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The dynamics of Poststroke depression among Ghanaians

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ABSTRACT

Objective: The very few published data on post-stroke depression (PSD) among indigenous Africans have covered its prevalence and predictors. We sought to evaluate the dynamics of PSD in a cohort of Ghanaian stroke survivors followed for 9 months after an acute stroke.

Methods: Stroke survivors in this prospective cohort were adults aged > 18 years with CT scan confirmed stroke, recruited into a randomized controlled trial to assess the feasibility of an mHealth technology-enabled, nurse guided intervention for blood pressure control. PSD was assessed a secondary outcome measure using the Hamilton Depression Rating Scale (HDRS) at enrollment, months 3, 6, and 9. Those with a score of > 7 points on HDRS were categorized as depressed. A multivariate logistic regression analysis was performed to identify independent predictors of PSF.

Results: Mean age of study participants was 55.1 ± 12.7 years with 65% being males. Ischemic strokes comprised 76.6% of study population. Prevalence of PSD at baseline was 78.6%, 43.6% at month 3, 41.1% at month 6 and 18.2% at month 9 ($p < .0001$). Factors significantly associated with PSD at baseline were higher NIH Stoke Scale score (adjusted OR 1.51, 95% CI: 1.03–2.23) and pain (adjusted OR 7.18, 95% CI: 1.52–33.89). NIHSS score (adjusted OR, 1.99, 95% CI: 1.12–3.52) as associated with PSD at month 9.

Conclusion: 80% Ghanaian stroke survivors have early PSD declining to 20% at month 9. Stroke severity is the persistent factor associated with PSD at baseline and follow-up, and good be a target for screening and promptly treating PSD.

1. Introduction

Poststroke depression (PSD) is rife among stroke survivors affecting approximately one third of individuals with stroke [1]. Outcomes for stroke survivors with PSD are poor due to recurrent vascular events, suboptimal functional recovery, with poor quality of life and increased mortality in this population [2,3]. The most consistent risk factors associated with PSD include physical disability, stroke severity, history of depression and cognitive impairment [2,4–6]. Evidence from longitudinal studies revealed a dynamic trajectory in PSD with a prevalence of 28% at month 1, 31% at months 1 to 6, 33% at months 6 to 12, 33% at year 1, 25% at year 5 and 23% at 5 years and beyond [4].

Management of PSD involves using appropriate screening instruments for detection and diagnosis followed by institution of pharmacotherapy, neuromodulation or psychosocial interventions either as solitary interventions or in combination. An expert consensus scientific statement noted that further research is needed to evaluate the optimal timing, threshold, and medications to use for PSD [7]. An understanding of the dynamics of depression risk after stroke in a longitudinal cohort may provide some insights into the potential time points for screening and possibly initiating therapy for PSD. Our objective was to determine and describe the trajectory of PSD in a cohort of Ghanaian stroke survivors followed for 9 months after an acute stroke. As a subaim, we compared the trajectory of PSD risk among stroke survivors on who were prescribed fluoxetine, a selective serotonin reuptake inhibitor (SSRI), with those who were not prescribed fluoxetine.

2. Methods

2.1. Study design and setting

This study is a secondary analysis of a cohort of 60 recent Ghanaian stroke survivors involved a pilot randomized trial assessing the feasibility of using a mobile health (mHealth) intervention under nurse

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guidance to improve blood pressure (BP) control [8]. Our study was approved by the Committee on Human Research Publication and Ethics (CHRPE) of the School of Medical Sciences, Kwame Nkrumah University of Science and Technology, in Kumasi, Ghana, as well as the Institutional Review Board at the Medical University of South Carolina. The study was conducted at the Neurology Clinic of the Komfo Anokye Teaching Hospital, a tertiary medical center in Kumasi, Ghana. Kumasi is the second largest city in Ghana with an estimated population of 4 million inhabitants. The Neurology clinic was instituted in 2011 and currently runs once a week providing care for adults > 16 years with neurologic disorders from 6 out of the 10 administrative regions of Ghana and serves an estimated population of 10 million [9]. The protocol and baseline characteristics of study participants have been previously published elsewhere [8,10,11]. Prospective assessments for PSD were conducted at baseline, months 3, 6 and 9.

