Scientific Research Publishing

Open Journal of Depression, 2026, 15(1), 17-42
https://www.scirp.org/journal/ojd
ISSN Online: 2169-9674
ISSN Print: 2169-9658

Post-Stroke Depression among Stroke Survivors at the University of Calabar Teaching Hospital, Calabar, Cross River State, Nigeria

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How to cite this paper: Okeke, I. E., Nwosu, P. C., Uma, U. A., Essien, E. A., & Uwah, E. E. (2026). Post-Stroke Depression among Stroke Survivors at the University of Calabar Teaching Hospital, Calabar, Cross River State, Nigeria. *Open Journal of Depression, 15,* 17-42.
https://doi.org/10.4236/ojd.2026.151002

Received: December 4, 2025
Accepted: February 6, 2026
Published: February 9, 2026

Abstract

Background: Post-stroke depression is very prevalent among stroke survivors but is often missed or underdiagnosed. There is much attention given to the physical rehabilitation of stroke survivors, with little or no attention given to the psychological sequelae of stroke. **Aim:** To investigate the occurrence of post-stroke depression among stroke survivors at the University of Calabar Teaching Hospital (UCTH), Calabar, Nigeria. **Materials and Methods:** This cross-sectional study was conducted among stroke survivors at the University of Calabar Teaching Hospital. All the stroke survivors had a CT scan-confirmed stroke. A consecutive sampling method was used to recruit respondents. The following questionnaires were administered to 122 stroke survivors. Sociodemographic/clinical questionnaire, National Institute of Health Stroke Scale (NIHSS), The Mini-International Neuropsychiatry Interview (MINI)-Depression module, Mini-Mental State Examination (MMSE), Oslo Social Support Scale (OSSS-3), and the Modified Rankin Scale (MRS). The data were analysed using SPSS version 25. **Results:** The study recruited 122 stroke survivors. The prevalence of Post-Stroke Depression among the respondents was 36.9%. The mean age of the participants was 60.23 ± 13.0. The proportion of male respondents was 62.3%, while that of female respondents was 37.7%. Respondents with right hemispheric stroke were 51.6%, while those with left hemispheric stroke were 36.1%. The proportion of respondents with ischaemic stroke (87.1%) was higher than that of those with hemorrhagic stroke (12.3%). The predictors of post-stroke depression in the study include respondents with comorbid diabetes mellitus (OR = 6.9, 95% CI = 1.4 - 32.9, $p = 0.01$) and those with coexisting hypertension and diabetes (OR = 24.1, 95% CI = 1.0 - 572, $p = 0.04$). **Conclusion:** The result of the study showed that depression among

stroke survivors is high among the study population. This condition is often neglected by the primary physicians managing these patients, leading to poor treatment outcomes. Efforts should be made to include psychological assessment/treatment in the routine care of stroke patients.

Keywords

Stroke Survivors, Depression, Cognitive Impairment

1. Introduction

1.1. Background

A stroke is a medical emergency that is currently defined as a sudden neurological impairment caused by a spontaneous bleeding or blockage in the central nervous system, leading to proof of tissue damage, regardless of how long the symptoms have been present (Theofanidis, 2014). The term stroke is believed to have been introduced into the medical literature only in the late seventeenth century (Theofanidis, 2014).

Globally, 1 in 4 adults above 25 years will have a stroke in their lifetime. Over 110 million people around the globe have had a stroke (Feigin et al., 2022) and every minute, six Africans develop a stroke (Akinyemi, 2021). The recent prevalence rate of stroke in Nigeria is 1.14 per 1000, while the monthly fatality rate is as high as 40% (Wahab, 2008).

Stroke has been linked with mental disorders such as depression, anxiety, apathy, and cognitive impairment (Robinson, 1997). Depression is the most common neuropsychiatric consequence of stroke, affecting about 33% of stroke patients (Gyagenda et al., 2015). Anxiety disorder is the second most common neuropsychiatric complication, with a prevalence rate of 25% (Robinson, 2006). Deficits in one or more domains of cognitive function are widespread after a stroke (Chemerinski & Robinson, 2000). Apathy without depression is linked with a loss of interest, while mania is rare in stroke patients. In addition, out-of-proportion emotional outbursts characterise pathological affective disorder, while catastrophic reactions in stroke patients are associated with a burst of aggressive behaviours, anxiety, and crying (Chemerinski & Robinson, 2000; Nemani & Gurin, 2021).

Previously, studies in stroke epidemiology were more focused on mortality and recurrence, and not on long-term complications (Chaturvedi et al., 2020). But currently, there is an increasing interest in the factors that could limit the quality of life and cause functional impairments among stroke survivors (Chaturvedi et al., 2020). Studies have shown that depression is among the strongest predictors of low quality of life among stroke patients (Chaturvedi et al., 2020). The quality of life characteristics affected by depression in stroke survivors include family and social roles, personal hygiene, mobility, upper extremity function, and work performance (Chaturvedi et al., 2020; Tatemichi et al., 1994).

According to the International Classification of Diseases, 11th edition, Depression is marked by decreased affect (e.g., sadness, feeling worthless) or diminished interest followed by reasoning, behavioural, or neurovegetative problems that entirely alter the patient's capacity to perform. An episode of depression is marked by near-daily decreased effect or reduced pleasure in enjoyable events spanning about 14 days, followed by complaints like poor concentration, emptiness or guilt, lack of hope, regular suicidal ideas or suicide, variability in biological functions, and decreased strength or weakness (World Health Organization, 2018).

