, and is recommended for use in both clinical and research settings.

Keywords: Activities of Daily Living, Psychometrics, Proxy, Reliability, Stroke, Stroke Rehabilitation, Validation Study.

INTRODUCTION

Non-communicable diseases (NCDs) represent a pressing global health crisis, accounting for approximately 63% of all deaths worldwide, with this burden projected to rise by 15% between 2010 and 2020 (1). Among these, stroke—a condition that can alter an individual's life within moments—is the second leading cause of death globally, surpassed only by ischemic heart disease (1,2). Defined by the World Health Organization in 1970 as a rapidly developing clinical event marked by focal or global neurological impairment lasting at least 24 hours or resulting in death, without any apparent cause other than vascular origin, stroke remains a critical focus for healthcare systems worldwide (3). It arises due to the disruption of blood flow to the brain caused either by a blockage, known as ischemic stroke, or by a rupture, termed hemorrhagic stroke—both leading to irreversible neuronal damage due to oxygen deprivation (4). Although ischemic stroke comprises the majority of cases, accounting for 80% of all incidents, hemorrhagic stroke—despite being less frequent—contributes to approximately 40% of all stroke-related mortalities, underscoring its severity (5). Transient ischemic attacks (TIAs), often referred to as "mini-strokes," are also significant as they precede full strokes in nearly 10% of cases within 90 days, serving as a clinical warning sign (6). The hallmark symptoms of stroke—including facial asymmetry, arm weakness, and speech disturbances—necessitate prompt neuroimaging via CT or MRI, with MRI providing superior early diagnostic accuracy (7). The widespread impact of stroke is reflected in its ranking as the third leading cause of disability and the second leading cause of death worldwide, accounting for over 113 million Disability Adjusted Life Years (DALYs) (8). Projections suggest that the global incidence of stroke may rise to 23 million annually by 2030 (9). Regional statistics further demonstrate the extensive burden, with Europe reporting 1.1 million stroke deaths annually and over a million survivors in the UK alone (10). The United States anticipates that by 2030, nearly 4% of its population will be affected by stroke, contributing to an annual economic cost exceeding $72 billion (11). Notably, sex-based disparities exist, as women appear to suffer more severe strokes, with a 25.5% mortality rate compared to 20.2% in men, possibly due to hormonal, physiological, and behavioral differences (12).

Stroke prevalence is rising in low- and middle-income countries as well. A 2013 national health survey in Brazil reported that over 22 million individuals had experienced a stroke, with Brazil also exhibiting the highest stroke mortality rate in South America (13). In Canada, the prevalence reached 405,000 individuals in 2013 (13). The risk of stroke increases significantly with age, doubling every decade after the age of 55 (14). In developed countries, it most commonly affects those between 70 and 75 years of age (3). A study in Singapore reported a stroke prevalence of 7.6% among individuals aged 60 and above (7,8). While age and gender remain unmodifiable risk factors, the most important modifiable contributors to stroke are hypertension and diabetes. In the United States, approximately 75 million individuals are hypertensive (3,4), while in Pakistan, the prevalence is as high as 33%, the highest in South Asia (9). Hypertension contributes to both ischemic and hemorrhagic strokes by inducing structural and functional changes in cerebral vasculature (3). Similarly, diabetes is a major stroke risk factor, conferring a 23% higher risk in diabetics compared to non-diabetics, with insulin resistance playing a key role in ischemic events (4). Alarmingly, Pakistan ranks sixth globally in diabetes prevalence, with an estimated 9–10% of the population affected (12). Many individuals remain undiagnosed or do not adhere to follow-up care due to limited awareness and healthcare accessibility (4). The consequences of stroke extend far beyond physical health, disrupting daily life and placing immense psychological, social, and economic burdens on individuals and families alike (11). Stroke survivors often experience a profound decline in quality of life (QOL), not only due to impaired mobility but also owing to changes in cognition, mood, self-perception, and social interaction (2,10). As a result, comprehensive post-stroke evaluations must consider all aspects of recovery, not merely physical independence. Given this alarming epidemiological trajectory, there is a critical need to investigate the modifiable risk factors contributing to stroke within vulnerable populations. This study therefore aims to rationally explore the prevalence and impact of key risk factors—particularly hypertension and diabetes—among individuals affected by stroke, in order to inform preventive strategies and optimize early intervention.

