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Evaluation of post-stroke complications and prevention measures among patients at kirkuk city hospitals: an observational cross-sectional study

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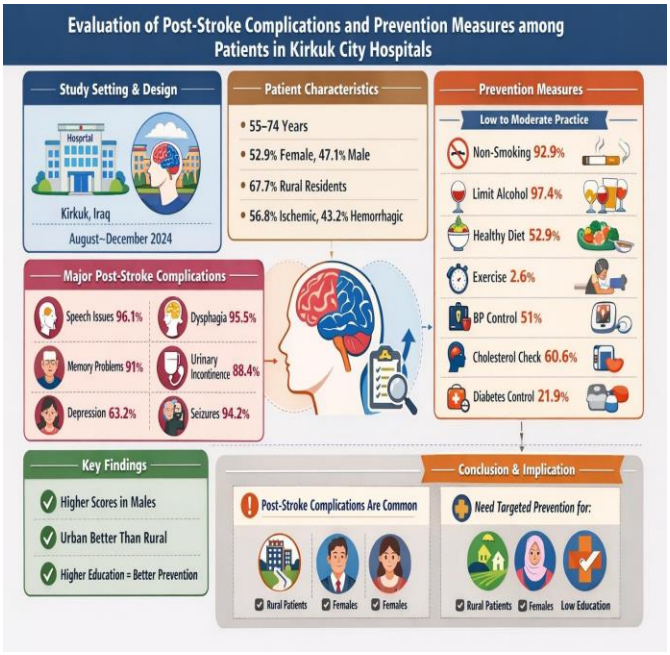
Abstract

Stroke is one of the leading causes of mortality and long-term disability worldwide, accounting for millions of new cases annually and representing a major global health burden. Post-stroke complications may significantly impede recovery and increase the risk of death. This study aimed to evaluate post-stroke complications and preventive measures among patients in hospitals in Kirkuk City. A descriptive cross-sectional study was conducted at Azadi Teaching Hospital in Kirkuk City. A total of 155 patients were randomly selected. Data were analyzed to assess differences in post-stroke complication prevention scores according to gender, residence, and educational level. The findings showed that prevention scores varied significantly by gender and area of residence. Male patients demonstrated higher average ranks compared to females. Similarly, urban participants achieved better preventive evaluation scores than rural patients. Educational level was also significantly associated with prevention measures. The study concluded that demographic factors influence post-stroke prevention outcomes. These findings highlight the importance of targeted educational and preventive strategies. Further large-scale cohort studies are recommended.

Keywords: Post-Stroke. Prevention Measures. Complications. Patients.

Graphical abstract



Source: Own authorship.

Introduction

Stroke remains one of the leading causes of mortality and long-term disability worldwide, accounting for millions of new cases annually and representing a major public health burden. Despite advances in acute stroke management and rehabilitation strategies in recent years, stroke continues to contribute significantly to morbidity, prolonged hospitalization, and healthcare costs globally **[1-3]**.

Post-stroke complications, including infections, neurological deterioration, edema, and functional impairments, substantially affect recovery outcomes. The severity of these complications depends on several factors, such as stroke type, lesion size, timing of treatment, age, and comorbidities. These complications may lead to long-term physical, cognitive, and psychological disabilities, ultimately reducing quality of life and increasing dependency **[4,5]**.

Although numerous international studies have examined post-stroke outcomes and preventive strategies, limited data are available regarding the evaluation of post-stroke complications and preventive measures among patients in Iraqi hospitals, particularly in Kirkuk City. Furthermore, few local studies have assessed the influence of demographic factors such as gender, residence, and educational level on prevention outcomes **[6-8]**. This lack of region-specific evidence highlights an important knowledge gap that needs to be addressed.

Early post-stroke complications, particularly those related to immobility, represent a major challenge in stroke unit care. Reported incidence rates vary widely across studies. For example, the incidence of post-stroke pneumonia ranges from 9% to 22%, while urinary tract infections have been reported in 2% to 25% of cases. Such variations may be attributed to differences in diagnostic criteria, patient characteristics, quality of documentation, and institutional prevention protocols **[8,9]**.