Post-stroke mood disturbances, as defined by DSM-5, are disturbances resulting from stroke with symptoms of depression, depressive-like events, or both types as subtypes (Ayres, 2015). A patient with a major depression-like episode as a result of a stroke must have a reduced affect or diminished pleasure in events previously enjoyed, along with four additional symptoms of depression over two or more weeks. A patient diagnosed with a mood disorder related to stroke with depression characteristics must exhibit reduced affect or diminished interest in previously enjoyable events, in addition to two but fewer than five features of major depression within a period of 2 or more weeks (Ayres, 2015; Robinson & Jorge, 2016).

Studies have also reported variations in the prevalence rate of post-stroke depression depending on the time at which the stroke occurred. A systematic review of studies in the US estimates that depression could be present up to 5 years post-stroke in 31% of cases studied (Hackett et al., 2005). In another meta-analysis, depression remained steady 10 years post-stroke, with a prevalence of 29% and a cumulative incidence of about 39% - 52% within the first five years after a stroke (Ayerbe et al., 2013). The study is also a systematic review of published work from hospital, community, and rehabilitation studies, and findings from the study revealed that impairment after stroke and depression before stroke were predictors of post-stroke depression that were strongly reported. Poor social support, severity of stroke, and cognitive dysfunction were some other risk factors identified.

A North African study by Khedr et al. showed a prevalence rate of 36.9% for post-stroke depression (PSD). Significant risk factors for PSD in the study were poor educational status, low social class, use of cigarettes, and functional dysfunction (Khedr et al., 2020). An East African study in Uganda had a slightly lower prevalence rate of 31.5% for PSD, and functional impairment was the only significant risk factor for post-stroke depression (Gyagenda et al., 2015). A meta-analysis study in sub-Saharan Africa by Ojagbemi et al. included studies from Nigeria and showed a pooled prevalence rate of 31% for PSD (Ojagbemi et al., 2017). Risk factors associated with PSD included low educational levels, cognitive impairment, physical impairments and being divorced.

In northeast Nigeria, a high prevalence rate of 93.6% was obtained for PSD. Female gender, older age, and decreased level of independence were significant

for PSD. Olibamoyo et al. in southwest Nigeria revealed that the independent determinants of depression among stroke survivors included younger age, unemployment, cognitive dysfunction, and perceived poor social support. The prevalence rate of PSD in the study was 42.9% (Olibamoyo et al., 2019). Another study in southeast Nigeria had a lower prevalence rate of 32.7%, with female gender and younger age predictors for PSD (Eze et al., 2022).

A recent study on the relationship between symptoms of depression and impairment of cognition was conducted in post-stroke patients at 3 weeks. Those with mild depression were 40%, while those with moderate to severe depression were 12%. Patients who had severe depression were three times more cognitively impaired when compared with those with mild depression (Nys et al., 2005).

Martin Roth was one of the first researchers of post-stroke depression, and he showed the link between atherosclerosis and melancholy (Cullen et al., 2007). Also, another study showed that depression is more common in cerebrovascular accident (CVA) survivors than in orthopaedic cases with the same level of physical impairment (Folstein et al., 1977).

1.2. Statement of the Problem

Studies have also shown that non-psychiatric physicians did not detect depression in more than two-thirds of patients who were diagnosed as depressed by screening and diagnostic instruments (Jones et al., 1987; Schubert et al., 1992). It has been found that physicians consistently underestimate, misinterpret, or neglect psychiatric aspects of care among the majority of patients, including stroke patients, in which depression is often underrated (Jones et al., 1987; Schubert et al., 1992). This is seen in many studies on post-stroke depression in which stroke patients have been managed for years without any psychological assessment, thereby undermining the effect of these conditions on stroke outcomes (Olibamoyo et al., 2019; Oni et al., 2018).

1.3. Study Rationale

This study aims to justify the incorporation of mental health services into chronic care for stroke management, as the integration of psychiatric services into chronic care clinics is being considered globally (Gyagenda et al., 2015).

Also, this study hopes to contribute to the body of evidence on the need for increased physicians' index of suspicion for depression, as the study hopes to provide data on the extent of PSD.

In addition, this research work looks forward to providing information on the factors associated with post-stroke depression, as there is little or no data on this in South-South Nigeria, which will help both to reduce and manage these conditions and also, this research work also hopes to study the link between post-stroke depression and cognitive impairment, as they affect prognosis and are often comorbid (Terroni et al., 2012).

1.4. Aim

To determine the occurrence of post-stroke depression among those who have suffered a stroke at the UCTH Calabar, Nigeria.

1.5. Objectives

1)To determine the prevalence of depression after stroke among stroke survivors at UCTH.

2) To assess the association between post-stroke depression and cognitive impairment among stroke survivors at UCTH.

3) To evaluate the relationship between stroke type and depression among stroke survivors at the UCTH.

4) To assess the relationship between stroke severity, stroke-related disability, and social support with depression.

1.6. Study Hypothesis

There is an association between post-stroke depression and cognitive impairment among stroke survivors.