METHODS

This study employed a descriptive cross-sectional design with a psychometric analysis component to evaluate the validity and reliability of the Urdu version of the Stroke Impact Scale (SIS-U) through translation and cultural adaptation. Following formal approval from the original developer of the SIS, the translation process was conducted in accordance with World Health Organization (WHO) guidelines.

This multistep procedure included forward translation, expert panel review, back-translation, cognitive debriefing, and pretesting to ensure conceptual and linguistic equivalence for the Urdu-speaking population. A total of 200 stroke patients were recruited using a convenience sampling technique. Participants included adult patients diagnosed with either ischemic or hemorrhagic stroke, who were clinically stable and capable of providing informed consent or whose proxies could participate on their behalf. Patients with pre-existing severe cognitive impairment, significant psychiatric disorders, or communication limitations that could interfere with the assessment process were excluded. Ethical approval for the study was obtained from the institutional review board, and written informed consent was secured from all participants or their legal representatives prior to data collection (3,7).

Demographic and clinical data, including age, gender, type and side of stroke, were recorded. Functional outcomes were assessed using both the SIS-U (for proxy assessment) and the Barthel Index. Data analysis was conducted using SPSS version 20. For internal consistency, Cronbach's alpha was calculated for each domain of the SIS-U, with values ≥0.70 considered acceptable. Test-retest reliability was assessed using the intraclass correlation coefficient (ICC), along with 95% confidence intervals, to measure the temporal stability of the tool. A subset of participants from the total sample was used for test-retest reliability evaluation, although the specific number was not detailed, which may affect interpretability. Construct validity was assessed by evaluating Spearman's correlation coefficients between the SIS-U and the Barthel Index, expecting a positive correlation across functionally related domains. Content validity was assured during the expert review phase of translation. The floor and ceiling effects were determined by identifying the proportion of participants scoring the lowest or highest possible scores in SIS-U domains, with less than 15% considered acceptable, indicating adequate scale responsiveness. For factor analysis, sample adequacy was tested using the Kaiser-Meyer-Olkin (KMO) measure, and Bartlett's test of sphericity was used to confirm the suitability of data for exploratory factor analysis. Factors were extracted based on Eigenvalues greater than one, consistent with established psychometric thresholds.

RESULTS

The study was conducted on a sample of 200 stroke patients with a mean age of 65.8 years (±11). Female participants slightly outnumbered males, comprising 52.2% (n=105) of the sample compared to 47.3% males (n=95). The majority of patients (81.6%) experienced ischemic strokes (n=164), while the remaining 17.9% (n=36) had hemorrhagic strokes. Left-sided stroke was more prevalent (58.2%, n=117) compared to right-sided (41.3%, n=83). Test-retest reliability of the SIS-U was evaluated in 50 participants who completed the assessment twice, with a 3-day interval between sessions. Pearson correlation coefficient for the overall SIS-U score between the two assessments was +0.99, reflecting a very strong correlation, while the ICC value was 0.892, indicating excellent reliability (p=0.000). Domain-wise test-retest reliability coefficients were also high, ranging from 0.81 to 0.99 across all domains: strength (0.97), cognition (0.99), emotions (0.98), communication (0.98), ADLs (0.99), mobility (0.95), hand function (0.81), and social participation (0.99), all statistically significant at p=0.000. Internal consistency of the SIS-U across its eight domains yielded a Cronbach's alpha of 0.892, confirming excellent internal reliability. Descriptive statistics further supported this consistency, with item-total correlations ranging from 0.71 to 0.88 for most domains. Notably, the item-total correlation for the social participation domain was substantially lower at 0.071, indicating possible limitations in internal alignment for this particular domain.