2.2. Assessment of study participants

We collected demographic information including age, gender, educational status, monthly income as well as location of residence. Vascular risk factors were assessed among stroke survivors based on self-report, use of relevant medications and review of medical records for evidence of hypertension, diabetes mellitus, dyslipidemia, atrial fibrillation or other cardiac disorders, and history of cigarette smoking and alcohol use. The following criteria were used to assess vascular risk factor status and post-stroke depression (PSD).

- PSD was assessed using the 21-item Hamilton Depression Rating Scale [12] (HDRS), one of the most widely used instruments in stroke studies with a sensitivity of 0.84 (95% CI: 0.75–0.90) and specificity of 0.83 (95%CI: 0.72–0.90) [13]. HDRS is used to rate the severity of depression by assessing mood, feelings of guilt, suicide ideation, insomnia, agitation or retardation, anxiety, weight loss and somatic symptoms. Each item on the questionnaire is scored on a 3 or 5 point scale depending on the item on a Likert scale. Participants with a score of 0 to 7 points considered normal, 8–13 as mild depression, 14–18 as moderate depression, 19–22 as severe depression and > 23 as very severe depression. The HDRS questionnaire was first translated into Twi (a local dialect widely spoken in the Ashanti region, where the study was conducted), pre-tested and back-translated into English language to establish semantic equivalence. HDRS assessments were performed by two experienced Research Officers who received four weeks of training on the study instruments until proficiency was attained with inter-rater agreement of > 95% among hospital-based volunteers.
- Early-onset PSD was defined as PSD occurring within 1 month after stroke i.e. participants with PSD at enrollment into the study and Persistent PSD was defined as PSD at month 9.
- Pain: The presence of bodily pain and its severity was assessed using a visual analog scale for assessing severity of pain with 0 = no pain and 4 = highest pain intensity.
- Participant weight was measured in kilograms using a scale with patient standing at the anatomical position on a scale, and height measured in centimeters using a stadiometer with patient standing at the anatomical position in front of the stadiometer. The weight and height measurements were used to calculate the body mass index (BMI) at enrollment.
- Blood pressure was measured thrice on the upper left arm using a validated automatic sphygmomanometer, after at least 5 min of rest and the second and third readings were averaged for analysis. Hypertension was diagnosed if the patient was on antihypertensive medications over the last 15 consecutive days or if the patient had a systolic and/or diastolic blood pressure of ≥140/90 mmHg.
- Participants were considered to have diabetes mellitus if they were on hypoglycemic medications or if their fasting blood glucose levels were > 126 mg/dl and/or HbA1C > 6.5% [14].
- Dyslipidemia was defined as a high total cholesterol > 200 mg/dl or LDL-cholesterol > 130 mg/dl, triglyceride > 150 mg/dl or HDL-cholesterol < 40 mg/dl for women and < 50 mg/dl for men or previous use of statin for dyslipidemia [15].
- Current smoking status and alcohol intake status were ascertained from either the patient self-report or report from a reliable relative. A high alcohol intake was defined as ≥14 units per week for women, and ≥ 21 units per week for men.

Stroke type was defined radiologically into ischemic and hemorrhagic based on cranial CT scan done at onset of stroke symptoms for all study participants. Stroke severity was assessed using National Institute of Health Stroke Scale (NIHSS) [16], and functional status was assessed using the Barthels' Activities of Daily Living [17]. Data were obtained by two trained Research Assistants by reviewing medical charts, and interviewing stroke survivors and/or their proxies where applicable.

2.3. Statistical analysis

Means and medians were compared using the Student's *t*-test or Mann-Whitney's *U* test for paired comparisons. Proportions were compared using the Chi-squared test with Yates correction for proportions with subgroupings < 5. A multivariate logistic regression analysis was performed to identify independent predictors of PSD at enrollment (early-onset depression) and at month 9 (persistent depression). The putative factors included in the multivariable logistic regression were carefully selected on the basis of literature review and empiric evidence from our data (significant associations observed in bivariate analyses). In all analysis, two-tailed *p*-values < .05 were considered statistically significant with no adjustments for multiple comparisons. Descriptive statistics were used for trajectory of PSD. Statistical analysis was performed using SPSS version 19 and GraphPad Prism version 7.