2. Methodology

2.1. Location of Study

Calabar is the capital of Cross River State and is located in southern Nigeria. It is 4.982 latitudes and 8.334 longitudes of the Greenwich Meridian (Nkang, n.d.). It covers 406 square kilometres (157 sq. mi) and has a population of 371,022 from the 2006 census. The Atlantic Ocean bounds the metropolis on the south, Odukpani L G A on the north, Akpabuyo L G A on the East, and the Calabar River on the west (Eko Jimmy et al., 2013).

Administratively, it is divided into two—Municipal and South and comprises three major tribes: Efik, Efut, and Qua. Its people are known for their rich cultural heritage, tourism, and hospitality. As a Cosmopolitan city, almost everyone understands and speaks English.

Calabar has three tertiary hospitals: the University of Calabar Teaching Hospital, the Navy Reference Hospital, and the Federal Neuropsychiatric Hospital.

This study was done at the UCTH, established in 1979, to provide tertiary health care services (Mkpanam, 2012). The facility is a six-hundred-and-ten-bed space hospital located at Calabar in Calabar Municipality. Clinical services are available in all specialised medical departments, such as Surgery, Internal Medicine, Paediatrics, Orthopaedics and Trauma, Anaesthesiology, Obstetrics and Gynaecology, and Psychiatry (Mkpanam, 2012). The internal medicine department comprises Neurology, Cardiology, Nephrology, Endocrinology, Respiratory, Dermatology, and Rheumatology units (Mkpanam, 2012).

This study was carried out at the Neurology clinic of the Internal Medicine department. Initially, the neurology clinic ran only on Mondays, but with the introduction of the Friday clinic, dedicated to stroke patients, it expanded its schedule.

Data from the medical records in 2021 showed that the neurology clinic attended to eight hundred and twelve patients, with stroke cases constituting the majority (about 609 stroke cases). With an average of 50 stroke cases per month, about 13 stroke cases per week were seen in 2021. Most of these cases were new (an average of 7 new cases per week), with others coming for a follow-up visit. The stroke centre/clinic, which was commissioned in 2023, further increased the number of stroke cases seen by the neurologist (Friday clinic). Stroke patients must routinely have a CT scan report in the Neurology clinic.

2.2. Study Design

The study was a cross-sectional study.

2.3. Study Population

Participants were adult stroke survivors 18 years and above at the University of Calabar Teaching Hospital.

2.4. Inclusion Criteria

1) Brain CT-scan confirmed stroke survivors within 1 month to 5 years after stroke.

2) Patients who gave consent for the study.

2.5. Exclusion Criteria

1) Those having a history of pre-stroke depression.

2) Patients receiving treatment for dementia pre-stroke.

3) Patients with severe language or physical impairment sufficient to prevent assessment.

4) Those who cannot understand the English language.

2.6. Sample Size Calculation

The study used the Cochran formula for calculating sample size for a known prevalence rate.

$$n = \frac{Z^2 pq}{d^2}.$$

n = sample size required.

Z = 1.96 from a z-table at a 95% confidence interval.

p = prevalence of post-stroke depression from previous study = 31% (Ojagbemi et al., 2017).

$q = 1 - p$.

margin of error (5%)

$$n = \frac{(1.96 \times 1.96)(0.31)(0.69)}{(0.05)^2}$$

$$n = \frac{0.82171824}{0.0025}$$

$$n = 328.68.$$

Assuming a 10% non-response rate, the sample size increases, thus (Ojagbemi et al., 2017)

$$na = \frac{n}{1-10\%}$$

$$na = \frac{328.68}{0.9}$$

$$na = 365.2$$

For a proposed study duration of 6 months, with an approximate population of 7 new cases per clinic day.

$$N = 26(\text{weeks}) \times 7 \times 1(\text{clinic days}) = 182$$

Using an estimated population of 182, the sample size calculation for a population of less than 10,000 was calculated using the formula

$$nf = \frac{n}{1+\frac{n}{N}}$$

where nf = desired sample size when the study population < 10,000.

n = desired sample size when study population > 10,000.

N = Estimated population size.

Thus $nf = \frac{365.2}{1+\frac{365.2}{182}}$

$$nf = 122$$

2.7. Sampling Technique

Those who satisfied the intake requirement were consecutively recruited into the study as they came for clinic visits.

2.8. Study Instruments

2.8.1. The Socio-Demographic/Clinical Questionnaire

The SDQ was an interviewer-administered pro forma questionnaire involving SDQ parameters like gender, marital status, tribe, denomination, employment level, educational attainment, and monthly earnings. The clinical variables, like stroke location and type, were obtained from the CT-scan report. In contrast, the number of stroke episodes and co-morbid disease conditions was obtained from the participant's case file.

2.8.2. MINI International Neuropsychiatric Interview (Mini Version 7.0)

MINI was produced in 1990 by clinicians in the US and Europe for DSM-III-R and ICD-10 psychiatric disorders and is a quick, structured diagnostic interview

with an administrative time of about 15 minutes (Pinninti et al., 2003). The MINI is an organised mental health questionnaire to assess and monitor epidemiological studies and drug experiments. Psychiatrists and health organisations use it widely in over 100 countries (Black et al., 2004). MINI is updated regularly and currently covers DSM-IV and DSM-5 psychiatric disorders with MINI versions 6.0 and 7.0, respectively. Its reliability score is high (kappa score more than 0.75) for major depressive disorder (Black et al., 2004). Compared with other diagnostic instruments, like the structured clinical interview for DSMIII, MINI does not take much time to administer (Mordal et al., 2010). It has been widely used in Nigerian studies (Olibamoyo et al., 2019; Popoola & Adewuya, 2012). The depression module of the MINI will be used in this study. The MINI has been validated for use in Nigeria (Opakunle et al., 2023).

