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PHQ-9 DIAGNOSTIC ACCURACY AND OPTIMAL CUT-OFF FOR DEPRESSION AMONG PATIENTS WITH STROKE IN NIGERIA

I.N. Okeafor[1], C.U. Okeafor[2]

1. Department of Public Health, Federal Ministry of Health, Nigeria
2. Department of Mental Health, University of Port Harcourt Teaching Hospital, Port Harcourt, Nigeria

Correspondence:
Dr. C. U Okeafor
Department of Mental Health,
University of Port Harcourt
Teaching Hospital
Port Harcourt,
Nigeria.
chukwuma.okeafor@uniport.edu.ng

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ABSTRACT

Background: **Depression is one of the most common and devastating consequences among stroke survivors. In spite of the availability of treatment for depression, the non- or under-detection precludes patients from benefiting from it.**

Objectives: **This study sought to validate the Patient Health Questionnaire (PHQ-9) as a tool for detecting depression among patients with stroke.**

Methodology: **A cross-sectional design comprising of adult patients diagnosed with stroke, who were attending the Neurology out-patient clinic of the University of Port Harcourt Teaching Hospital was employed in the study. The Receiver Operator Characteristics (ROC) curve and validity tests were performed using the Structured Clinical Interview for Diagnostic and Statistical Manual of Mental Disorders (SCID-DSM IV) as the gold standard. The optimal PHQ-9 cut-off was determined using Youden Index. Kappa statistics was performed at $p<0.05$.**

Results: **The study had a total of 197 stroke cases with PHQ-9 and SCID-DSM IV findings. The median age was 54 years (range: 35-76 years). ROC Curve for PHQ-9 revealed an Area under the Curve (AUC) value of 0.93(95% CI: 0.88-0.98). The optimal cut off value of six was obtained based on Youden Index. Sensitivity, specificity, positive predictive and negative predictive values at the optimal cut-off were 88.7%, 93.1%, 82.5% and 95.7% respectively. The Kappa statistics yielded 0.80 (95% CI: 0.68-0.86).**

Conclusion: **PHQ-9 is a useful screening tool for identifying depression among patients with stroke. An optimal cut-off score of six for PHQ-9 should be adopted for patients with stroke in Nigeria to identify depression, and the provision of holistic care.**

Keywords: Stroke, Depression, PHQ-9, Validity, Optimal cut-off

INTRODUCTION

Globally, stroke has been recognized as a major health problem, largely due to the negative effect on the physical and mental wellbeing of the affected individual.[1] Stroke, also known as Cerebrovascular Accident (CVA) has been defined as a rapidly developing clinical features of focal or global neurological deficit, lasting twenty-four hours or longer or even leading to death with no apparent cause other than that of vascular origin.[2] Beyond the high prevalence of stroke, and being the leading cause of adult physical disability, the sequelae on the mental health of the sufferer is contributing greatly to the burden of stroke especially in low-and middle-income countries.[1] Notably, of all the neuropsychiatric consequence of stroke, depression tops the list, as being the most common.[3]

Depression is increasingly being recognized as a significant sequelae of stroke across the globe.[4,5] The frequency of depression following stroke ranges from 29% to 36%.[4] Sadly, depression gives a double negative impact in stroke. Firstly, it hinders complete recovery of the stroke victim, which could lead to prolonged hospitalization.[6] Secondly, depression, though a mental disorder has been shown to increase the risk of cardiovascular disease, which invariably increases the risk of the occurrence of another stroke in the victim.[7,8] Thus, greatly compromising the quality of life of the patient and increasing the mortality risk.[9,10]

Undoubtedly, the treatment of depression is vital to the improved clinical outcome among affected patients with stroke. Therefore, early recognition of depression is vital in patient care. However, this could be difficult especially in low-resource settings, where the focus in stroke care is solely on the restoration of cognitive and motor function.[11]This is not unconnected to the high patient load in the out-patient clinics, which pre-

empts depression screening. Hence, there is a need for a validated, brief, and easy to administer tool for assessing depression among patients with stroke in such settings. This will ensure holistic care and avert the negative aftermath stemming from undiagnosed and subsequently untreated depression.

Notably, several screening tools for depression exist. The Patient Health Questionnaire-9, commonly referred to as PHQ-9 is an easy to administer tool for identifying depression in out-patient settings.[12] The PHQ-9 also has the advantage of being concise, and has been widely used in most primary care settings.[12,13,14] However, its use among patients with stroke is yet to be fully elucidated. Also, the controversy of the optimal cut-off of the tool in identifying depression among patients with stroke necessitates present research. Although, validation studies carried out in primary care settings have found the tool useful.[12,13] The validation findings among patients with stroke is limited, with no optimal cut-off identified for patients with stroke in Nigeria.

