



## Association between post-stroke psychological disorders, activity limitations and health-related quality of life in chronic stroke survivors in Benin

Orthelo Léonel Gbètoho Atigossou, Fatimata Ouédraogo, Aristide S. Honado, Etienne Alagnidé, Toussaint Godonou Kpadonou & Charles Sèbiyo Batcho

To cite this article: Orthelo Léonel Gbètoho Atigossou, Fatimata Ouédraogo, Aristide S. Honado, Etienne Alagnidé, Toussaint Godonou Kpadonou & Charles Sèbiyo Batcho (2022): Association between post-stroke psychological disorders, activity limitations and health-related quality of life in chronic stroke survivors in Benin, *Disability and Rehabilitation*, DOI: [10.1080/09638288.2022.2083703](https://doi.org/10.1080/09638288.2022.2083703)

To link to this article: <https://doi.org/10.1080/09638288.2022.2083703>



Published online: 11 Jun 2022.



Submit your article to this journal [↗](#)



View related articles [↗](#)



View Crossmark data [↗](#)

# Association between post-stroke psychological disorders, activity limitations and health-related quality of life in chronic stroke survivors in Benin

Orthelo Léonel Gbètoho Atigossou<sup>a,b,c</sup>, Fatimata Ouédraogo<sup>c,d,e</sup>, Aristide S. Honado<sup>f</sup>, Etienne Alagnidé<sup>c,g</sup>, Toussaint Godonou Kpadonou<sup>c,g</sup> and Charles Sèbiyo Batcho<sup>a,b</sup>

<sup>a</sup>Center for Interdisciplinary Research in Rehabilitation and Social Integration (Cirris), Centre Intégré Universitaire de Santé et de Services Sociaux de la Capitale Nationale (CIUSSS-CN), Quebec, Canada; <sup>b</sup>Department of Rehabilitation, Faculty of Medicine, Laval University, Quebec, Canada; <sup>c</sup>Ecole Supérieure de Kinésithérapie, Faculté des Sciences de la Santé, Université d'Abomey-Calavi, Cotonou, Benin; <sup>d</sup>School of Rehabilitation, Université de Montréal, Montreal, Canada; <sup>e</sup>Marie Enfant Rehabilitation Center, Sainte-Justine University Hospital Research Center, Montreal, Canada; <sup>f</sup>Service de Rééducation, Centre Hospitalier Universitaire Départemental de l'Ouémé et du Plateau (CHUD-OP), Porto-Novo, Benin; <sup>g</sup>Clinique Universitaire de Médecine Physique et Réadaptation, Centre National Hospitalier Universitaire Hubert Koutoukou MAGA (CNHU-HKM), Cotonou, Benin

## ABSTRACT

**Purpose:** To evaluate the association between depression/anxiety and activity limitations and health-related quality of life (HRQoL) in chronic stroke survivors in Benin.

**Materials and methods:** One hundred and seventy-six chronic stroke survivors (113 males; mean age ( $\pm$ SD): 56.5 ( $\pm$ 10.5) years old) were included. We used the Barthel index (BI) to assess activity limitations. Participants were screened for depression and anxiety symptoms using Hamilton Depression Rating Scale (HDRS) and Hamilton Anxiety Rating Scale (HARS). Euroqol-5 Dimensions-3 Levels (EQ-5D-3L) including a Visual Analog Scale (EQ-VAS) was used to assess HRQoL. Multivariate linear regressions were performed to determine the impact of psychological disorders on activity limitations and HRQoL.

**Results:** Depression ( $\beta = -0.54$ ;  $p < 0.0001$ ) and anxiety ( $\beta = -0.35$ ;  $p < 0.0001$ ) were negatively associated with activity limitations ( $R^2 = 0.60$ ). Similar patterns of association were observed with HRQoL ( $\beta \leq -0.28$ ;  $p < 0.0001$ ;  $R^2 \geq 0.40$ ). Inversely, occupational status showed positive association with EQ-5D-3L summary index scores ( $\beta = 0.21$ ;  $p = 0.015$ ).

**Conclusions:** Depression and anxiety had a negative impact on activity limitations and HRQoL in Beninese chronic stroke survivors. This call for action to integrate psychological interventions as part of rehabilitation programs in low and middle-income countries.

## ARTICLE HISTORY

Received 14 September 2021  
Revised 10 May 2022  
Accepted 15 May 2022

## KEYWORDS

Stroke survivors; activity limitations; depression; anxiety; health-related quality of life

## ► IMPLICATIONS FOR REHABILITATION

- Post-stroke depression and anxiety are quite common among stroke survivors in sub-Saharan Africa.
- Post-stroke depression and anxiety negatively impact activities and health-related quality of life in chronic stroke survivors in sub-Saharan Africa.
- Managing these post-stroke psychological disorders is necessary to promote the functional recovery and social reintegration of stroke survivors in their communities.