2.8.3. MINI-Mental State Examination (MMSE)

MMSE is used to evaluate cognitive impairment, grade the severity of cognitive impairment at any particular time, follow up fluctuations in patients' cognition, and note patients' response to treatment (Huang et al., 2019). The Mini-Mental State Examination is graded on a scale of 0 - 30, with values equal to or higher than 24 interpreted as normal cognition. A score range of 0 - 17 means severe cognitive impairment, while a score of 18 - 23 equals mild impairment. When interpreting the MMSE, consider the patient's native language, educational level, and culture, as these factors affect performance (Galea & Woodward, 2005). It has a sensitivity of 81% (95% Cl, 78% to 84%) and specificity of 89% (95% Cl, 87% to 91%) (Fan & Rossi, 2015). It has been widely used in Nigerian studies (Baiyewu et al., 2003; Olibamoyo et al., 2019). It has also been validated for use in Nigeria (Adebusoye et al., 2021).

2.8.4. National Institute of Health Stroke Scale (NIHSS)

The NIHSS is a tool used to measure the severity of stroke. It is typically used in clinical settings to assess and monitor the neurological status of acute stroke patients, determine appropriate care, and facilitate communication between healthcare providers. Additionally, the NIHSS can help predict both immediate and long-term outcomes for stroke survivors (Brott et al., 1989). The NIHSS comprises assessments graded on a scale, and patients can be evaluated quickly in less than 10 minutes. The grading system ranges from zero, indicating some level of dysfunction. The average total score is 42, with the lowest score being 0. The grading system is as follows: no stroke symptoms are graded at zero, mild symptoms at 1 - 4, and average symptoms at 5 - 15. Average to severe stroke symptoms at 16-20, and severe symptoms at 21 - 42. This tool has been used in several studies in Nigeria (Olibamoyo et al., 2019; Ekeh et al., 2018). It has also been validated for use in Nigeria (Dawodu & Olaniyan, 2012).

2.8.5. Modified Rankin Scale (MRS)

The MRS is a rating scale used to assess stroke patients' functional independence

level compared to their pre-stroke functions rather than evaluate their ability to perform a specific task. It is a single-item scale administered by an interviewer. Based on the following scoring, a single MRS score should be given: no symptoms 0, no significant disability despite symptoms = 1, minor dysfunction: not able to perform all previous functions but can take care of oneself without assistance = 2, average dysfunction: needs a certain level of support but can ambulate without support = 3, average-severe dysfunction: can't ambulate and take care of oneself without support = 4, severe dysfunction: urinating on oneself, permanently bedridden with the need for regular nursing attention = 5 (De Haan et al., 1995; Ekeh et al., 2018). MRS has a kappa score of 0.78 (Wilson et al., 2005). It has been widely used in Nigerian studies (Owolabi & Ogunniyi, 2009; Wilson et al., 2005). It has been validated for use in Nigeria (Owolabi & Ogunniyi, 2009).

2.8.6. Oslo Social Support Scale (OSSS-3)

The OSSS-3 is a short questionnaire used to measure the amount of social support received. (Van Lente et al., 2012). It contains only three items that ask about the number of firm friends, the feeling of care from other individuals, and the association among neighbours to get feasible help. The overall scoring can be grouped into three primary levels of social support: 1) 3 - 8 low help, 2) 9 - 11 medium help, and 3) 12 - 14 vital help (Meltzer, 2003). It has a Cronbach alpha value of 0.640 (Kocalevent et al., 2018), and has been used in many studies in Nigeria (Kocalevent et al., 2018; Meltzer, 2003). It has been validated for use in Nigeria (Abiola et al., 2013).

The estimated time to complete all the questionnaires was 15 minutes.

2.9. Pre-Testing

A pre-test was conducted with 10% of the sample size (12 participants) at the diabetic clinic of UCTH on 7/2/23. The study was conducted by the researcher and two research assistants (health personnel) who were properly trained by the supervising consultants. The questionnaires were test-run to ensure consistency with the results obtained.

2.10. Ethical Consideration

Ethical clearance was obtained from the research committee of the University of Calabar Teaching Hospital. Patients were informed that their participation was voluntary and that there would be no foreseeable risk. They could withdraw their consent at any point during the study. Written informed consent was obtained from the patients. Referral for treatment was offered to those who screened positive for any domains assessed in the study.

2.11. Procedure

This study was carried out by the researcher and two research assistants. The research assistants were health personnel who were properly trained by the supervising consultants. Using the Neurology registry of the records department of

UCTH, case notes of patients present for clinic each Monday and Friday were obtained. The case files of each patient were assessed to ascertain those that met the inclusion criteria. Those who met the inclusion criteria were taken into a separate clinic room, where the study was properly explained to them; thereafter, written informed consent was obtained from the patients.