This study therefore sought to validate the usefulness of PHQ-9 in diagnosing depression in relation to the gold standard of the Structured Clinical Interview for Diagnostic and Statistical Manual of Mental Disorders (SCID-DSM IV), and also determine the optimal cut-off value of PHQ-9 for depression among patients with stroke.

MATERIALS AND METHODS

Study area and study population: The study was conducted in the University of Port Harcourt Teaching Hospital, (UPTH), a tertiary health institution in Port Harcourt, the capital of Rivers State, located in the southern part of Nigeria, West Africa. The study population comprised of adult patients diagnosed with stroke attending the Neurology out-patient clinic of UPTH. Patients with severe cognitive impairment were excluded from the study.

Study design: A descriptive cross-sectional validation study was employed, using the Patient Health Questionnaire (PHQ-9) as the screening tool and the Structured Clinical Interview for Diagnostic and Statistical Manual of Mental Disorders (SCID-DSM IV) as the gold standard tool.

Sample size calculation: Using the Right Size software, a sample size of 197 was obtained following a depression prevalence rate of 11.4% in a similar validation study,[13] alpha level of 0.05, precision of 5% and non-response of 20%.

Sampling method: A total of 10 stroke survivors attend the weekly Neurology clinic of UPTH. Convenience non probability sampling was employed in the recruitment of stroke survivors for the six-month study period.

Ethical considerations: Ethical approval was obtained from the Research and Ethics Committee of the University of Port Harcourt Teaching Hospital (UPTH). Informed written consent, confidentiality and anonymity were upheld in the research.

Data collection: Data was collected for a six-month period using PHQ-9 and SCID-DSM IV. The PHQ-9 is a self-administered easy to use questionnaire comprising of nine DSM-IV criteria for the depression module.[15] The scoring of each of the nine items that make up PHQ-9 comprise of '0' (not at all) to '3' (nearly every day). Thus, it has a minimum and maximum score of 0 and 27 respectively. It has been validated for use in primary care settings.[12,13]

The Structured Clinical Interview for Diagnostic (SCID) for DSM-IV was employed as the gold standard instrument for determining depression. It is a widely used semi-structured interview intended to determine whether an individual meets the criteria for any DSM disorder.[16] It was interviewer administered and it took about 10 to15minutes to fill the complete questionnaire. The overall content of SCID in this study was to assess both current and lifetime diagnoses of depression.[17]

Statistical analysis: Data were entered in Microsoft Excel and exported to IBM Statistical Package for Social Sciences version 23. The diagnostic accuracy of PHQ-9 in relation to the gold standard of SCID-DSM IV was determined using the Receiver Operator Characteristics (ROC) Curve and the Area under the Curve (AUC) values. The optimal cut-off was determined via Youden Index. Youden Index was computed for each of the PHQ-9 cut-offs using the formula: [(sensitivity + specificity) – 1]. The PHQ-9 cut-off points versus the corresponding Youden Index value was depicted on a graph. The PHQ-9 cut-off that yielded the maximum Youden Index was the optimal value. Validity tests were performed using sensitivity, specificity, positive predictive value, and negative predictive value. The Kappa statistics was performed to determine the level of agreement between the two tools. Confidence intervals were computed at the 95% level and a p-value of less than 0.05 was considered statistically significant.

RESULTS

Age and gender characteristics

The study had a total of 197 stroke cases with PHQ-9 and DSM-SCID findings. The median age was 54 years with minimum and maximum ages of 35 years and 76 years respectively. The Male to Female ratio was 2:1.

Determination of optimal cut-off using Youden Index

Figure 2 shows the plot between PHQ-9 cut-off values on the horizontal axis and Youden Index values on the vertical axis. The cut-off value of PHQ-9 with the highest value of Youden Index is the optimal cut-off as depicted in Figure 2. PHQ-9 optimal cut-off in stoke patients in the study, when rounded to the nearest whole number yielded a value of 6.

Table 1: Validity tests for PHQ-9 in relation to gold standard of DSM-SCID in identification of depression among stroke patients

		DSM-SCID (Gold Standard)		
		Depression	**No depression**	**Total**
PHQ-9 classification	**Depression (based on PHQ optimal cut-off ≥6)**	47 *True positive*	10 *False positive*	57
	No depression (PHQ score ≤5)	6 *False negative*	134 *True negative*	140
	Total	53	144	197