3. Results

3.1. Prevalence of Poststroke depression at baseline

At baseline, 57 out of 60 study participants had HDRS scores completed of which 44 (77.2%) had scores > 7 indicative of depression. Of the 44 with PSD, 30 had HDRS scores between 8 and 13 (mild depression), 8 had scores between 14 and 18 corresponding to moderate PSD, 4 had severe depression (with scores between 19 and 22 with 2 subjects having very severe depression (HRDS score > 23). Socio-demographic variables such as age, gender, location of residence, household income and educational attainment were non-significantly different between those with early onset PSD as shown in Table 1. Among those with PSD, 75% had ischemic stroke compared with 46.2% among those without PSD. Significantly, those with PSD had more severe stroke with mean NIHSS score of 5.3 ± 3.4 compared with 2.5 ± 1.9, $p = .007$, worse functional status with mean modified Rankin score of 2.5 ± 0.8 versus 1.5 ± 0.9, $p = .001$. Furthermore, those with PSD reported more severe post-stroke pain with a visual analogue score of 2.0 ± 0.8 versus 1.3 ± 0.5 among those without PSD at baseline. There was a higher frequency of statin use among those with PSD (77.3%) than those without PSD (46.2%) but this may be due to the higher frequency of ischemic stroke in the group with PSD.

3.2. Risk factors for early onset PSD

Unadjusted logistic regression analysis identified stroke severity, pain, and statin use as factors associated with PSD. Upon adjustment for confounders, the factors that remained significantly associated with PSD with adjusted OR (95%CI) were NIHSS score, 1.51 (1.03–2.23), $p = .04$ and pain 7.18 (1.52–33.89), $p = .01$. (Table 2).

Table 1
Socio-demographic characteristics of early onset Post-stroke depression.

Characteristic	Early-onset Post-stroke depression	No early onset post-stroke depression	P-value
	N = 44	*N* = 13	
Female, n (%)	18 (40.9)	2 (15.4)	0.09
Age, median (IQR)	59 (46–66)	45 (42–61)	0.14
Location of domicile			0.63
Urban	27 (61.4)	7 (53.8)	
Rural	17 (38.6)	6 (46.2)	
Marital status			0.02
Single	1 (2.3)	3 (23.1)	
Married	33 (75.0)	9 (69.2)	
Divorced/separated/ widow	10 (22.7)	1 (7.7)	
Household income/month			0.66
0–100 USD	14 (31.8)	5 (38.5)	
> 100 USD	30 (68.2)	8 (61.5)	
Educational attainment			0.31
None/primary level	22 (50.0)	7 (53.8)	
Secondary level	15 (34.1)	2 (15.4)	
Tertiary level	7 (15.9)	4 (30.8)	
Stroke type			0.12
Ischemic	33 (75.0)	6 (46.2)	
Hemorrhagic	9 (20.5)	5 (38.5)	
Untyped	2 (4.5)	2 (15.3)	
Stroke severity, NIHSS score, mean ± SD	5.3 ± 3.4	2.5 ± 1.9	0.007
Functional status, Barthels index, mean ± SD	72.2 ± 24.2	86.9 ± 16.8	0.046
Modified Rankin score, mean ± SD	2.5 ± 0.8	1.5 ± 0.9	0.001
Presence of post-stroke pain, score, mean ± SD	2.0 ± 0.8	1.3 ± 0.5	0.0025
Systolic BP, mean ± SD	143.5 ± 27.6	144.2 ± 27.0	0.94
Number of antihypertensive medications, median (IQR)	3 (2–3)	2 (2–3.5)	0.40
Use of statins, n (%)	34 (77.3)	6 (46.2)	0.043
Anti-diabetic medications, n (%)	8 (18.2)	2 (15.3)	0.82
Use of fluoxetine, n (%)	20 (45.5)	4 (30.8)	0.35