Common post-stroke complications include pneumonia, urinary tract infections, pressure ulcers, deep vein thrombosis, constipation, edema or high intracranial pressure, or post-stroke infections and falls. These complications may delay rehabilitation, prolong hospital stay, increase healthcare costs, and contribute to higher mortality rates **[10]**. Despite improvements in stroke unit management, the prevention and early detection of these complications remain critical components of patient care.

Therefore, this study aimed to evaluate post-stroke complications and prevention measures among patients in Kirkuk City hospitals and to assess the association between demographic characteristics and prevention outcomes.

Methods

Study Design and Setting

This study developed a cross-sectional observational study, following the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) rules. Available at: https://www.strobe-statement.org/checklists/. Accessed on: December, 18, 2024. This study employed a descriptive observational cross-sectional design to assess post-stroke complications and prevention measures. The study was conducted at Kirkuk City hospitals, including Azadi Teaching Hospital, from August 20, 2024 to December 18, 2024.

Study Population and Sampling

A total of 155 stroke patients were selected using a random sampling technique. The study included patients admitted during the study period.

Inclusion Criteria

1. Adult patients aged 18 years and older.
2. Diagnosed with ischemic or haemorrhagic stroke.
3. Admitted during the study period.

Exclusion Criteria

1. Patients with severe cognitive impairment.
2. Unconscious or critically unstable patients.
3. Patients who refused to participate.

Sample Size Calculation

The sample size was calculated using the formula for cross-sectional studies based on an assumed prevalence rate, 95% confidence level, and 5% margin of error. The minimum required sample size was determined to ensure adequate statistical power. A total of 155 participants were included in the final analysis.

Data Collection Tool

Data were collected using a structured questionnaire consisting of three parts:

1. Demographic characteristics (age, gender, marital status, residence, occupation, education level, type of stroke, and living condition before stroke).
2. Post-stroke complications (13 items).
3. Prevention measures (8 items).

Statistical Analysis

Data were analysed using Statistical Package for Social Sciences (SPSS) version 26. Descriptive statistics were presented as frequencies, percentages, means, and standard deviations. Inferential statistical tests, including Mann-Whitney U test and Kruskal-Wallis test, were used to compare prevention scores across demographic variables. A p-value of less than 0.05 was considered statistically significant.

Ethical Considerations

Ethical approval was obtained from the Ethics

Committee of the College of Nursing/University of Kirkuk under approval (2024). Written informed consent was obtained from all participants prior to data collection.

Results

Table 1 represents the sociodemographic features of the full research sample.

Table 1. Socio-demographic variables distribution of study sample.

Variables	Groups	Freq.	%
Age	25-34 years	5	3.2%
	35-44 years	21	13.5%
	45-54 years	27	17.4%
	55-64 years	44	28.4%
	65-74 years	36	23.2%
	75 years and above	22	14.2%
Gender	Male	73	47.1%
	Female	82	52.9%
Marital status	Unmarried	15	9.7%
	Married	140	90.3%
Residence	Urban	50	32.3%
	Rural	105	67.7%
Job	retired	19	12.3%
	free work	50	32.3%
	employed	21	13.5%
	housewife	65	41.9%
Education level	illiterate	31	20%
	read and write	34	21.9%
	primary school	43	27.7%
	intermediate school	9	5.8%
	secondary school	20	12.9%
	institution	18	11.6%
Types of cerebrovascular accident	ischemic stroke	88	56.8%
	haemorrhagic stroke	67	43.2%
Living situation during pre-stroke	Independent at home	78	50.3%
	Dependent at home	77	49.7%
Total		**155**	**100%**

Freq.=frequency; **%** =percentage. Source: Own authorship.

Table 2 show Nearly all participants experienced issues with speech and expression (96.1%) and difficulty swallowing (95.5%). Memory problems were common, affecting 91% of patients, while muscle weakness and spasms were 84.5%, indicating significant motor deficits. Urinary incontinence was affecting 88.4% of patients. Convulsions were reported by 94.2%, underscoring the risk of post-stroke seizures. Depression and mood swings were present in 63.2% of patients.

Table 2. Distribution of Complication of cerebrovascular accident.