Kappa (95% CI)=0.80 (0.69-0.89); p-value=0.0001

CI)=0.80 (0.69-

$$Sensitivity = \frac{TruePositive}{TruePositive+FalseNegative} \times 100$$

$$= \frac{47}{47+6} \times 100 = 88.7\%$$

$$Specificity = \frac{TrueNegative}{TrueNegative+FalsePositive} \times 100$$

$$\frac{134}{134+10} \times 100 - 93.1\%$$

$$Positive\ Predictive\ Value\ (PPV) = \frac{True\ Positive}{TruePositive+False\ Positive} \times 100$$

$$\frac{47}{47+10} \times 100 = 82.5\%$$

$$Negative\ Predictive\ Value\ (NPV) = \frac{True\ Negative}{TrueNegative+False\ Negative} \times 100$$

$$= \frac{134}{134+6} \times 100 = 95.7\%$$

$$Overall\ Accuracy = \frac{True\ Positive+True\ Negative}{Total} \times 100$$

$$= \frac{47+134}{197} \times 100 = 91.9\%$$

PHQ-9 and DSM-SCID *findings*

The median (range) PHQ-9 score was 4 (1 – 22). The DSM-SCID reported 53 (26.9%) stroke cases with depression and 144 (73.1%) with no depression. The prevalence of depression among stroke cases was 26.9%.

Receiver operator characteristics (ROC) curve

ROC Curve for PHQ-9 revealed an Area under the Curve (AUC) value of 0.93(95% CI: 0.88-0.98). (Figure 1).

Validity of PHQ-9 using determined optimal cut-off in relation to DSM-SCID.

The study showed that based on an optimal cut-off of 6, the sensitivity and specificity of PHQ-9 is 88.7% and 93.1% respectively. Positive and negative predictive values yielded 82.5% and 95.7% respectively. The overall accuracy of PHQ-9 in this study was 91.9%.

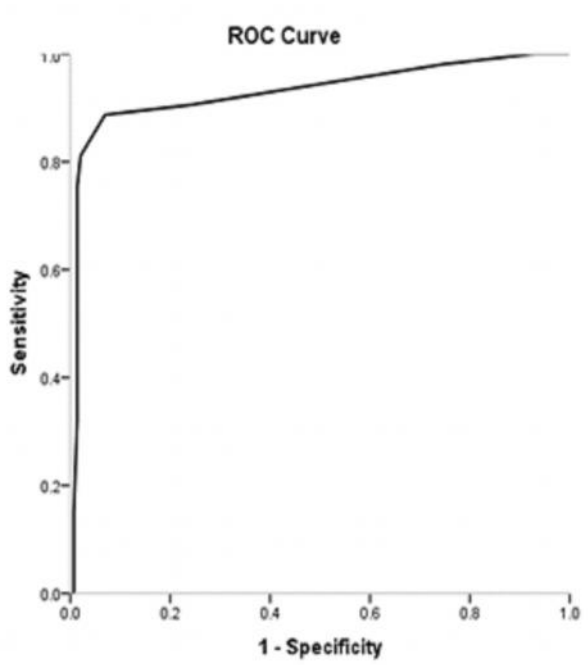

Figure 1: ROC Curve of PHQ-9 among stroke patients in relation to gold standard of SCID-DSM IV for diagnosis of depression.

The Kappa level of agreement between the two tools obtained a value of approximately 0.80, which was statistically significant (p=0.0001).

Structured Clinical Interview based on DSM-IV in identifying depression among the study population. The finding of AUC value of 0.930 (95% CI: 0.881-0.980) reflects the high discriminability property of the screening tool in identifying depression among patients with stroke. This finding is comparable to an AUC value of 0.87 (95% CI: 0.78-0.96) reported in the study among Thai patients,[12] and AUC value of 0.85 (95% CI: 0.82-0.90) among South African patients.[13] Unlike the index and Thailand study,[12] which comprised of patients with stroke, the South-African study[13] comprised of patients with chronic illness. The similarity of our findings with the South-African study in spite of the differences in the study population could be explained by the understanding that stroke could constitute a chronic illness due to the prolonged disability among the sufferers. Another African study with focus on depression among patients with epilepsy also reported similar AUC value with the index study.[18] Concerning the optimal-cut off for PHQ-9 among stroke patients in Nigeria, this study appears to be the first to achieve this feat. The optimal cut-off value of six obtained in this study is in agreement with another study involving stroke patients in Thailand.[12] The study in Thailand reported the same value of six as their optimal cut-off. The study population of both studies comprising of patients with stroke and the study