## Introduction

Stroke is one of the leading causes of acquired physical disability worldwide [1]. About two-thirds of stroke survivors continue to suffer from sensorimotor and cognitive impairments such as muscle weakness, spasticity, and memory deficits, that affect their daily and/or self-care activities, even six months after stroke onset [2–4]. This leads to many physical and psychosocial consequences such as activity limitations, psychological disorders, and poor health-related quality of life (HRQoL) [5,6]. Activity limitations are described as difficulties encountered by a person in performing various activities [7]. These limitations vary depending on the overall functional deficit, autonomy, or disability levels [8]. Stroke survivors also experience social isolation which seems to be associated with increased risk of post-stroke depression (PSD) [9–12]. The occurrence of the psychological disorders compromises

functional recovery and reintegration into the person's previous daily activities after a stroke [12,13]. Psychological disorders, mainly depressive and/or anxious mood, lead to important social consequences, ranging from loss of vitality to difficulty to communicate with others. Post-stroke depression is one of the common psychological disorders in stroke survivors and its prevalence in developed countries varies across studies (30–50%) [14–17] depending on time of assessment and evaluation tools. A study conducted in Finland had reported significant relationships between PSD and poor functional recovery and HRQoL [18]. A recent meta-analysis that included 14 randomized controlled trials highlighted the need for appropriate interventions to address depression after stroke [19]. Like PSD, there is evidence that post-stroke anxiety (PSA) also affects HRQoL in stroke survivors [17,20]. Moreover, PSA is considered as a predictor of PSD [20], and both

PSD and PSA represent important costly public health issues, warranting investigations into preventive and curative therapies [12,17]. In summary, stroke-related deficits and associated complications have significant long-term impact on patients' life. HRQoL deterioration after a stroke is more prevalent when activity limitations and psychological disorders are concomitantly present [21]. In Benin, a developing country in sub-Saharan Africa, little is known about the relationship between psychological disorders, activity limitations, and HRQoL in chronic stroke survivors. In fact, current neurorehabilitation research in this country mainly focuses on physical impairments, activity, and participation after stroke [22–24]. Overall, according to studies conducted in Africa context, physiotherapists tend to focus on the patient's main objective, which is to recover locomotion and manual functions [23,25,26]. In addition, in Benin, stroke survivors are not often assessed for psychological disorders since psychologists are not systematically part of the stroke rehabilitation teams. However, efficient patient-oriented rehabilitation strategy should address all stroke deficits and complications [27]. This suggests that, in low- and middle-income countries, understanding the impact of post-stroke psychological disorders on activity limitations and HRQoL is important for efficient management of stroke rehabilitation toward better social reintegration of stroke survivors. Unfortunately to our knowledge, there is very limited evidence on the relationship between psychological disorders, activity limitations and HRQoL in African chronic stroke survivors and no such study has been conducted in Benin. Therefore, this study investigated the association between depression/anxiety, activity limitations and HRQoL in chronic stroke survivors in Benin.

## Materials and methods

### Participants

Participants were recruited from January to November 2017, through the registers of rehabilitation unit of the Centre Hospitalier Universitaire Départemental de l'Ouémé et du Plateau (CHUD-OP) in Benin, a French-speaking country. We first searched medical files to identify potential participants in outpatients. Then, we contacted them by phone or met in person to briefly explain to them the study project. To those who expressed their interest, we gave them a detailed information letter about the study and the consent form. Participants who could move were assessed at the rehabilitation unit. For the others, the evaluation was done at their communities. Self-report and interview-based assessments were conducted with French version of selected questionnaires, and all included participants speak and understand French, even at various levels.

To be included in the study, participants should: (1) have suffered from a stroke at least 6 months before enrolment in the study, (2) have no major cognitive impairment likely to affect self-report (Mini-Mental State Examination (MMSE) score  $\geq 24$ ) [28], (3) not be on antidepressant and/or anxiolytic medication, and (4) be aged 18 years old or more. Exclusion criteria were: (a) presence of aphasia due to difficulty in assessing of aphasic stroke survivors by surveys, (b) presence of anxiety or depression symptoms prior to stroke event, and (c) diagnosis of dementia or other psychiatric disorders. This study followed the local ethics guidelines and was approved by no. 1610/2014/CHDOP/DIR/SAAE/SAF/SG/DGAP/SA. All included patients signed an informed consent form.