The floor and ceiling effects were assessed by dividing total SIS scores (range 1–295) into five quartiles. No participants were found in the lowest quartile (1–59), and only 13.9% (n=28) scored in the highest range (237–295), indicating no significant floor or ceiling effect. The majority of participants (40.8%, n=82) fell within the mid-range quartile (119–177), reflecting moderate functional impact and supporting the tool's ability to capture a broad range of functional outcomes. Inter-item correlation analysis revealed significant positive relationships among all domains, with correlation coefficients ranging from mild to moderate. Exceptions were noted for the social participation domain, which showed no significant correlations with other domains, despite reaching statistical significance (p=0.000), suggesting a potential issue in construct integration. Construct validity was confirmed through a strong positive Spearman correlation (r = 0.88, p = 0.000) between the SIS-U and the Barthel Index, indicating that SIS-U reliably aligns with established measures of functional independence. Content validity, evaluated via expert ratings, yielded a content validity index (CVI) of 0.83, demonstrating satisfactory content adequacy, supported by an item agreement score of 49 out of 6 raters and an average S-CVI of 0.96. Factor analysis confirmed sampling adequacy with a KMO value of 0.94 and a highly significant Bartlett's test (χ^2 = 18291.8, df = 1711, p < 0.001). Seven factors were extracted with Eigenvalues >1, explaining a cumulative variance of 82.25%. The first component accounted for 53.04% of the total variance, followed by 11.83%, 5.79%, 4.29%, 3.09%, 2.46%, and 1.75% by the subsequent components. Factor loadings showed clear alignment of items within specific components, with coefficients ≥0.30 used as a threshold for component assignment.

Table 1: Age Mean, SD, Frequencies

Variable	Mean ±SD
Age	65.8 ±11
Variables	Frequency
GENDER	
Male	95(47.3%)
Female	105(52.2%)
STROKE TYPE	
Ischemic	164(81.6%)
Hemorrhagic	36(17.9%)
SIDE OF STROKE	
Left	117(58.2%)
Right	**83(41.3%)**

Table 2: Test Re-Test Coefficient of Urdu Version of SIS-3

	ICC	Pearson's correlation (r)	p-value
1st assessment	0.892	0.99	0.000
2nd assessment			

Table 3: Psychometric Properties of SIS-U Domains and Cronbach's Alpha

Domains 1st and 2nd assessment	Mean	Standard Deviation	Range	Item-Total Correlation	Pearson's r (Test-Retest)	p-Value
Strength	10.5	4.24	16	0.88	0.97	0
Cognition	22.6	8.6	28	0.8	0.99	0
Emotions	28.6	7.27	33	0.71	0.98	0
Communication	23.3	8.66	28	0.79	0.98	0
ADLs	24.8	11.24	40	0.87	0.99	0
Mobility	22.8	10.85	36	0.88	0.95	0
Hand function	11.3	6.07	20	0.764	0.81	0
Social participation	21.6	9.7	30	0.071	0.99	0
Total items				Cronbach's Alpha		
N=8				0.892		

Table 4: Floor and Ceiling Effect

Quartiles of total score of SIS	Frequency	Percentage
1 (score range from 1-59)	0	0%
2 (score range from 60-118)	44	21.9%
3 (score range from 119-177)	82	40.8%
4 (score range from 178-236)	46	22.9%
5 (score range from 237-295)	**28**	**13.9%**

Table 5: Inter-Item Correlation

SIS domains	Strength	Cognition	emotions	communication	ADLs	Mobility	Hand function	Social participation
Strength	rs =1	rs=0.71 p=0.0	rs=0.71 p=0.0	rs=0.73 p=0.0	rs=0.8 p=0.0	rs=0.85 p=0.0	rs=0.72 p=0.0	rs=0.11 p=0.0
Cognition	rs=0.73 p=0.0	rs=1 p=0.0	rs=0.73 p=0.0	rs=0.79 p=0.0	rs=0.72 p=0.0	rs=0.73 p=0.0	rs=0.51 p=0.0	rs=0.06 p=0.0
Emotions	rs=0.71 p=0.0	rs=0.73 p=0.0	rs=1 p=0.0	rs=0.58 p=0.0	rs=0.71 p=0.0	rs=0.72 p=0.0	rs=0.56 p=0.0	rs=0.04 p=0.0
Communication	rs=0.73 p=0.0	rs=0.79 p=0.0	rs=0.58 p=0.0	rs=1 p=0.0	rs=0.7 p=0.0	rs=0.75 p=0.0	rs=0.61 p=0.0	rs=0.11 p=0.0
ADLs	rs=0.84 p=0.0	rs=0.72 p=0.0	rs=0.71 p=0.0	rs=0.76 p=0.0	rs=1 p=0.0	rs=0.89 p=0.0	rs=0.84 p=0.0	rs=0.02 p=0.0
Mobility	rs=0.85 p=0.0	rs=0.85 p=0.0	rs=0.72 p=0.0	rs=0.75 p=0.0	rs=0.89 p=0.0	rs=1 p=0.0	rs=0.75 p=0.0	rs=0.08 p=0.0
Hand function	rs=0.72 p=0.0	rs=0.56 p=0.0	rs=0.56 p=0.0	rs=0.61 p=0.0	rs=0.84 p=0.0	rs=0.75 p=0.0	rs=1 p=0.0	rs=0.10 p=0.0
Social participation	**rs=0.11 p=0.0**	**rs=0.06 p=0.0**	**rs=0.04 p=0.0**	**rs=0.11 p=0.0**	**rs=0.02 p=0.0**	**rs=0.08 p=0.0**	**rs=0.10 p=0.0**	**rs=1 p=0.0**