Afterwards, the patients were facilitated to see their doctors for treatment, and then the study instruments were administered. An interviewer from the research team administered the Socio-Demographic Questionnaire. The trained research assistants administered the Modified Ranking Scale Questionnaire, the NIHSS, the OSSS-3, and the MMSE. Thereafter, the researcher administered the depression module of the MINI version 7.0 Questionnaire. Codes were used to identify the questionnaires, and the case notes of participants were marked discreetly to avoid assessing twice. The filled questionnaires were collected for analysis.

An average of ten to twelve stroke patients were recruited per week, and the study lasted for 3 months

2.12. Data Management

Completed questionnaires were entered into the SPSS version 25 software. All analyses were two-tailed, and the significance level was set at a *p*-value less than 0.05.

3. Results

This study was a cross-sectional study done among stroke patients with 122 participants. The study aimed to assess post-stroke cognitive impairment and depression among stroke survivors at UCTH. The following results will be discussed in line with the study objectives.

3.1. Sociodemographic Characteristics of the Respondents

A total of 122 patients were recruited for the study, comprising 76 males (62.3%) and 46 females (37.7%). Most respondents were married (91.8%), Christians (98.4%), and above 50 years of age (40.2%). They were mainly self-employed (39.3%) and unemployed (37.7%), with an income of thirty-one thousand naira and above (54.1%). Furthermore, more than half of the population had a tertiary education (54.9%). A greater percentage of the respondents (45.9%) were from other tribes in Cross River State, with 24.6% from the Efik tribe (Table 1).

Table 1. Sociodemographic characteristics of the respondents.

Variable	Frequency	Percentage (%)
Age		
18 - 34	5	4.1
35 - 49	24	19.7
50 - 64	49	40.2

Continued		
65 and above	44	36.0
Mean (±SD) 60.23 ± 13.0		
Gender		
Male	76	62.3
Female	46	37.7
Marital Status		
Married	112	91.8
Single	10	8.2
Ethnicity		
Efik	30	24.6
Ibibio	17	13.9
Igbo	18	14.8
Yoruba	1	0.8
Others	56	45.9
Level of Education		
Primary	14	11.5
Secondary	41	33.6
Tertiary	67	54.9
Religion		
Christianity	120	98.4
Islam	1	0.8
Traditional	1	0.8
Occupation		
Employed	28	23.0
Self-employed	48	39.3
Unemployed	46	37.7
Monthly Income		
30,000 Naira and Less	13	10.7
31,000 to 99,000 Naira	66	54.1
100,000 Naira and Above	43	35.2

SD-Standard deviation.

3.2. Clinical Variables of the Respondents

Table 2 shows the clinical variables of stroke location, stroke type, number of stroke episodes, stroke duration, and comorbidities of the respondents. Those with right hemispheric stroke constituted more than half (51.6%) of the study

population, while those with left hemispheric stroke were 36.1%. Participants with stroke lesions affecting other areas of the brain (i.e., the "others" category), which include both cerebral hemispheres (3.3%), cerebellum (4.1%), basal ganglia (2.2%), brainstem (0.8%), multifocal (0.8%) and the subarachnoid space (0.8%), were less than 15%. Most of the respondents had Ischemic stroke (87.7%), with only 12.3% having hemorrhagic stroke. In addition, more respondents presented within the first year of stroke (77.9%), while the fewest were those who presented within 3 to 5 years of stroke (9.8%). Furthermore, most of the respondents were hypertensive (76.2%), with about 11% having both diabetes and hypertension. Participants with diabetes constituted about 6% of the study population.

Table 2. Clinical variables of the respondents.

Variable	Frequency	Percentage (%)
Stroke Location		
Right Cerebral Hemisphere	63	51.6
Left Cerebral Hemisphere	44	36.1
Others	15	12.3
Stroke Type		
Hemorrhagic	15	12.3
Ischemic	107	87.7
Number of Stroke Episodes		
1	104	85.2
2	15	12.3
3 or more	3	2.5
Duration of Stroke		
Less than 1 Year	95	77.9
1 Year to 3 Years	15	12.3
More than 3 years	12	9.8
Comorbidities		
Hypertension	93	76.2
Diabetes Mellitus	7	5.7
Hypertension and Diabetes	13	10.7
None	9	7.4

3.3. Prevalence of Post-Stroke Depression in Relation to the Gender of the Respondents

Table 3 showed that the overall prevalence rate of depression among the respondents was 36.9%, with males (23.0%) being more depressed than females (13.9%). The relationship between depression and gender was not statistically significant ($p = 0.57$).

Table 3. Prevalence of post-stroke depression by gender.

Variable	Male	Female	Total	Statistic	df	*p*-value
Depression						
Yes	28 (23.0)	17 (13.9)	48 (36.9)	$\chi^2 = 0.00$	1	0.57
No	48 (39.3)	29 (23.8)	77 (63.1)			

3.4. Association between Post-Stroke Cognitive Impairment and Depression

Table 4 shows the association between post-stroke cognitive impairment and depression among the study participants. The prevalence rate of depression was higher among those with cognitive impairment (51.1%) than those without cognitive impairment (48.9%). However, the association between cognitive impairment and depression was not statistically significant ($p = 0.05$).

Table 4. Association between post-stroke depression and cognitive impairment.