### Assessment procedure

Activity limitations were evaluated with the Barthel index (BI), a widely used instrument for assessing limitations in basic activities of daily living. It covers different domains of activities such as feeding, bathing, personal care, dressing, bowel, and bladder continence, washing, chair transfer, walking and stair climbing [8]. HRQoL was assessed with Euroqol three-level version instrument (EQ-5D-3L) through five dimensions, namely: mobility, personal care, usual activities, pain/discomfort, and anxiety/depression. EQ-5D-3L also includes a Visual Analog Scale (EQ-VAS), allowing respondents to report their perceived health status from 0 (worst imaginable health) to 100 (best imaginable health). Each dimension has three graded response categories. Due to unavailability of a weighting system for assessing EQ-5D-3L raw scores for Benin, we adopted the algorithm of Prieto and Sacristán in order to determine the unweighted summary scores based solely on the responses provided by subjects to descriptive dimensions of the EQ-5D-3L [29]. This method allows obtaining EQ-5D-3L summary index ranging from  $-0.59$  (worse health state) to a maximum of 1 (perfect health) [29,30]. Depression and anxiety symptoms were screened using the Hamilton Depression Rating Scale (HDRS) and Hamilton Anxiety Rating Scale (HARS) [31,32]. HDRS is a 17-item scale that allows patients to assess their current situation related to depression between 0 (no symptoms) and 4 (symptoms present in most of the time and interfere in the daily life of the patient). HDRS total scores of 0–7 are considered as being normal; 8–16 suggest mild depression; 17–23 moderate depression and scores  $\geq 24$  are indicative of severe depression [31]. HARS consists of 14 items about both psychological and physical symptoms of anxiety. The response format is the same as for HDRS, and its total score is interpreted as follows: 0–5 indicates “no anxiety”; 6–14 indicates “minor anxiety”; and  $\geq 15$  indicates “major anxiety” [32,33].

### Statistical analysis

Data were summarized using descriptive statistics such as frequency, percentage, mean and standard deviations – SD or median (25th–75th percentile). The sample was divided in subgroups based on socio-demographic characteristics such as gender, marital status, education, occupation, and monthly income. One-way analyses of variances (ANOVAs) were then performed to compare activity limitations, depression, anxiety, and HRQoL across subgroups. Numerical variables that were not normally distributed were compared using the nonparametric Kruskal–Wallis test. We used the Pearson or Spearman correlation coefficients to determine the relationships between anxiety, depression, and activity limitations and HRQoL in patients. Multivariate linear regressions were performed with HDRS and HARS scores (independent variables) and BI, EQ-5D-3L summary index and EQ-VAS scores (dependent variables), separately to determine the associative link between the two psychological disorders and activity limitations and HRQoL of stroke survivors. We also verified the inverse association between activity limitations and these two psychological disorders by the same method. Statistical significance was defined as  $p < 0.05$ . Statistical analyses were performed with IBM SPSS Statistics 22 software (Armonk, NY).

## Results

One hundred and seventy-six chronic stroke survivors (113 males; mean age ( $\pm$ SD): 56.5 ( $\pm$ 10.5) years old; median time since stroke (25th–75th percentile): 36 (14–60) months) participated in the

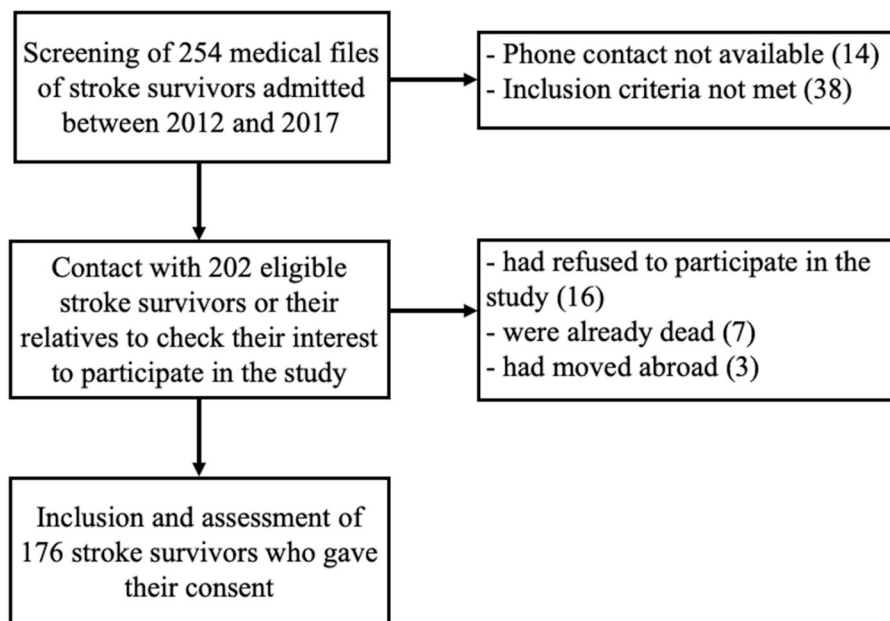


Figure 1. Sampling process diagram.