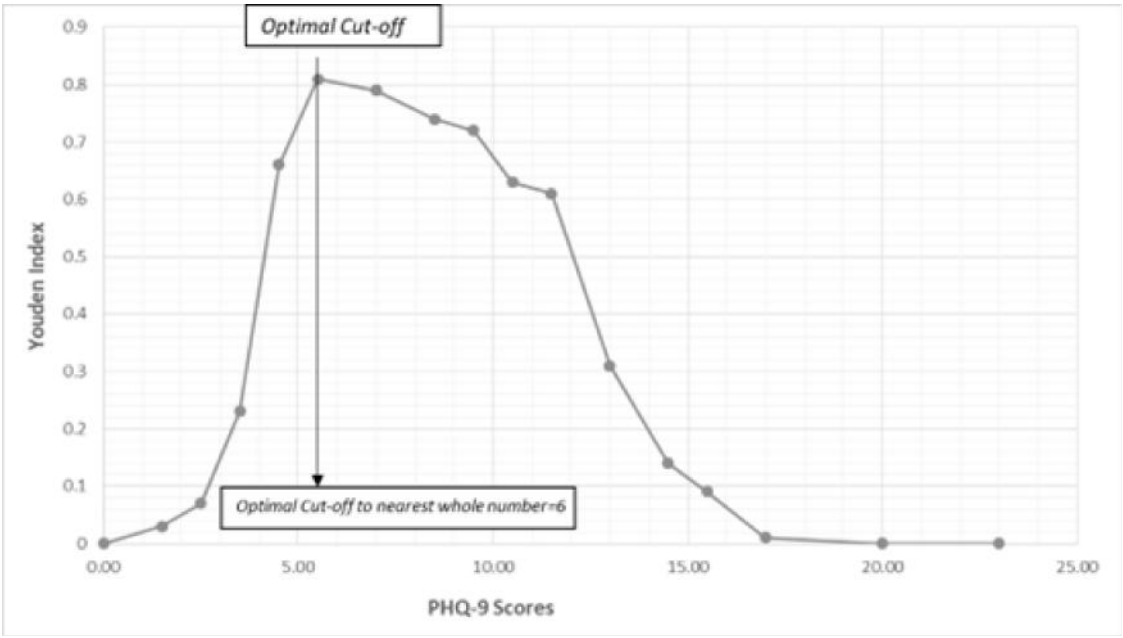

Figure 2: Plot between PHQ-9 scores and Youden's Index to identify optimal cut-off

DISCUSSION

The assessment of PHQ-9 diagnostic accuracy and optimal cut-off for patients with stroke in low resource settings such as Nigeria in this study fills the existing knowledge gap. This study investigated PHQ-9 as a screening tool in relation to the gold standard of

settings being alike i.e. low-middle income countries, could explain the similarity reported. Furthermore, another African setting, though among patients with epilepsy also noted a cut off value of six.[18] Other studies have reported cut-off values of nine and 12, which

are at variance with the index study.[19,20,21] However, in contrast to the index study, these studies comprised of a non-stroke study population.

It has been noted that study settings of middle-high income countries report higher cut-offs scores for depression in comparison to resource constrained settings.[19,20,21] This subtly reveals the possible contributory role of external environment to depression. The absence of social support services, lack of health insurance, payment of health care services via out-of-pocket method, limited rehabilitation services and equipment, are some of the sad realities confronted by patients with stroke in resource constrained settings.[22] Of course, these impinge on their emotional state, leading-to or worsening the depressed state. These unfavourable external conditions herald the need for national and international agencies to collaborate with the government of such settings in tackling these issues. Also, the importance of domesticating cut-offs due to the peculiarities of the study population is a necessity. Notably, the identification of optimal cut-off would reduce the incidence of false-positives and false-negatives in depression screening.

The optimal cut-off value of six observed among patients with stroke in this study yielded a sensitivity and specificity of 88.7% and 93.1%, which reveal the good psychometric properties of PHQ-9. This is in keeping with several studies.[14,18,20,21] Higher values of 85.2% and 95.7% were reported as positive and negative predictive values respectively. This observation further exposes the usefulness of PHQ-9 as a screening tool for depression. In the same vein, the overall accuracy of PHQ-9 of 91.2% shows it matches very close to the gold standard of the structural clinical interview, which is quite demanding, tasking and requires user competency skills.

The limitation of this study includes the inability to determine the optimal cut-off for assessing the levels of severity of depression. This was attributed to the categorization of the patients using the gold standard tool, as either depressed or not depressed. This therefore pre-empted the assessment of optimal cut-offs of PHQ-9 in accordance with the degree of depression. The authors hope that this gap could stir up further research in this area. Another limitation was the possibility of social desirability bias among the patients with stroke, this was minimized by patient reassurance, anonymity, and confidentiality.

CONCLUSION

The diagnostic accuracy of PHQ-9 in relation to the gold standard of the structured clinical interview reveals it as a valid screening tool for detecting depression among patients with stroke using an optimal cut-off value of six among patients in low-constrained settings such as Nigeria. The findings on the accuracy of PHQ-9 in this study requires its widespread use in Neurology out-patient clinic in Nigeria to ensure patients with stroke receive holistic care, which will in turn promote their wellbeing and quality of life.

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