No	Complication	Freq. (%)		
		Yes	Not sure	No
1.	influence on speech and expression	149 (96.1%)	6 (3.9%)	0
2.	difficulty swallowing	148 (95.5%)	6 (3.9%)	1 (0.6%)
3.	memory problems	141 (91%)	13 (8.4%)	1 (0.6%)
4.	Muscle weakness and spasm	131 (84.5%)	24 (15.5%)	0
5.	Venous thrombosis	18 (11.6%)	135 (87.1%)	2 (1.3%)
6.	Depression and mood swings.	98 (63.2%)	49 (31.6%)	8 (5.2%)
7.	Chronic headache.	34 (21.9%)	116 (74.8%)	5 (3.2%)
8.	Lung and urinary tract infections.	84 (54.2%)	64 (41.3%)	7 (4.5%)
9.	Heart attacks and heart arrhythmias.	16 (10.3%)	123 (79.4%)	16 (10.3%)
10.	Internal bleeding in the GIT	6 (3.9%)	75 (48.4%)	74 (47.7%)
11.	Urinary incontinence	137 (88.4%)	13 (8.4%)	5 (3.2%)
12.	Falls and bone fractures.	13 (8.4%)	140 (90.3%)	2 (1.3%)
13.	convulsions;	146 (94.2%)	8 (5.2%)	1 (0.6%)

Freq.=frequency; **%** =percentage. Source: Own authorship.

Table 3 reveal a majority of patient avoiding smoking (92.9%) and limiting alcohol consumption (97.4%). Only 52.9% chose healthy foods and drinks, and 7.1% maintained a healthy weight. About 2.6% engaged in regular physical activity. Among patients, 60.6% checked their cholesterol levels, and 51% controlled their blood pressure. However, diabetes management was low, with only 21.9% actively controlling the condition.

Table 3. distribution of Prevention measures of stroke.

No	Prevention	Freq. (%)	
		Yes	No
1.	do you choose healthy foods and drinks?	82 (52.9%)	73 (47.1%)
2.	do you keep a healthy weight?	11 (7.1%)	144 (92.9%)
3.	do you get regular physical activity?	4 (2.6%)	151 (97.4)
4.	Don't smoke?	144 (92.9%)	11 (7.1%)
5.	do you limit alcohol?	151 (97.4%)	4 (2.6%)
6.	do you check cholesterol?	94 (60.6%)	61 (39.4%)
7.	do you control blood pressure?	79 (51%)	76 (49%)
8.	do you control diabetes?	34 (21.9%)	121 (78.1%)

Freq.=frequency; **%** =percentage. Source: Own authorship.

Table 4 revels male and female patients showed

similar prevalence rates, with no statistically significant differences in speech impairment, swallowing difficulty, memory problems, muscle weakness, depression, convulsions, or urinary incontinence (p-values > 0.05). Lung and urinary tract infections were significantly common in males (58.9%) than females (50%), with a p-value of 0.033. Heart attacks and arrhythmias were higher in males (16.4%) compared to females (4.9%), with strong statistical significance (p= 0.009). Chronic headache nearly significance (p=0.053), with nearly equal prevalence in both genders.

Table 4. Gender-based differences in post-stroke complications.

No	Complication	Freq. (%)		p-value
		Male	Female	
1.	influence on speech and expression	70 (95.9 %)	79 (96.3 %)	0.884
2.	difficulty swallowing	70 (95.9 %)	78 (95.1 %)	0.453
3.	memory problems	66 (90.4 %)	75 (91.5 %)	0.568
4.	Muscle weakness and spasm	62 (84.9 %)	69 (84.1 %)	0.893
5.	Venous thrombosis	8 (11 %)	10 (12.2 %)	0.315
6.	Depression and mood swings.	45 (61.6 %)	53 (64.6 %)	0.665
7.	Chronic headache.	16 (21.9 %)	18 (22 %)	0.053
8.	Lung and urinary tract infections.	43 (58.9 %)	41 (50 %)	0.033
9.	Heart attacks and heart arrhythmias.	12 (16.4 %)	4 (4.9 %)	0.053
10.	Internal bleeding in the GIT	3 (4.1 %)	3 (3.7 %)	0.987
11.	Urinary incontinence	64 (87.7 %)	73 (89 %)	0.841
12.	Falls and bone fractures.	7 (9.6 %)	6 (7.3 %)	0.874
13.	convulsions;	68 (93.2 %)	78 (95.1 %)	0.558

Freq.=frequency; % =percentage. Source: Own authorship.