study. Figure 1 illustrates the sampling process. Participants' socio-demographic and clinical details are provided in Table 1. Mild depression was reported in 48.9% of patients, moderate depression in 19.9%, and severe depression in 11.9%. Minor anxiety was observed in 43.8%, while 46% of the sample presented major anxiety. We observed a significant difference of EQ-5D-3L summary index ( $p < 0.0001$ ) and EQ-VAS ( $p = 0.02$ ) in subgroups according to participants' occupational status. Similar patterns (EQ-VAS ( $p = 0.02$ ); EQ-5D-3L summary index ( $p < 0.0001$ )) were observed in subgroups defined according to monthly salary estimate. Figure 2 depicts correlations between depression/anxiety, activity limitations and HRQoL ( $r$  or  $\rho \leq -0.48$ ;  $p < 0.0001$ ). Tables 2–4 present linear regressions as an illustration of the impact of psychological disorders on activity limitations and HRQoL in chronic stroke survivors. Results showed that HDRS and HARS scores explained 60% of variances of BI scores, 57% of EQ-VAS scores, and 40% of EQ-5D-3L summary index scores. Conversely, BI scores explained 50% of variance of HDRS scores and 37% of variance of HARS scores.

## Discussion

The objective of this study was to assess associations between depression/anxiety and activity limitations and HRQoL in chronic stroke survivors in Benin. Our results showed that depression and anxiety were associated with activity limitations and HRQoL in chronic stroke survivors, and these psychological disorders accounted for large variances of activity and HRQoL scores.

Our study reports high proportions of mild to severe PSD (80.7%) and PSA (minor: 43.8%, major: 46%). Ezema et al., using the same depression evaluation tool as in our study, reported similar results in Nigeria with 84.8% of their chronic stroke patients with depression (about 57% severely depressed) [34]. These results suggest that PSD may be quite common among stroke survivors in sub-Saharan Africa and deserves to be taken into consideration in the overall rehabilitation of these patients [34,35]. Moreover, in this study, we focused on depression and anxiety occurring after the stroke. However, with a prevalence of up to 24%, pre-stroke depression has been shown to significantly

increase the odd of PSD [36]. Therefore, the exclusion of stroke survivors who presented with depression and anxiety before stroke onset might have resulted in an underestimation of the rates of psychological disorders reported in our study. It should be noted that the rate of PSD varies according to screening tools and time since stroke [15,16]. By way of illustration, Sarfo et al. in their study, observed a prevalence of 78.5% of PSD, using the 20-item Center for Epidemiologic Studies Depression Scale (CES-D tool), and 42.5% when considering the 15-item Geriatric Depression Scale (GDS) on the same stroke sample [36]. Another study has reported that approximately 40% of patients with an acute stroke will develop depression [37].

In our study, 46% of the participants presented major anxiety. Although PSA is less investigated compared to PSD, reported prevalence in high-income countries vary depending on the assessment methods (interview or standardized rating scale) and post-stroke periods. These variations across studies induce uncertainty about the true rate of PSA occurrence in stroke survivors [17]. Thus, many studies including that of Li et al. reported lower rates of major anxiety (approximately 20–30%) in the acute, sub-acute and chronic post-stroke phases [17,38]. However, some studies conducted by D'Aniello et al. [39], and Ponchel et al. [40] reported higher PSA rates in chronic stroke survivors, respectively, 55.6% in Italy and 40.8% in France. On the other hand, PSA is rarely evaluated in studies from sub-Saharan Africa and more details are needed to define its actual prevalence among stroke survivors in this region. Recently, Ojagbemi et al. have reported that one in three stroke survivors is anxious after 1 year indicating a gradual increase in PSA during the first post-stroke year [41]. In our study, the important rate of major anxiety in chronic stroke survivors could therefore be explained by the chronicity of the post-stroke situation, which may generate more anxiety due to the growing concern as time goes without full recovery of lost functions [17,41].