Table 6: Summary of Construct Validity, Content Validity, and Sampling Adequacy

Measure		Statistical Value	p-Value	Interpretation
Barthel Index and SIS Correlation		Spearman’s r = 0.88	0.000	Strong correlation
Content Validity Index (CVI		S-CVI = 0.96; CVI = 0.83	N/A	Satisfactory content validity
No. of Rate = 5	Total item agreement = 49			
Sampling Adequacy (KMO)		KMO = 0.94	0.000	Excellent sampling adequacy

Table 7: Components of SIS and %age Variance

Components	Eigen value	%age of variance
1	31.2	53.04
2	6.9	11.83
3	3.4	5. 79
4	2.5	4.29
5	1.8	3.09
6	1.4	2.46
7	**1.03**	**1.75**

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Table 8: Factor Loading

Items	Factor loading	Component
SIS3	0.73	1
SIS4	0.71	1
SIS18	0.49	1
SIS32	0.65	1
SIS33	0.54	1
SIS34	0.55	1
SIS35	0.65	1
SIS36	0.73	1
SIS37	0.69	1
SIS39	0.69	1
SIS41	0.69	1
SIS42	0.74	1
SIS43	0.73	1
SIS44	0.76	1
SIS45	0.74	1
SIS46	0.8	1
SIS47	0.79	1
SIS48	0.77	1
SIS5	0.82	2
SIS6	0.84	2
SIS7	0.79	2
SIS8	0.8	2
SIS9	0.76	2
SIS10	0.78	2
SIS11	0.74	2
SIS12	0.61	2
SIS13	0.55	2
SIS38	0.56	2
SIS40	0.56	2
SIS1	0.57	3
SIS2	0.65	3
SIS28	0.74	3
SIS29	0.67	3
SIS30	0.56	3
SIS31	0.68	3
SIS49	0.73	3
SIS50	0.77	3
SIS51	0.81	3
SIS52	0.8	3

Items	Factor loading	Component
SIS53	0.73	3
SIS54	0.92	4
SIS55	0.92	4
SIS56	0.92	4
SIS57	0.91	4
SIS58	0.91	4
SIS59	0.93	4
SIS21	0.58	5
SIS22	0.62	5
SIS23	0.68	5
SIS24	0.64	5
SIS25	0.65	5
SIS26	0.66	5
SIS14	0.56	6
SIS15	0.58	6
SIS16	0.57	6
SIS27	0.56	6
SIS17	0.83	7
SIS19	0.76	7
SIS20	**0.79**	**7**