3.3. Dynamics of Poststroke depression

The mean ± SD score on the Hamilton Depression Scale at baseline was 10.9 ± 5.7, decreasing to 7.8 ± 5.4 at month 3, to 6.9 ± 5.5 at month 6 and to 5.5 ± 5.2 at month 9, $p < .0001$ by ANOVA. (Fig. 1A) Correspondingly, at baseline, 78.6% of stroke survivors had depressive symptoms, decreasing significantly to 43.6% at month 3, 41.1% at month 6 and 18.2% at month 9, p < .0001 by Chi-squared test. (Fig. 1B) Overall, the slope of decline in HDRS score for the study participants overall was −0.59 units per month. Among those assigned to the mHealth intervention for blood pressure control for a 3 month period, the HDRS scores declined from 10.6 ± 5.4 at baseline to 7.5 ± 5.8, $p = .040$ but among those on standard care, HRDS declined non-significantly from 11.1 ± 6.1 at baseline to 8.1 ± 4.9, at month 3, $p = .051$.

3.3.1. Effect of fluoxetine on HDRS scores

The mean score on the HDRS among those who were prescribed fluoxetine at a dose of 20 mg once daily at enrollment was not significantly higher than those prescribed fluoxetine, 11.7 ± 4.6 versus 9.6 ± 6.9, $p = .15$. The scores on HDRS declined in both groups being 9.6 ± 6.9 at month 0, 7.9 ± 6.5 at month 3, 6.2 ± 4.9 at month 6 and 3.7 ± 3.1 at month 9, $p = .007$ (by ANOVA) for those not prescribed Fluoxetine after stroke. Among those prescribed fluoxetine, HDRS also declined from 11.7 ± 4.6 at month 0 to 7.8 ± 4.6 at month 3, 7.3 ± 5.8 at month 6 and 6.6 ± 5.8 at month 9, $p = .0004$. At month 9, the mean HDRS score was significantly lower among those not prescribed fluoxetine at 3.7 ± 3.1 versus 6.6 ± 5.8, $p = .04$. The slope of decline in depression scores among those not prescribed fluoxetine was −0.64 ± 0.05 units per month compared with −0.53 ± 0.19 units among those prescribed fluoxetine, $p = .61$ (comparison of slopes). Fig. 2A shows the trajectory of HDRS among stroke survivors who were not prescribed fluoxetine compared with those prescribed fluoxetine for < 3 months and those who used fluoxetine for between 3 months and 9 months. At baseline, 15 out of 23 (65.2%) subjects who were never prescribed fluoxetine had depression and at 9 months, only 2 out of these 22 (9.1%) subjects had persisting depression. Among those who had prescription for Fluoxetine, 29 out of 34 (85.3%) had depression at baseline and 8 out of 34 (23.5%) had persisting depression at month 9.

3.3.2. Effect of baseline stroke severity on trajectory of PSD

Among stroke survivors with mildly severe stroke at enrollment (NIHSS score 0–4, $n = 30$), mean scores on HDRS at enrollment was 8.2 ± 4.4, decreasing to 5.8 ± 3.7 at month 3, 5.7 ± 4.0 at month 6 and 4.0 ± 3.1 at month 9, $p = .0006$ by ANOVA. Among those with moderate-to severe strokes (NIHSS score > 4, $n = 27$), baseline HDRS score was 13.8 ± 5.6, declining to 9.9 ± 6.0 at month 3, 8.2 ± 6.5 at month 6 and 7.2 ± 6.4 at month 9, $p = .0009$ by ANOVA. As shown in Fig. 2B, the curve for those with moderately severe strokes remained consistently above that for those with mild stroke at enrollment.

3.4. Frequency and factors associated with Poststroke depression at month 9

Next, we compared those with depression at month 9 ($n = 10$) with those without depression ($n = 45$) in Table 3. Compared with those without depression at month 9, those with depression were significantly more likely to have attained no or primary level education, have higher NIHSS scores at month 9, lower Barthels index scores at month 9, higher modified Rankin score and perceived pain. Although, there were no significant differences in mean systolic blood pressures between the two groups, those with persistent depression at month 9 were on fewer

Table 2
Factors associated with early onset Post-stroke depression.