The Table 5 revealed significant differences in prevention scores based on gender and residence. Males had higher mean ranks (89.23) than females (68.01), with a p-value of 0.003. Similarly, urban residents scored significantly higher (mean rank 99.77) than rural residents (67.63), with a p-value of 0.001. No significant differences were found between types of cerebrovascular accidents (ischemic vs. haemorrhagic; p=0.678) or living situations prior to stroke (independent vs. dependent; p=0.39). Education level showed a significant effect on prevention scores using the Kruskal-Wallis test (p=0.001). Participants with intermediate school (mean rank 111.33) and institutional education (107) had notably higher scores compared to those with lower educational attainment.

Table 5. Comparison of Prevention Scores Across Demographic and Clinical variables.

	Variables	N	Average Rank	Total Ranks	Mann-Whitney U.	p-value
Prevention scores	**Gender**					
	Male	73	89.23	6513.50	2173.5	0.003
	Female	82	68.01	5576.50		
	Residence					
	Urban	50	99.77	4988.50	1536.5	0.001
	Rural	105	67.63	7101.50		
	Types of cerebrovascular accident					
	Ischemic stroke	88	79.27	6976	2836	0.678
	Haemorrhagic stroke	67	76.33	5114		
	Living situation during pre-stroke					
	Independent at home	78	75	5850	2769	0.39
	Dependent at home	77	81.04	6240		
	Education level					
	Illiterate	31	72		20.159	0.001*
	Read and write	34	64.76			
	Primary school	43	68.5			
	Intermediate school	9	111.33			
	Secondary school	20	89.13			
	Institution	18	107			
	Total	155				

*Kruskal-Wallis test; Mann-Whitney U. Source: Own authorship.

Discussion

Table 1 Statistics indicates that most of the patients were in the age group of 55-74. The largest share of patients was in the age group of 55-64 years (28.4) and the second-largest share was in the age group 65-74 years (23.2). Women (52.9%) suffered slightly more than men (47.1%) as per the gender split. The data indicates that a majority of participants (67.7%) lived in rural areas, and most of them were married (90.3%). Similar findings were also reported in the study conducted by Islam et al. (2024) **[11]** involving 424 people with a mean age of 57.25 ± 12.13 years (40-61). Most of residents were from rural areas (57.8%), married (80.9%), had only gone to elementary (67.7%), and were male (64.9%).

A recent study Abdu et al. (2022) **[12]** findings were almost similar in terms of age, gender and place of residence as there were approximately 51.9% female respondents in the study. On average, the participants in the research were 59.2 ± 14.6 years old. 41.7% of the participants were aged 65-84 years. In addition, a majority of 65.7% of the respondents were from rural areas.

In addition, about 12.2% and 14.7% most of the workers were housewives (41.9%) followed by patients worked for free (32.3%). It was noted that 27.7% of the sample had only basic schooling while 20 were illiterate. The majority of the patients were illiterate (14, 28%), could read and write (4, 8%), only attended primary school, and were housewives (18,

36%) according to a study by Taha and Gümüş (2025) **[13]**.

When it came to cerebrovascular accident occurrence, ischemic stroke (56.8%) was more common than haemorrhagic stroke (43.2%). Prior to suffering the stroke, 50.3% of the individuals lived independently whereas 49.7% were dependently at home. Our results resemble the study conducted by Mufti et al. **[7]**, conducted between 2011 and 2015, which indicates that 565 suffered ischemic strokes (70,6%) while 235 suffered haemorrhagic strokes (29.4%). The results of this research corroborate the findings of Yi et al. (2020) **[14]** in southwest China. There were 524 stroke patients (3.1%) and 2893 participants (17.1%) out of 16,892 participants. Out of 524 stroke patients, 95 (18.1%) experienced a haemorrhagic stroke and 429 (81.9%) had an ischemic stroke. The overall stroke rate was found to be 3.1% (95% CI 2.6-3.9%).

As shown in Table 2 nearly all respondents had a problem with swallowing (95.5%) and talking and making oneself understood (96.1%). 91% of them had memory-related issues. Muscular weakness and spams experienced by 84.5% also suggested the patient's motor was severely impaired. Findings of the present research is in line with Ehsaan et al. (2023) **[5]** where majority of cases had swallowing difficulty, i.e., 68.7% and communication problem 66%. Just like that, research shows that 73% of dysphagia patients with either a aphasia, dysarthria, or apraxia of speech, and only 26% of those with only dysphagia, have stroke dysphagia.