Multivariate linear regressions showed that depression and anxiety were associated with high activity limitations and conversely. Furthermore, these disorders were also associated with low HRQoL in Beninese chronic stroke survivors. These results confirm previous observations that depression and anxiety

**Table 1.** Patients' socio-demographic and clinical characteristics, mean ( $\pm$ SD) or median (25th–75th percentile).

Characteristics	Total	Activity limitations (BI)	Depression (HDRS)	Anxiety (HARS)	HRQoL (EQ-5D-3L summary index)	HRQoL (EQ-VAS)
Gender, <i>n</i> (%)						
Male	113 (64.2%)	54.42 ( $\pm$ 27.28)	14.22 ( $\pm$ 9.21)	14.81 ( $\pm$ 8.79)	0.36 (0.04–0.68)	39.73 ( $\pm$ 24.96)
Female	63 (35.8%)	50.40 ( $\pm$ 27.21)	15.33 ( $\pm$ 7.43)	13.68 ( $\pm$ 7.38)	0.36 (0.04–0.52)	35.48 ( $\pm$ 26.13)
Age (years)	56.47 ( $\pm$ 10.46)					
Body mass index (kg/m <sup>2</sup> )	21.64 ( $\pm$ 3.37)					
Marital status, <i>n</i> (%)						
Not married (single, divorced, widowed)	51 (29%)	47.94 ( $\pm$ 26.32)	14.98 ( $\pm$ 7.05)	14.73 ( $\pm$ 8.06)	0.36 (0.04–0.68)	35.00 ( $\pm$ 27.01)
Married	125 (71%)	55.04 ( $\pm$ 27.45)	14.47 ( $\pm$ 9.19)	14.27 ( $\pm$ 8.44)	0.36 (0.04–0.68)	39.52 ( $\pm$ 24.69)
Education, <i>n</i> (%)						
Primary school	55 (31.3%)	51.73 ( $\pm$ 25.20)	15.71 ( $\pm$ 8.22)	14.56 ( $\pm$ 8.17)	0.20 (0.04–0.52)	35.45 ( $\pm$ 23.49)
Secondary school	71 (40.3%)	52.18 ( $\pm$ 28.26)	15.07 ( $\pm$ 9.25)	14.28 ( $\pm$ 8.50)	0.36 (0.04–0.68)	40.00 ( $\pm$ 25.96)
University	50 (28.4%)	55.50 ( $\pm$ 28.30)	12.78 ( $\pm$ 7.93)	14.40 ( $\pm$ 8.36)	0.28 (0.006–0.84)	38.70 ( $\pm$ 26.79)
Occupational status, <i>n</i> (%)						
No professional activity	54 (30.7%)	46.76 ( $\pm$ 24.47)	16.31 ( $\pm$ 8.05)	15.93 ( $\pm$ 9.00)	0.04 (–0.27 to 0.36)	30.56 ( $\pm$ 23.08)
Retired	52 (29.5%)	54.62 ( $\pm$ 27.73)	14.06 ( $\pm$ 9.44)	14.06 ( $\pm$ 8.48)	0.36 (0.04–0.68)	43.56 ( $\pm$ 27.23)
Having an income-generating professional activity	70 (39.8%)	56.57 ( $\pm$ 28.44)	13.73 ( $\pm$ 8.31)	13.49 ( $\pm$ 7.56)	0.52 (0.20–0.84)**	40.14 ( $\pm$ 24.64)*
Monthly salary estimate (in American dollars \$), <i>n</i> (%) <sup>a</sup>						
No monthly income	54 (30.7%)	46.76 ( $\pm$ 24.47)	16.31 ( $\pm$ 8.05)	15.93 ( $\pm$ 9.00)	0.04 (–0.27 to 0.36)	30.56 (23.08)
0–200	53 (30.1%)	55.85 ( $\pm$ 29.51)	13.96 ( $\pm$ 8.60)	13.49 ( $\pm$ 7.70)	0.36 (0.20–0.84)	41.04 (26.71)
200–400	32 (18.2%)	50.00 ( $\pm$ 26.12)	15.25 ( $\pm$ 9.85)	16.03 ( $\pm$ 8.74)	0.36 (–0.07 to 0.68)	36.88 (26.81)
Beyond 400	37 (21%)	60.54 ( $\pm$ 27.30)	12.54 ( $\pm$ 8.05)	12.08 ( $\pm$ 7.26)	0.52 (0.20–0.84)**	46.49 (23.00)*
Time since stroke (months)	36 (14–60)					

BI: Barthel index; HDRS: Hamilton Depression Rating Scale; HARS: Hamilton Anxiety Rating Scale; EQ-5D-3L: Euroqol three-level version instrument; EQ-VAS: Euroqol Visual Analog Scale; SD: standard deviation.