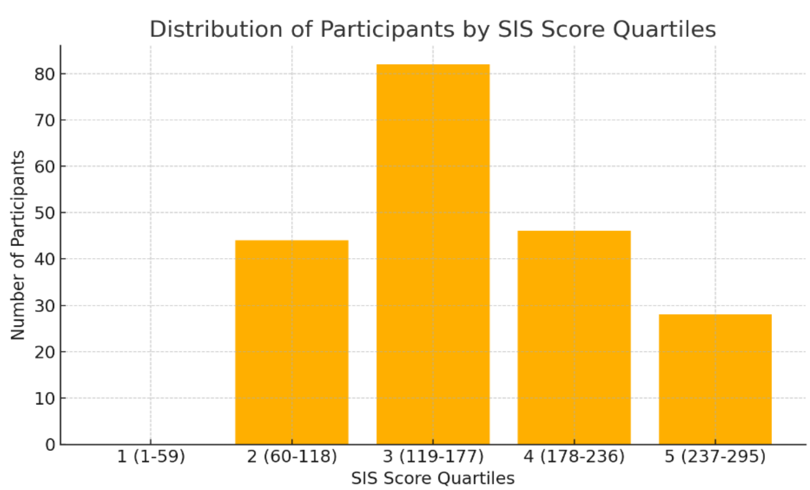

Figure 2 Distribution of Participants by SIS Score Quartiles

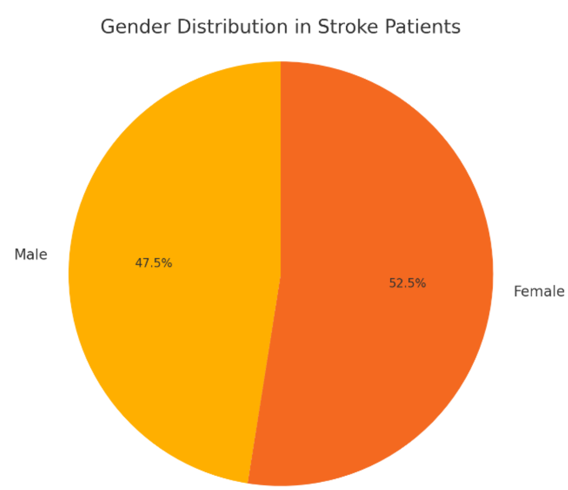

Figure 1 Gender Distribution in Stroke Patients

DISCUSSION

The present study was conducted to translate and culturally adapt the Stroke Impact Scale version 3 (SIS-3) for proxy use into the Urdu language and evaluate its psychometric properties in a clinical population of stroke patients. The findings demonstrated that the Urdu version (SIS-U) possessed robust validity and reliability, meeting the pre-established psychometric hypotheses and aligning well with the standards set by international adaptations of the scale (15,16). The translation process adhered rigorously to established World Health

Organization (WHO) protocols, ensuring semantic and conceptual equivalence through expert consensus and careful linguistic handling, which contributed to the clarity and usability of the final version in clinical settings. Test-retest reliability, a cornerstone of psychometric evaluation, was established with an ICC of 0.892, indicating excellent reliability across repeated assessments (17,18). The domain-specific test-retest reliability values, which ranged from 0.81 to 0.99, reflected high temporal stability and were consistent with or exceeded the benchmark value of 0.96 set during hypothesis formulation. Comparative analysis with other cultural versions revealed that the Korean, Brazilian, and Italian versions of SIS reported relatively lower reliability values for domains like social participation and mobility (19,20). These discrepancies may be attributed to differences in study populations, as prior studies were hospital-based whereas the current study focused on outpatient stroke survivors who likely presented with less acute impairment and more stable functional status at the time of assessment (21).

Internal consistency, evaluated using Cronbach's alpha, was found to be 0.892 for SIS-U, which indicates high inter-item correlation and scale coherence. This finding aligns with values reported for Korean, Brazilian, Italian, and Nigerian versions, all of which demonstrated Cronbach's alpha values exceeding 0.74 (22). The consistency of these results across diverse linguistic and cultural contexts supports the structural integrity of SIS-3 as a reliable multidimensional measure of stroke recovery. However, the domain of social participation in this study showed a relatively weak item-total correlation, suggesting potential variability in interpretive relevance or construct representation in the Urdu-speaking population. Future modifications may be considered to enhance its cultural sensitivity and measurement fidelity. Construct validity was demonstrated through strong positive correlation between SIS-U and the Barthel Index ($r = 0.88$, $p = 0.000$), confirming its concurrent validity as a functional outcome measure. This result is in agreement with findings from French and Korean versions, where similar correlations were reported between SIS physical domains and Barthel-related indices (23). This supports the argument that SIS-U effectively captures real-world functional limitations and performance in stroke survivors and can be integrated with established tools to provide a comprehensive clinical picture.

Exploratory factor analysis yielded seven components with Eigenvalues greater than one, explaining a cumulative variance of 82.25%. The strongest component accounted for over half of the total variance (53.04%). These results differ from earlier psychometric studies in which fewer components were extracted, such as one UK-based study where a single factor explained 68.76% of the variance and was used to generate a composite index (22). The multidimensional structure observed in the current analysis supports the domain-based approach of the SIS, emphasizing its utility in separately evaluating cognitive, emotional, and physical domains of post-stroke recovery. The absence of floor or ceiling effects in SIS-U further confirms that the tool has an appropriate range and sensitivity to detect subtle variations in patient-reported outcomes, unlike some previous studies which reported domain-specific floor or ceiling effects, particularly in cognition and social participation (24). The content validity index (CVI = 0.83) confirmed expert agreement on the relevance and appropriateness of the items in the Urdu context. This level of agreement supports the assertion that the SIS-U maintains the conceptual intent of the original scale. The cultural adaptation process appears to have preserved the integrity of the original items, while ensuring linguistic and contextual resonance.