Depression	Cognitive impairment				
	Yes	No	Statistics	df	*p*-value
Yes n (%)	23 (51.1%)	22 (48.9%)	$\chi^2 = 3.55$	1	0.05
No n (%)	26 (33.8%)	51 (66.2%)			

3.5. Relationship between Stroke Type and Depression

Table 5 shows that respondents with hemorrhagic stroke (60%) were more depressed than those with ischaemic stroke (40%), and the relationship between stroke type and depression was statistically significant ($p = 0.04$).

Table 5. Relationship between stroke type and depression.

Variable	Stroke Type		Statistic	df	*p*-value
	Hemorrhagic	Ischaemic			
Depression					
Yes	9 (60)	6 (40)	$\chi^2 = 3.92$	1	0.04*
No	36 (33.6)	71 (66.4)			

*Statistically significant.

3.6. Relationship between Post-Stroke Depression with Stroke Severity, Stroke-Related Disability and Social Support

Table 6 showed that the highest prevalence rate of depression was among respondents with mild stroke (41.1%), and the relationship between stroke severity and depression was not statistically significant ($p = 0.67$). Also, respondents with severe stroke-related disability had the highest prevalence of depression (47.2%), and the relationship between stroke-related disability and depression

was statistically significant ($p = 0.04$). The prevalence rate of depression among respondents with strong social support was the least (27.3%), but the relationship between social support and depression was not statistically significant ($p = 0.28$).

Table 6. Relationship between post-stroke depression with stroke severity, stroke-related disability and social support.

Variable	Depression		Statistic	df	*p*-value
	Yes	No			
Stroke severity					
Mild	23 (41.1)	33 (58.9)	$\chi^2 = 0.77$	2	0.67
Moderate	20 (33.3)	40 (66.9)			
Severe	2 (33.3)	4 (66.7)			
Stroke-related disability					
Mild	1 (7.7)	12 (92.3)	$\chi^2 = 6.41$	2	0.04*
Moderate	27 (37.0)	46 (63.0)			
Severe	17 (47.2)	19 (52.8)			
Social support					
Poor	14 (41.2)	20 (58.8)	$\chi^2 = 2.49$		0.28
Moderate	19 (43.2)	25 (56.8)			
Strong	12 (27.3)	32 (72.7)			

*Statistically significant.

3.7. Binary Logistic Regression Showing the Predictors of Post-Stroke Depression

Table 7 shows the predictors of post-stroke depression among the respondents. Respondents with comorbid hypertension and diabetes mellitus were 24 times more likely to develop depression than those with comorbid hypertension. However, those with comorbid diabetes mellitus (alone, without hypertension) were 7 times more likely to develop depression than those with comorbid hypertension. The other variables, like gender, marital status, level of education, stroke location, stroke duration, stroke-related disability, and severity, did not predict depression among the respondents.

Table 7. Binary logistic regression showing the predictors of post-stroke depression.

Variable	B	S E	Wald	df	*p*-value	Odds Ratio	95% CI	
							Lower	Upper
Age (Years)								
60 and above	0.22	0.52	0.18	1	0.67	1.24	0.44	3.47
18 to 59								

Continued

Gender								
Female	0.32	0.57	0.31	1	0.57	1.38	0.45	4.24
Male								
Marital Status								
Single	−0.74	1.52	0.23	1	0.62	0.47	0.02	9.35
Married								
Stroke location								
Left Cerebral Hemisphere	−0.35	0.53	0.43	1	0.50	0.70	0.24	1.99
Right Cerebral Hemisphere								
Stroke Type								
Ischaemic	−1.71	1.00	2.90	1	0.08	0.18	0.02	1.29
Hemorrhagic								
Cognitive Impairment								
Severe	−1.24	0.82	2.28	1	0.13	0.28	0.05	1.44
Mild to Moderate	−0.01	0.77	0.00		0.98	0.98	0.21	4.52
No								
Social Support								
Strong	−0.49	0.65	0.57	1	0.44	0.60	0.16	2.19
Moderate	−0.26	0.69	0.15		0.69	0.76	0.19	2.96
Poor								
Level of Education								
Tertiary	0.27	0.62	0.20	1	0.65	1.32	039	4.46
Secondary	0.30	0.89	0.11		0.73	1.35	0.23	7.83
Primary								
Monthly Income (Naira)								
100,000 and above	−0.28	0.61	0.21	1	0.64	0.75	0.22	2.49
50,000 and above	−1.86	1.03	3.23		0.07	0.15	0.02	1.18
30,000 and less								
Post-Stroke Duration								
Above 3 Years	−0.92	1.20	0.59	1	0.44	0.39	0.03	4.20
On to Three Years	−1.19	0.94	1.60		0.20	0.30	0.04	1.92
Less Than a Year								
Comorbidities								
Hypertension and Diabetes	3.18	1.61	3.88	1	0.04*	24.1	1.01	572
Diabetes	1.93	0.79	5.86		0.01*	6.90	1.44	32.9

Continued

Hypertension								
Stroke-Related Disability								
Moderately Severe	0.04	0.57	0.00	1	0.93	1.04	0.34	3.21
Mild								
Stroke Severity								
Moderately Severe	0.01	0.54	0.00	1	0.98	1.01	0.34	2.94
Mild								

*Statistically Significant.