\* $p < 0.05$ .

\*\* $p < 0.0001$ .

<sup>a</sup>Exchange rate: 1 \$US = 597 CFA francs (CFA: franc from French-speaking community of Africa).

negatively influence activity level and HRQoL in chronic stroke survivors. It has been demonstrated that stroke-related psychosocial consequences tend to lower the HRQoL and the functional status of stroke survivors [17,18,42]. In fact, faced with persistent stroke-related neurological deficits, patients end up with a lack of interest in rehabilitation, a decrease or even an absence of motivation, and eventually develop a feeling of hopelessness, helplessness, and social worthlessness, and all these contribute in the development of psychological disorders [34,35]. This leads to a vicious circle in the long term, as physical disabilities also have an impact on the development or the maintenance of these disorders [43]. Most patients end up not believing in a possible return to their pre-stroke life, giving up hope of resuming professional activity [44,45]. These so-called “invisible” disorders also contribute to lower participation in activities of daily living, and are not likely to allow better social reintegration [46]. Considering their high prevalence in chronic stroke survivors, it is important for rehabilitation professionals to pay particular attention to the evaluation and management of these psychological disorders to help stroke survivors regain as much functional independence as possible [47].

The socio-demographic characteristics used as covariates in linear regressions design in our sample, are similar to those reported in previous studies conducted in Benin [24,48,49]. Indeed, there was a male predominance in our sample as in Sogbossi et al. [24], Natta et al. [48], and Honado et al. [49]. Moreover, an epidemiological study carried out in an urban city in Benin by Cossi et al. [50] had also reported male predominance in stroke survivors. However, contrary to this observation, Adoukonou et al. have recently observed a female predominance in another epidemiological study carried out in a semi-urban city of Benin [51]. Similarly, a female predominance has been reported in Nigerian stroke survivors by Ezejimofor et al. [52]. Even though sex appears to be a risk factor for stroke in developing countries [53], regional context (e.g., rural or urban) seems to be an important factor to

take into account when examining male or female prevalence in stroke survivors.

We have also observed that occupation and monthly income had a significant impact on the HRQoL of stroke survivors. A similar result was reported by Singhpoo et al. in Thai stroke survivors [54]. In fact, 30.7% of stroke survivors in our study were no longer employed and had no personal monthly income because they no longer had the physical capacity to continue to work after their stroke in their informal manual jobs (drivers, carpenters, masons, hairdressers, seamstresses, and traders). The persistence of their disability according to the severity of the stroke is an additional concern which can explain the non-return to their professional activities [55,56]. In addition, they stated they were financially supported by their relatives in the absence of a national health insurance system. Similarly, 69.3% of assessed stroke survivors continued to receive a monthly income according to their professional status (retired, self-employed, or civil servant) after their stroke. These observations could justify the impact of occupation and monthly income on the HRQoL of stroke survivors in our study.

Finally, in the present study, participants' mean age (56.5  $\pm$  10.5 years old) is similar to the mean ages reported in studies carried out on post-stroke patients in sub-Saharan region [49,57,58]. Indeed, a mean age of 52.7 ( $\pm$ 11.7) years old was reported by Honado et al. [49] in Beninese stroke survivors, 54.8 ( $\pm$ 13.1) by Vincent-Onabajo et al. in Nigeria [57], and 55.1 ( $\pm$ 12.7) by Sarfo et al. in Ghana [58]. These figures appear to be lower than those of developed countries where mean age at stroke onset is often reported around 65 years old [59]. This could be explained by the effectiveness of the preventive health system set up in developed countries leading to later onset of stroke in these populations [60]. Stroke risk factors such as poor diet, obesity, high blood pressure, and high cholesterol are more prevalent in developing countries and promote early onset of stroke [61].