A major strength of this study lies in its comprehensive psychometric assessment encompassing content validity, construct validity, internal consistency, and test-retest reliability. Additionally, the use of a representative outpatient stroke population enhances the external validity of the findings and reflects the tool's practical relevance in real-world rehabilitation settings. The rigorous adherence to standardized guidelines for translation and cultural adaptation further strengthens the methodological integrity. However, certain limitations merit consideration. The study was conducted in a single region, and results may not reflect broader national variations in language usage or healthcare access. Furthermore, while domain-wise psychometric properties were explored, subgroup analysis by stroke type, gender, or age was limited and should be expanded in future research to identify specific patient needs or biases in item performance. The lower inter-item correlation for social participation domain and its poor association with other domains indicate a potential need for cultural recalibration of this component. Future studies should explore the responsiveness of SIS-U to intervention over time and its predictive validity in longitudinal designs. Incorporating qualitative feedback from stroke survivors and caregivers could also enrich the cultural alignment of the tool. Moreover, evaluating SIS-U in inpatient, rural, and linguistically diverse populations within Pakistan would provide a more nuanced understanding of its broader applicability. In conclusion, the Urdu version of SIS-3 for proxy reporting demonstrated excellent psychometric performance and cultural relevance, making it a reliable and valid instrument for assessing post-stroke recovery in Urdu-speaking populations. Its multidimensional scope, linguistic accessibility, and clinical applicability position it as a valuable addition to stroke rehabilitation outcome assessment in low-resource settings.

CONCLUSION

The study concludes that the Urdu version of the Stroke Impact Scale (SIS) for proxy use is a valid and reliable instrument for assessing the impact of stroke on the lives of survivors. Through rigorous translation, cultural adaptation, and psychometric evaluation, the tool demonstrated strong measurement properties, making it suitable for both clinical practice and research settings. Its availability in Urdu enables healthcare providers and researchers to more accurately evaluate post-stroke recovery in native-speaking populations, thereby supporting targeted rehabilitation planning and outcome monitoring in culturally relevant contexts.

Author Contribution

Author	Contribution
Dania Junaid	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Nafeesa Ishfaq	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
M Behzad Ali*	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Aqsa Lakhani	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Iqra Khan	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Zonera Khalid	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published
Muhammad Waqas	Contributed to study concept and Data collection Has given Final Approval of the version to be published
Sana Muneeb	Writing - Review & Editing, Assistance with Data Curation

REFERENCES

1. Jones F, Gombert K, Honey S, Cloud G, Harris R, Macdonald A, et al. Addressing inactivity after stroke: The Collaborative Rehabilitation in Acute Stroke (CREATE) study. Int J Stroke. 2021;16(6):669-82.
2. Mulder M, Nikamp CD, Prinsen EC, Nijland RH, van Dorp M, Buurke J, et al. Allied rehabilitation using caregiver-mediated exercises combined with telerehabilitation for stroke (ARMed4Stroke): A randomised controlled trial. Clin Rehabil. 2024;38(10):1321-32.
3. Wang Y, Tyagi S, Hoenig H, Lee KE, Venketasubramanian N, Menon E, et al. Burden of informal care in stroke survivors and its determinants: a prospective observational study in an Asian setting. BMC Public Health. 2021;21(1):1945.
4. Murayama LHV, Filho PTH, Winckler FC, Meirelles HAA, Sampaio N, Moreira BZ, et al. Caregiver burden, hopelessness, and anxiety: Association between sociodemographic and clinical profiles of patients with stroke. J Stroke Cerebrovasc Dis. 2024;33(11):107905.