The current study's results are in agreement with Kaylor and Singh (2023) **[15]**, who found that 53 of the 68 patients referred for SLT following stroke had dysphagia, 50 (73.53%) had aphasia, 50 (73.53%) had dysarthria, while 11 (16.17%) had apraxia of speech. 88% of subjects exhibited co-occurring disorders. Dysarthria, dysphagia, and aphasia were the most common co-disorders (38.23%). Urine incontinence occurred in 88.4% of patients. Of responders, 94.2% commented on seeing someone having convulsions indicating seizure may occur after stroke. 63.2% of the patients had mood swings and depression.

A study by Mnaather and Shaker (2024) **[6]** investigated how urinary incontinence and indwelling urinary catheters were predictive factors for death after a new-onset stroke. Around 55% of the study cohort had an ischemic stroke (cortical ischemic stroke). Moreover, Anger, Emotional Incontinence, and Post-Stroke Depression: Long term also study hypertension, diabetes, and smoking as study sample risk factors for stroke. Based on Table 3, the majority of patients limit their alcohol consumption (97.4%) and do not smoke (92.9%). A mere 52.9 percent of people made healthy food and beverage choices, while 7.1 percent were of healthy weight. Roughly 2.6% of individuals stated that they exercise regularly.

The outcome of the study was similar to Othman (2013) **[16]**, whereby approximately 75 patients (83.3%) were right-handed while 15 patients (16.7%) were left-handed. Among the 26 patients (28.9%) with diabetes mellitus, 5 (19.2%) received insulin therapy, 14 (53.8%) took oral anti-diabetic medications and 7 (27%) were on dietary management. Out of the total 32 patients (35.6%), half of them had been smoking more than 10 years, and half smoked more than a pack (i.e., 20 cigarettes) a day. Of the 55 patients with hypertention, 32 (58.2%) were being treated while the remaining 23 (41.8%) were not. Among the patients, 49 cases (54.4%) were having a positive history of cardiovascular diseases. In this, seven cases (14.3%) had symptoms of peripheral vascular disease, twenty-seven cases (55.1%) had ischemic heart disease and fifteen cases (30.6%) were having a CVA history. Certain patients had ischemic heart disease and peripheral vascular disease. The study showed that 60.6% of patients monitored their cholesterol levels and 51% of patients managed their blood pressure.

Guo et al. (2025) **[8]** found that only 21.9% of persons had diabetes under control. Across 15.81 years, 3,055 strokes occur (500 HS, 2,555 IS), and 5,340 all-cause deaths take place. Among the five groups based on LDL-C levels, patients with an LDL-C level of < 1.40 mmol/L had the highest incidence of HS and all-cause mortality.

Additionally, Hypertension (18.5%) was the most common chronic disease among 11,036 users, according to Lu et al. (2019) **[17]**. This was followed by dyslipidemia (8.3%) and diabetes (6.0%). Older age and increased body mass index were all-risk factors for the three diseases. According to the study, there is a connection between sex, central obesity, and smoking with hypertension. Moreover, the number of family members, salt intake, and family history of hypertension acquired statistical significance in association with hypertension. Likewise, there were associations of central obesity, smoking, and alcohol consumption with diabetes. Furthermore, a family history of diabetes also acquired statistical significance in association with diabetes. In addition, diabetes increased the risk of hypertension.

According to Table 4, the frequencies of some impairment in speech, problems in swallowing, problems in cognition, problems in weakness of muscles, depression, convulsion, and incontinence of urine between men and women were not statistically different ($p>0.05$). Women's stroke recurrence risks

found by Dong et al. (2020) **[18]** were contradictory to the findings of this study. This study found no significant differences between the genders in regards to depression history and current medical treatment at the time of stroke ($p<0.001$) with all being equal. At 90 days, depression was prevalent in 28.2% of males and 32.7% of females (95% confidence interval). There were no substantial differences between the sexes in regard to those people who did and did not present a history of depression. Women were far less likely than men to suffer depression after 90 days. After a stroke, infection issues were more common in men (58.9%) than in women (50%) with a p-value of 0.033. The incidence of heart attack and arrhythmias in males (16.4%) was more than three times higher than in females (4.9%) which was statistically significant ($p=0.009$). Males and females had almost similar rates of persistent headaches which is nearly significant ($p=0.053$). According to the 87 trials carried out on 137,817 persons, the findings of this study correspond to Dong et al. (2020) **[18]**. Eight studies involved patients who were admitted to critical care unit (ICU) only. The studies exhibited significant differences, $p<0.001$, $I^2 = 97\%$. The overall pooled infection rate was 30% (24-36%). In subsequent, more accurate studies, there was a greater occurrence of pneumonia.