Predictor	Unadjusted OR (95% CI)	P-value	Adjusted OR (95% CI)	P-value
Increasing age, each 10 years higher	1.42 (0.84–2.37)	0.19	–	–
Female gender	3.81 (0.75–19.28)	0.11	–	–
Stroke severity, each unit increase in NIHSS score	1.49 (1.10–2.02)	0.01	1.51 (1.03–2.23)	0.04
Pain, each unit increase	7.41 (1.97–27.83)	0.003	7.18 (1.52–33.89)	0.01
Prescribed Fluoxetine	1.88 (0.50–7.01)	0.35	–	–
Statin use	3.97 (1.08–14.53)	0.04	4.37 (0.84–22.80)	0.08
Ischemic stroke	3.67 (0.95–14.15)	0.06	–	–
Rural residence	0.83 (0.24–2.90)	0.77	–	–
No education/primary education versus higher (referent)	0.99 (0.28–3.47)	0.99	–	–
Not married	0.48 (0.11–2.00)	0.31	–	–

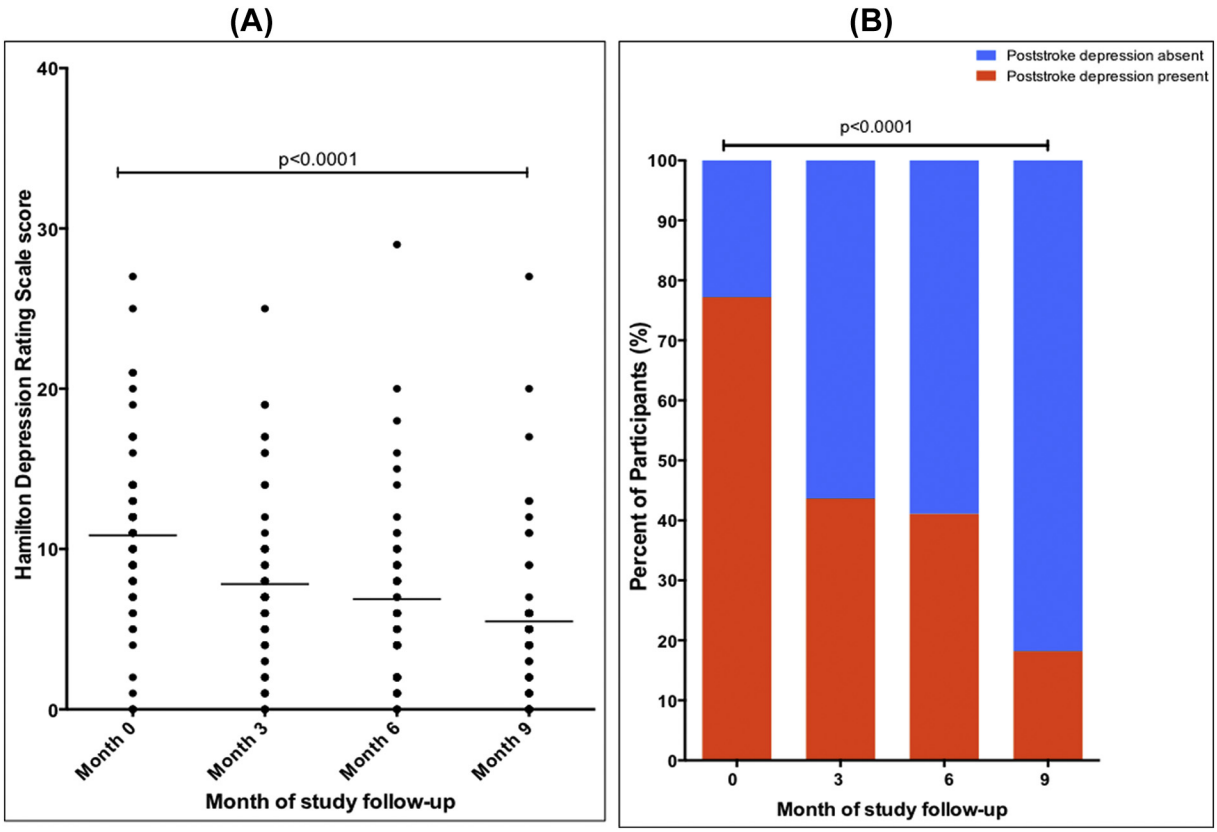

Fig. 1. A. Changes in mean scores on the Hamilton Depression Rating Scale over time among Ghanaian stroke survivors. Fig. 1B. Prevalence of depression assessed using the Hamilton Depression Rating Scale over time among Ghanaian stroke survivors.

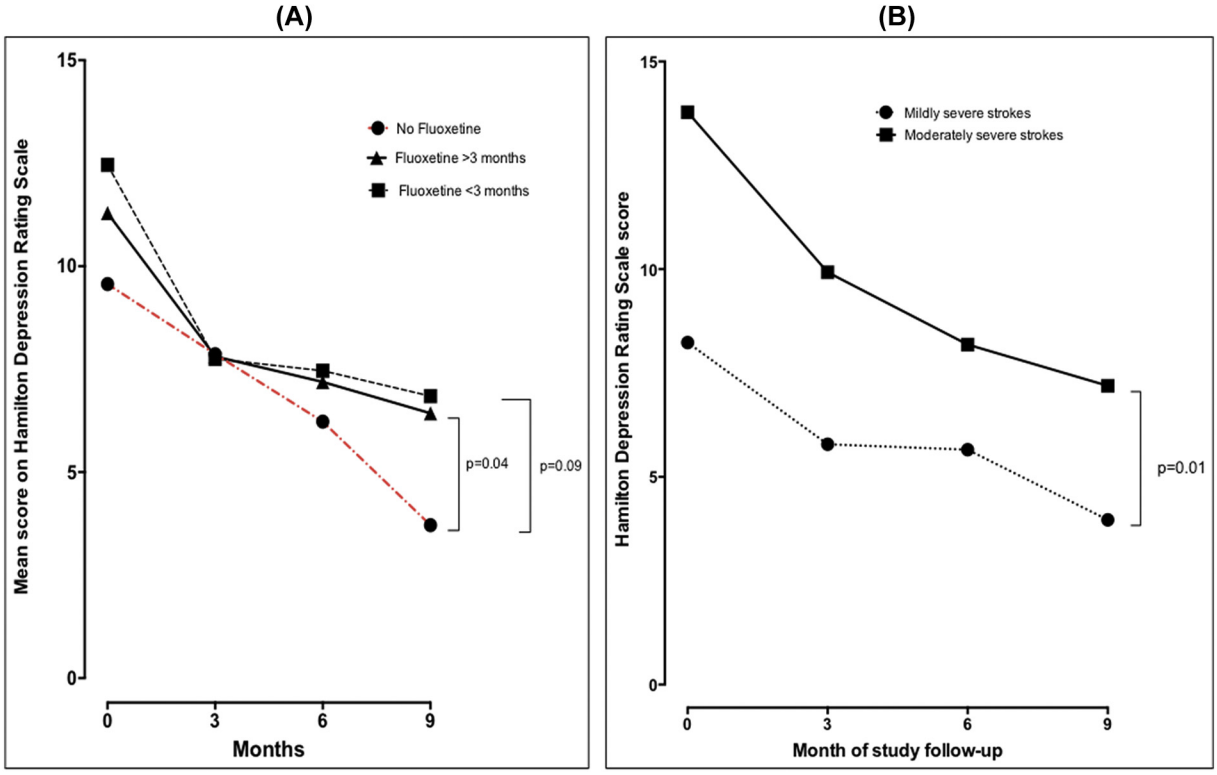

Fig. 2. A. Trajectory of depression over 9 months among Ghanaian stroke survivors according use of Fluoxetine and duration of Fluoxetine use. Fig. 2B: Trajectory of depression over 9 months among Ghanaian stroke survivors according use of severity of stroke assessed using the National Institute of Health Stroke Scale at baseline.