5. Kroll A, Karakiewicz B. Do caregivers' personality and emotional intelligence modify their perception of relationship and communication with people with aphasia? Int J Lang Commun Disord. 2020;55(5):661-77.
6. Pedapati R, Bhatia R, Shakywar M, Gupta A, Vishnubhatla S, Srivastava MVP, et al. Educating Caregivers to Reduce Complications and Improve Outcomes of Stroke Patients (ECCOS) - A Cluster-Randomized Trial. J Stroke Cerebrovasc Dis. 2021;30(9):105966.
7. Ding Y, Xu J, Liang QY, Zheng JQ, Wang F, Lin Y, et al. Effects of a nurse-led motor function rehabilitation training program for patients with ischemic stroke and family caregivers: study protocol for a randomized controlled trial. Trials. 2024;25(1):538.
8. Zachry AH, Williams L, Chen M, Surbhi S, Bailey J. Efficacy Studies of Home-Based Occupational Therapy Services Following Stroke: A Scoping Review. Occup Ther Health Care. 2024;38(2):254-75.
9. Khan MH, Smithson L, Li E, Kirton A, Pei J, Andersen J, et al. Executive behavior and functional abilities in children with perinatal stroke and the associated caregiver impact. Child Neuropsychol. 2021;27(1):83-95.
10. Seok Y, Lee MK. Health-related quality of life predictors for patients with stroke: A prospective longitudinal study of matched pairs of patients with stroke and family caregivers. J Clin Nurs. 2025;34(4):1277-92.
11. Li D, Guo H, Sun Y, Zhang Z, Liu H. Knowledge, attitude, and practice of stroke patients' family members towards stroke rehabilitation: A cross-sectional study. J Stroke Cerebrovasc Dis. 2025;34(2):108177.
12. Lapin BR, Thompson NR, Schuster A, Katzan IL. Magnitude and Variability of Stroke Patient-Proxy Disagreement Across Multiple Health Domains. Arch Phys Med Rehabil. 2021;102(3):440-7.
13. Pucciarelli G, Vellone E, Bolgeo T, Simeone S, Alvaro R, Lee CS, et al. Role of Spirituality on the Association Between Depression and Quality of Life in Stroke Survivor-Care Partner Dyads. Circ Cardiovasc Qual Outcomes. 2020;13(6):e006129.
14. Na Y, Htwe M, Rehman CA, Palmer T, Munshi S. Sexual dysfunction after stroke-A biopsychosocial perspective. Int J Clin Pract. 2020;74(7):e13496.
15. Sahbaz T, Medin-Ceylan C. Stroke severity to determine musculoskeletal symptoms in family caregivers. Rev Lat Am Enfermagem. 2023;31:e4004.
16. Rudberg AS, Berge E, Laska AC, Jutterström S, Näsman P, Sunnerhagen KS, et al. Stroke survivors' priorities for research related to life after stroke. Top Stroke Rehabil. 2021;28(2):153-8.
17. Maggio MG, Corallo F, De Francesco M, De Cola MC, De Luca R, Manuli A, et al. Understanding the family burden and caregiver role in stroke rehabilitation: insights from a retrospective study. Neurol Sci. 2024;45(11):5347-53.
18. Zawawi NSM, Aziz NA, Fisher R, Ahmad K, Walker MF. The Unmet Needs of Stroke Survivors and Stroke Caregivers: A Systematic Narrative Review. J Stroke Cerebrovasc Dis. 2020;29(8):104875.
19. Malik A, Khan MA, Zehra F, Wasay M, Khan RN. POTENTIAL RISK FACTORS OF STROKE: A COMMUNITY-BASED, CROSS-SECTIONAL STUDY FROM SINDH PROVINCE OF PAKISTAN. Khyber Medical University Journal. 2020;12(1):25-8.
20. Anwar A, Saleem S, Aamir A, Diwan M. Organization of stroke care in Pakistan. International Journal of Stroke. 2020;15(5):565-6.
21. Liu J, Shi Z, Bai R, Zheng J, Ma S, Wei J, et al. Temporal, geographical and demographic trends of stroke prevalence in China: a systematic review and meta- analysis. Annals of Translational Medicine. 2020;8(21).
22. King D, Wittenberg R, Patel A, Quayyum Z, Berdunov V, Knapp M. The future incidence, prevalence and costs of stroke in the UK. Age and ageing. 2020;49(2):277-82.
23. Byun E, Kohen R, Becker KJ, Kirkness CJ, Khot S, Mitchell PH. Stroke impact symptoms are associated with sleep-related impairment. Heart & Lung. 2020;49(2):117-22.
24. Sherin A, Ul-Haq Z, Fazid S, Shah BH, Khattak MI, Nabi F. Prevalence of stroke in Pakistan: Findings from Khyber Pakhtunkhwa integrated population health survey (KP-IPHS) 2016-17. Pakistan Journal of Medical Sciences. 2020;36(7):1435.