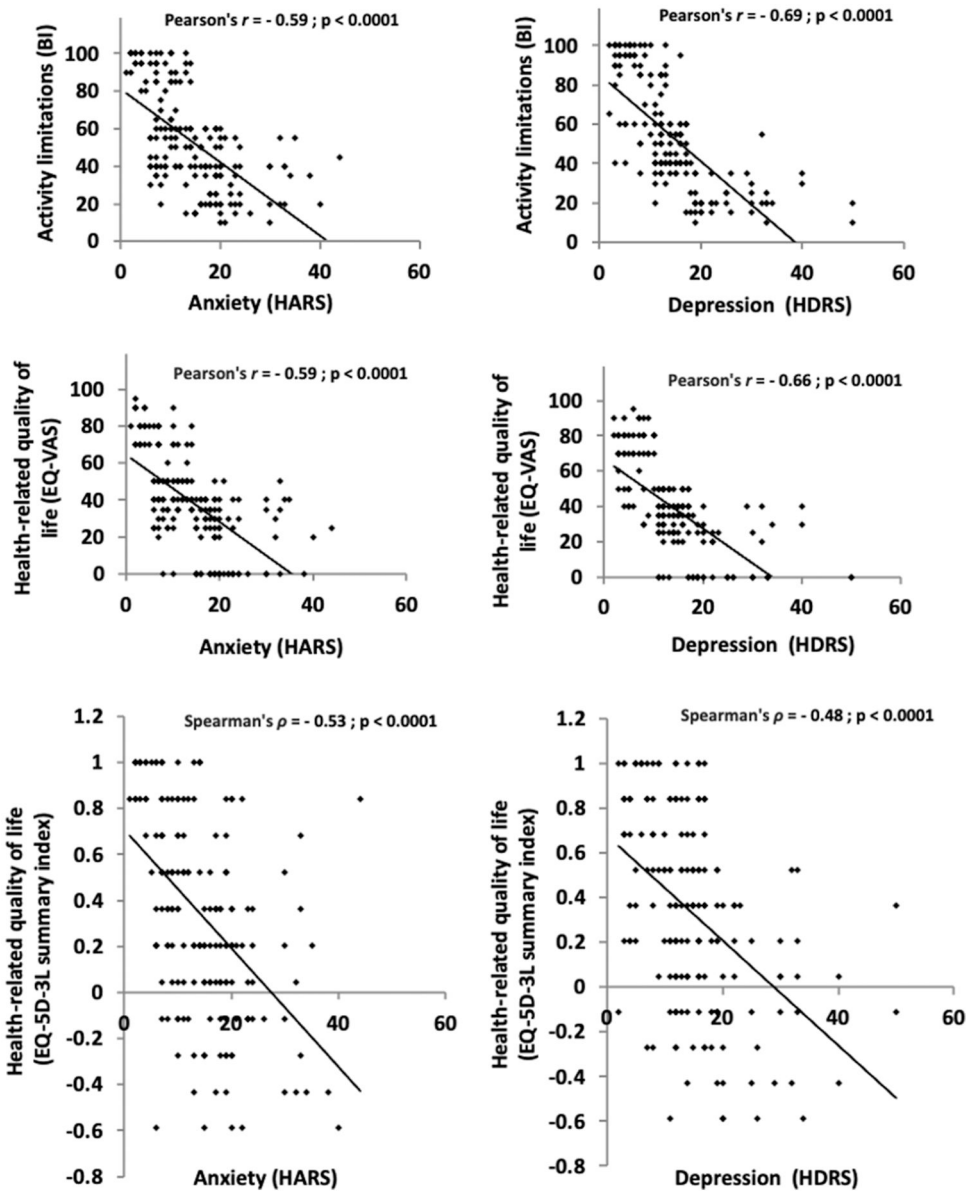


Figure 2. Relationships between depression/anxiety, and activity limitations, and health-related quality of life of stroke survivors.

Table 2. Multivariate linear regression analysis of Barthel index scores.

Variables	Non-standardized coefficient $B$ (SE)	Regression coefficient ( $\beta$ )	$p$ Value	95%CI of $B$	Model $R$ -squared
Gender	-2.54 (3.27)	-0.045	0.43	-9.01 to 3.93	$R^2=0.60$
Age	-0.08 (0.15)	0.031	0.59	-0.37 to 0.21	
Body mass index	-0.34 (0.40)	-0.042	0.40	-1.14 to 0.46	
Marital status	3.59 (3.36)	0.06	0.28	-3.04 to 10.23	
Education	-1.78 (2.10)	-0.051	0.40	-5.94 to 2.38	
Occupational status	0.03 (2.36)	0.001	0.99	-4.63 to 4.69	
Monthly salary estimate	1.33 (1.95)	0.055	0.49	-2.52 to 5.18	
Time since stroke	-0.03 (0.02)	-0.061	0.23	-0.09 to 0.02	
Depression	-1.70 (0.17)	-0.54	0.000*	-2.05 to -1.36	
Anxiety	-1.14 (0.18)	-0.35	0.000*	-1.50 to -0.78	

CI: confidence interval; SE: standard error.

\*Statistically significant at  $p < 0.05$ .