Table 3
Socio-demographic characteristics of persisting Post-stroke depression at month 9.

Characteristic	Persisting post-stroke depression	No post-stroke depression at month 9	P-value
	N = 10	N = 45	
Female, n (%)	5 (50.0)	15 (33.3)	0.32
Age, median (IQR)	60.7 ± 10.6	54.1 ± 12.8	0.14
Location of domicile			0.90
Urban	6 (60.0)	26 (57.8)	
Rural	4 (40.0)	19 (42.2)	
Marital status			0.55
Single	0 (0.0)	3 (6.7)	
Married	9 (90.0)	34 (75.6)	
Divorced/separated/widow	1 (10.0)	8 (17.7)	
Household income/month			0.59
0–100 USD	4 (40.0)	14 (31.1)	
> 100 USD	6 (60.0)	31 (68.9)	
Educational attainment			0.04
None/primary level	8 (80.0)	20 (44.4)	
Secondary level or higher	2 (20.0)	25 (55.6)	
Stroke type			0.60
Ischemic	8 (80.0)	30 (66.7)	
Hemorrhagic	2 (20.0)	12 (26.7)	
Untyped	0 (0.0)	3 (6.6)	
Stroke severity at month 9, NIHSS score, mean ± SD	7.4 ± 7.7	1.4 ± 1.7	< 0.0001
Functional status at month 9, Barthels index, mean ± SD	69 ± 35	97 ± 9	< 0.0001
Modified Rankin score at month 9, mean ± SD	2.3 ± 1.1	1.6 ± 0.6	0.006
Pain, mean ± SD	2.2 ± 0.8	1.6 ± 0.9	0.04
Systolic BP, mean ± SD	143.7 ± 18.1	139.4 ± 21.7	0.57
Number of antihypertensive medications, median (IQR)	2.1 ± 0.6	2.8 ± 1.0	0.04
Use of statins, n (%)	10 (100.0)	33 (73.3)	0.06
Use of fluoxetine at month 9, n (%)	6 (60.0)	13 (28.9)	0.06

antihypertensive medications than those without depression. A multivariate model identified stroke severity at month 9 as the sole independent factor associated with PSD at month 9 with adjusted OR (95%CI) of 1.99 (1.12–3.52), $p = .018$ for each unit rise in NIHSS score. This association between stroke severity and PSD persisted among those who were prescribed fluoxetine, unadjusted OR (95%CI) of 1.59 (1.02–2.45), $p = .04$. (See Table 4.)

4. Discussion

We found nearly 8 out of 10 Ghanaian stroke survivors had mild to severe depression within the first month of stroke onset. During follow-up, depressive symptoms resolved with approximately 20% having PSD at month 9 of follow up. Stroke severity and post-stroke pain were independently associated with early onset PSD and stroke severity remained persistently associated PSD at month 9. Indeed, stroke survivors with moderately severe strokes had persistently higher scores on the HDRS over follow-up compared with those with mild strokes. Furthermore, we observed a resolution of depressive symptoms whether or not patients were prescribed fluoxetine. Persistence of PSD at month 9 was accompanied by lower functional status and higher level of disability. Finally, there was a significant decline in scores on the HDRS within the 3 months period for those assigned to the mHealth intervention for blood pressure control under nurse guidance than those on standard of care. This observation may have been due to more provider input to stroke care and potentially on stroke recovery afforded by the PINGS intervention compared with usual care.

An area of uncertainty in the clinical management of PSD is the optimal time to screen for, and when to initiate treatment for PSD given that PSD may resolve in a subset of stroke patients [7]. The decline in PSD severity and frequency within the proximal 3 months after stroke found in our Ghanaian cohort, may suggest that screening should be carried out promptly after stroke onset preferably within the first month and probably repeated once or twice more before month 3 to identify those with persistent depressive symptoms for possible therapeutic interventions. This approach has support from the AIM (Activate-Initiate-Monitor) clinical trial where nurses employed psycho-educational sessions to activate stroke survivors and their families to understand post-stroke depression, accept and initiate antidepressant therapy with monitoring of patients for 3 months [18]. Screening may be of higher yield and utility among patients with moderate to severe stroke who have a higher propensity for both early-onset and persistent PSD.