Multiple studies show that women patients and older people take an interest in UTI. Death was significantly associated with pneumonia. Table 5 of study indicate that, prevention scores vary significantly in gender and place of residence. The average ranking for men is greater (89.23) than for women (68.01) with a p-value of 0.003. Likewise, urban individuals obtained significantly greater scores (mean rank 99.77) compared to rural residents (67.63) at $p=0.001$. The different was not significant ($p=0.087$) due to a small number of cases in this age group. The cerebrovascular accident types (ischemic-haemorrhagic; $p=0.678$) and living situations before (independent-dependent; $p=0.39$) did not have any notable differences in the study as well. According to the Kruskal-Wallis Test, a strong association ($p=0.001$) exists between level of education and preventive scores. Those having a school education (mean rank 111.33) and institutional education (107) scored much higher than those with less education.

The investigation results are consistent with Salvadori et al. (2020) **[19]** which revealed no difference between IS and HS regarding discharge destination ($p=0.428$) or functional status change (mRS) at discharge ($F=0.01$; $p=0.902$). In all varieties of stroke, age and clinical severity forecasted functional prognosis factors. HS patients had a worse clinical and functional condition than IS patients on their admission at an intensive rehabilitation unit. Age and initial stroke severity were the main predicting factors, and despite that initial difference, the functional recovery trajectories of both stroke types matched.

Study Limitations

There are a number of limitations to this study. First, it was only carried out in hospitals in one city, which might have limited how broadly the results can be applied in other areas. Second, it is not possible to determine the causal links between variables using the cross-sectional approach. Third, the analysis's statistical strength can be diminished by the very small sample size. Additionally, reliance on questionnaire-based data may introduce response bias.

Conclusion

The current study showed a substantial correlation between specific demographic factors and both preventative strategies and post-stroke survival. Urban participants outperformed rural ones, and male patients had higher preventive ratings than female patients. Additionally, there was a substantial correlation between educational attainment and preventative outcomes. These results point to the significance of focused preventative and educational initiatives in enhancing post-stroke treatment. It is advised that these connections be further investigated in future extensive longitudinal research.

CRediT

Author contributions: **Conceptualization -** Rebaz I. Ali, Shelan Q. Shakor, Khanda M. Ahmed, Faeza F. Basas, Marwah A. Khalaf. **Data curation-** Rebaz I. Ali, Shelan Q. Shakor, Khanda M. Ahmed; **Formal Analysis-**Faeza F. Basas, Marwah A. Khalaf; **Investigation-** Rebaz I. Ali, Shelan Q. Shakor, Khanda M. Ahmed, Faeza F. Basas, Marwah A. Khalaf; **Methodology-** Rebaz I. Ali, Shelan Q. Shakor, Khanda M. Ahmed, Faeza F. Basas, Marwah A. Khalaf; **Project administration-** Rebaz I. Ali; **Supervision -** Rebaz I. Ali; **Writing - original draft-** Rebaz I. Ali, Shelan Q. Shakor, Khanda M. Ahmed, Faeza F. Basas, Marwah A. Khalaf; **Writing-review & editing-** Rebaz I. Ali, Shelan Q. Shakor, Khanda M. Ahmed, Faeza F. Basas, Marwah A. Khalaf.

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Ethical Approval

Ethical approval was obtained from the Ethics Committee of the College of Nursing / University of Kirkuk under approval (2024). Written informed consent was obtained from all participants prior to data collection.

Informed Consent

It was applicable.

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Data Sharing Statement

All referenced sources are accessible through the respective journals or public repositories.

Conflict of Interest

The authors declare no conflict of interest.

Similarity Check

It was applied by Ithenticate[@].

Application of Artificial Intelligence (AI)

Not applicable.

Peer Review Process

It was performed.

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