4. Discussion

This study assessed the presence of depression among stroke survivors at UCTH. Among the respondents, 51.6% had right hemispheric stroke, while 36.1% had left hemispheric stroke; most of the respondents had ischaemic stroke (87.7%) compared to hemorrhagic stroke (12.3%). The prevalence of post-stroke depression was 36.9%. The study results will be discussed in harmony with the study objectives.

4.1. Prevalence of Post-Stroke Depression among the Respondents

The total prevalence rate of depression among the study participants was 36.9%. This is comparable to a study done by Eze et al. at the Federal University Teaching Hospital, Abakaliki, where 32.7% of the respondents were depressed (Eze et al., 2022). The slightly lower prevalence rate obtained in the study might be due to the assessment of depression with the Beck Depression Index which is a screening tool. This is similar to a study done by Kedr et al. at Qena University Hospital, Egypt, where 36.9% of the respondents had post-stroke depression (Khedr et al., 2020). Also, a survey by Gyagenda et al. in Uganda showed a prevalence rate of 31.5% (Gyagenda et al., 2015), while a study by Schottke et al. in Germany had a prevalence rate of 31.1% (Schöttke & Giabbiconi, 2015). However, a study by Oni et al. showed a much lower prevalence rate of 22.9% (Oni et al., 2018). This might be due to the use of the Schedule for Clinical Assessment in Neuropsychiatry (SCAN) for the assessment of depression. The SCAN is a detailed diagnostic tool with more stringent criteria for the diagnosis of depression, which might have resulted in a lower prevalence rate of depression in their study. In addition, more chronic stroke patients were recruited in their study (60% of the study participants had a stroke over one year duration), and the majority of the respondents were either retired or unemployed. This might have contributed to the lower prevalence rate of depression in their study. A study by Ayerbe et al. in the UK had a lower prevalence rate of 29% (Ayerbe et al., 2013). This might be due to their inclusion criteria, which included studies with different sample sizes and studies done in different languages. The study by Olibamoyo et al. on the prevalence and corre-

lates of depression among Nigerian stroke survivors had a higher prevalence rate of 42.9% (Olibamoyo et al., 2019). This might be due to their inclusion criteria, which require respondents to be up to six months post-stroke. The six-month post-stroke period might have given room for more respondents to come down with post-stroke depression, resulting in a higher prevalence rate. Another study in India on frequency and clinical determinants of post-stroke depression by Pohjasvaara et al. had a higher prevalence rate of 40.1% (Pohjasvaara et al., 1998). This might be because respondents were recruited from an older age group of 55 to 85 years.

The predictors of post-stroke depression from the study include respondents with diabetes mellitus and those with coexisting hypertension and diabetes. A study by Tennen et al. on vascular risk factors associated with post-stroke depression showed that hypertension is a risk factor for post-stroke depression (Tennen et al., 2011). Also, another study by Zhang et al. showed that diabetes mellitus predisposed stroke patients to late-onset post-stroke depression (Zhang et al., 2017). A prospective study by Whyte et al. on risk factors for post-stroke depression showed that both hypertension and diabetes are predictors of post-stroke depression (Whyte et al., 2004). Most local studies on predictors of post-stroke depression did not have comorbidities such as hypertension and diabetes mellitus as their predictors.

4.2. Association between Post-Stroke Cognitive Impairment and Depression

The association between cognitive impairment and depression showed that respondents who were depressed had lower cognitive scores on the Mini-Mental State Examination (MMSE) than those who were not depressed. The association between cognitive impairment and depression was not statistically significant. Most Nigerian studies showed a statistically significant relationship between cognitive impairment and depression (Fatoye et al., 2007; Ojagbemi et al., 2014). However, a study done by House et al.in the UK on the relationship between cognitive impairment and depression showed a negative correlation between scores on the MMSE and symptom levels of depression. This relationship between cognitive impairment and depression was not statistically significant (House et al., 1990). Another study by Andersen et al. compared the course of cognitive impairment in depressed and non-depressed stroke patients (Andersen et al., 1996). The results showed that an improvement in intellectual performance did not accompany an improvement in mood score, therefore showing no correlation between mood symptoms and cognitive function (Andersen et al., 1996). In contrast, a study by Ojagbemi et al. showed a statistically significant relationship between cognitive dysfunction and major depression among stroke survivors (Ojagbemi et al., 2014) This might be because the survey had a larger sample size. Similar studies done by Fatoye et al., Olibamoyo et al., and Nys et al also showed that cognitive impairment and depression were statistically related among stroke survivors (Fatoye et

al., 2007; Nys et al., 2005; Olibamoyo et al., 2019). The variations in the cut-off point for the diagnosis of cognitive impairment on the MMSE and the different instruments used for the diagnosis of depression might have accounted for the discrepancies in results across studies.