This is a secondary analysis of a clinical trial designed to evaluate feasibility of mHealth for post-stroke blood pressure control in Ghana. Hence reasons for prescription of fluoxetine and duration of its use were not captured. Without screening for post-stroke depression, it is likely that fluoxetine was prescribed by physicians at this single study site based on the observed association between SSRI use and motor recovery after stroke [19,20]. However the purported beneficial effect of SSRI on functional outcomes has recently been challenged by findings from a large RCT conducted in the United Kingdom [21]. It is of interest to note that the curve of decline in depression risk among stroke survivors on prescribed fluoxetine remained consistently above those not prescribed a selective serotonin reuptake inhibitor during follow-up. Admittedly, the baseline mean score on the HDRS was non-significantly higher among those prescribed fluoxetine than those not prescribed. However, a meta-analysis of 12 trials involving 1121 subjects demonstrated efficacy of antidepressant medications for treating PSD [22]. The optimal threshold and timing for initiation antidepressant medications as well as which medications should be used remains to be clearly and rigorously delineated in controlled studies. Our observations may support a notion that pharmacotherapy may need to be supplemented with psycho-educational interventions to achieve more sustained remission of PSD for patients whose depressive symptoms do not resolve optimally on pharmacotherapy alone.

A few studies have been conducted to assess the prevalence of PSD in sub-Saharan Africa where the burden of stroke is rapidly rising and outcomes are poor [23–37]. These previous studies conducted among indigenous African stroke subjects, all of which were cross-sectional with variable duration of stroke diagnosis, reported post-stroke

Table 4
Factors associated with late-onset or persisting Post-stroke depression.

Predictor	Unadjusted OR (95% CI)	P-value	Adjusted OR (95% CI)	P-value
Age > 60 years	3.50 (0.80–15.35	0.10	–	–
Female gender	2.00 (0.50–8.00)	0.33	–	–
No education/primary education versus higher (referent)	5.00 (0.95–26.23)	0.06	11.45 (0.77–169.51)	0.08
Stroke severity, each unit increase in NIHSS score	1.87 (1.22–2.85)	0.004	1.99 (1.12–3.52)	0.018
Ischemic stroke	1.73 (0.32–9.31)	0.52	–	–
Pain at month 9	2.25 (0.98–5.14)	0.05	2.18 (0.75–6.31)	0.15

depression rates ranging between 20% and 40% [38–46]. The present study highlights a dynamic and sustained downward trajectory in the burden of PSD in a longitudinal cohort from West Africa with stroke severity exerting differential impact on PSD kinetics. Given that patients with PSD tended to have worse functional outcomes at month 9, clinicians need to be mindful of depressive symptoms among stroke survivors during follow-up and institute the necessary referrals for its clinical management.

A limitation of our study is the relatively small sample size which resulted in wide confidence intervals for adjusted odds ratios. This was a secondary analysis of a pilot clinical trial data with no formal power calculations performed a priori to assess the predictors of PSD. Other key variables known to be associated with PSD such as pre-stroke depression, cognitive dysfunction, and family dysfunction were not assessed in the current study with potential for residual confounding due to these and other unmeasured covariates. We also cannot draw causal associations between PSD and the factors identified in the present study. Furthermore, formal diagnosis of depression using a formal structured clinical interview based on the *Diagnostic and Statistical Manual of Mental Disorders, 4th Edition criteria* was not performed. In spite of these limitations, our study findings contribute to the knowledge base on the salience of the dynamic trajectory of PSD within the context of a resource-limited setting such as ours.

In conclusion, 8 in 10 Ghanaian stroke survivors experience PSD within a month of stroke onset with persistence of depression in about 2 in 10 at month 9 of follow-up. Adequately powered interventional, multi-center trials are eagerly awaited to provide solid evidence base to determine the optimal timing for screening and treatment of PSD.

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Declaration of Competing Interest

None to declare.

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