4.3. Relationship between Stroke Type and Depression

The study showed that participants with hemorrhagic stroke were more depressed than those with ischaemic stroke, and the relationship between stroke type and post-stroke depression was statistically significant. A study in Edinburgh on Anxiety and Depression after spontaneous subarachnoid haemorrhage showed a relationship between hemorrhagic stroke and depression (Morris et al., 2004). There are some possible explanations for the link between hemorrhagic stroke and depression. After an intracerebral haemorrhage, severe neurological deficits occur in the emotional processing areas of the brain, resulting in depression in the subjects (Hackett & Anderson, 2005). Secondly, due to the severity of most hemorrhagic strokes, patients tend to have more functional impairment, resulting in depression (Hackett & Anderson, 2005). There were no Nigerian studies that showed a relationship between stroke type and depression to the best of my knowledge, based on my search. Another survey by Vataja et al. showed that ischaemic lesions in specific locations of the brain were associated with post-stroke depression (Vataja et al., 2001). This might be because of the link between post-stroke depression and lesions in specific areas of the brain (Shi et al., 2017).

4.4. Relationship between Stroke Severity, Stroke-Related Disability, and Social Support to Depression

The study showed no statistical relationship between stroke severity and depression among the respondents. This is similar to work done in Northwest Nigeria on depression in long-term stroke survivors, where participants whose stroke severity was assessed on admission showed no statistical association with depression (Abubakar et al., 2014). Most international studies showed a statistical relationship between stroke severity and depression (Ayerbe et al., 2013; Pohjasvaara et al., 1998). Also, studies done by Olibamoyo et al. and Salihu et al. showed that stroke severity was statistically correlated with depression (Olibamoyo et al., 2019; Salihu et al., 2023). This might be because of the variability of the assessment time of stroke severity in these studies. However, the study showed that respondents with mild stroke were more depressed than those with severe stroke. The prevalence of depression is expected to be low in those with mild stroke, but this is not always the case, as seen in a study by Shi et al on depression after minor stroke: prevalence and predictors, where three in ten patients (29%) developed PSD over the first year after a minor stroke (Shi et al., 2015). This shows that every stroke patient is prone to developing depression, irrespective of the stroke severity. Also, respondents with severe stroke may not be able to express their emotional experiences adequately, which may result in a false negative diagnosis

of depression.

The association between stroke-related disability and depression among the participants was statistically significant. This is comparable to studies done both locally and globally, which showed a statistical relationship between stroke-related disability and depression (Bakare et al., 2024; Khedr et al., 2020; Olibamoyo et al., 2019). On the contrary, studies done by Oladiji et al., Salihu et al., and Hackett et al. showed that the relationship between stroke-related disability and depression was not statistically significant (Hackett et al., 2005; Oladiji, Akinbo, & Aiyejusunle, 2009; Salihu et al., 2023). This might be due to the variability of the assessment time and the different instruments used to assess stroke-related disability.

Furthermore, the study revealed that respondents who had strong social support had the least occurrence of depression. However, the relationship between social support and depression was not statistically significant. This is comparable to studies done by Olibamoyo et al. and Bi et al, which showed that the odds of depression were lower in patients receiving higher levels of social support (Bi & Wang, 2022; Olibamoyo et al., 2019).

4.5. Study Limitations

1) The study design was cross-sectional, which limits the inference of causality between the associations found.

2) The exclusion of severe aphasic patients, an important study population, might have limited the study's generalizability.

3) The single-centre nature of the study and the use of a non-probability consecutive sampling method, both of which might have affected the study's generalizability.

5. Conclusion and Recommendations

5.1. Conclusion

The prevalence of post-stroke depression is high among the study participants. Stroke survivors with depression are more likely to have comorbid conditions such as hypertension and diabetes mellitus. Hence, the screening of stroke survivors for depression using identifiable risk factors as an integral part of their management may have potential benefits.

5.2. Recommendations

1) There should be an increased awareness and high index of suspicion among the managing physicians for the presence of depression among stroke survivors.

2) Psychological assessment and screening of all stroke survivors using the MINI-depression module should be integrated into the routine clinical follow-up for all stroke survivors at the UCTH.

3) Future research should consider longitudinal studies to help establish a causal relationship(s) between post-stroke depression and cognitive impairment.

4) The government should fund further research on the psychological aspect of stroke management to aid in a better understanding of the impact of these conditions on stroke survivors.

Ethics Approval and Consent to Participate

Ethical clearance was obtained from the research committee of the University of Calabar Teaching Hospital, and the research was conducted in accordance with the 'Helsinki' declaration. Patients were informed that their participation was voluntary and that there would be no foreseeable risk. An informed verbal/written consent was obtained from the patients. Referral for treatment was offered to those who screened positive for any domains assessed in the study.

Clinical trial number not applicable.

Availability of Data and Materials

The data set used and/or analysed during the current study is available from the corresponding Author on reasonable request.

Funding

There is no funding for this research.

Authors' Contributions

IO: Conceptualised the research, carried out recruitment of study participants and was involved in the analysis of the results.

PN: Logistics and review.

UU: Involved in supervising and analysing data.

EE: Involved in supervising and analysing data

EU: Involved in supervising and analysing data.

All authors read and approved the final manuscript.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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List of Abbreviations

NIHSS	National Institute of Health Stroke Scale
MINI	Mini-International Neuropsychiatry Interview
MMSE	Mini-Mental State Examination
OSSS-3	Oslo Social Support Scale
MRS	Modified Rankin Scale
DSM5	Diagnostic Statistical Manual 5th Edition
ADL	Activities of Daily Living
SDQ	Socio Demographic Questionnaire
SPSS	Statistical Package for Social Sciences
MoCA	Montreal Cognitive Assessment
PSCI	Post Stroke Cognitive Impairment