## Rehabilitation implications

This study draws the attention of health professionals to the impact of depression and anxiety in stroke survivors and the need to manage these psychological disorders to promote functional recovery and social reintegration of stroke survivors into their

communities. In Benin, stroke rehabilitation is mainly provided by physiotherapists, although some rehabilitation centers can also count on the contribution of physical and rehabilitation medical doctors, and speech language therapists. However, these multidisciplinary teams rarely include psychologists. Our results highlight

**Table 3.** Multivariate linear regression analysis of EQ-VAS scores.

Variables	Non-standardized coefficient <i>B</i> (SE)	Regression coefficient ( $\beta$ )	<i>p</i> Value	95%CI of <i>B</i>	Model <i>R</i> -squared
Gender	-3.39 (3.16)	-0.064	0.28	-9.65 to 2.85	$R^2=0.57$
Age	0.005 (0.14)	0.002	0.97	-0.28 to 0.29	
Body mass index	0.12 (0.39)	0.016	0.75	-0.65 to 0.90	
Marital status	1.14 (3.25)	0.02	0.72	-5.27 to 7.55	
Education	-2.95 (2.03)	-0.09	0.14	-6.97 to 1.07	
Occupational status	-0.62 (2.28)	-0.02	0.78	-5.12 to 3.88	
Monthly salary estimate	2.72 (1.88)	0.12	0.15	-0.99 to 6.44	
Time since stroke	-0.004 (0.02)	-0.008	0.87	-0.05 to 0.05	
Depression	-1.47 (0.16)	-0.50	0.000*	-1.81 to -1.14	
Anxiety	-1.14 (0.17)	-0.36	0.000*	-1.46 to -0.77	

CI: confidence interval; SE: standard error.

\*Statistically significant at  $p < 0.05$ .

**Table 4.** Multivariate linear regression analysis of EQ-5D-3L summary index scores.

Variables	Non-standardized coefficient <i>B</i> (SE)	Regression coefficient ( $\beta$ )	<i>p</i> Value	95%CI of <i>B</i>	Model <i>R</i> -squared
Gender	-0.04 (0.06)	-0.051	0.47	-0.17 to 0.08	$R^2=0.40$
Age	-0.003 (0.003)	-0.063	0.37	-0.008 to 0.003	
Body mass index	-0.004 (0.008)	-0.028	0.65	-0.019 to 0.012	
Marital status	-0.073 (0.06)	-0.076	0.26	-0.20 to 0.05	
Education	-0.035 (0.04)	-0.063	0.39	-0.11 to 0.04	
Occupational status	0.11 (0.04)	0.21	0.015*	0.02 to 0.25	
Monthly salary estimate	0.05 (0.03)	0.13	0.18	-0.02 to 0.12	
Time since stroke	0.00 (0.001)	-0.014	0.81	-0.001 to 0.001	
Depression	-0.015 (0.003)	-0.28	0.000*	-0.021 to -0.008	
Anxiety	-0.017 (0.004)	-0.33	0.000*	-0.024 to -0.01	

CI: confidence interval; SE: standard error.

\*Statistically significant at  $p < 0.05$ .

the need to include psychologists in the rehabilitation teams for better management of stroke survivors in low-income settings.

### Limitations

A limitation of our study is the recruitment of participants from a limited number of rehabilitation centers using convenience sampling method, and the lack of data regarding the severity and type of stroke that would better characterize the sample. We failed to report this due to the non-availability of these data in the patient registers. Moreover, the exclusion of stroke survivors with aphasia limits the generalizability of our findings. Indeed, stroke survivors with aphasia have high levels of depression and anxiety [62,63]. Therefore, their exclusion most definitely results in sampling bias that underestimates both PSD and PSA. Further studies should consider a more inclusive approach, considering the procedures and assessment tools that have been designed or adapted for stroke survivors with aphasia [64–66]. Moreover, this study focused on only two psychological disorders (i.e., depression and anxiety), and this may be an additional limitation since there are several other disorders (i.e., social phobia, panic disorder, post-traumatic stress disorder, etc.). Furthermore, apart from financial and occupational status, we were not able to assess other psychosocial factors such as return to work or psychosocial support that could have an additional impact on the HRQoL of stroke survivors. Another limitation is that our study was cross-sectional and does not allow us to assess how the associations of these psychological disorders with activity level and HRQoL evolve over time in chronic stroke survivors. Further studies with large sample sizes should investigate this through longitudinal study designs.

### Conclusions

Depression and anxiety were associated with high activity limitations and low HRQoL in chronic stroke survivors. They seem to

have a significant impact on stroke survivors in Benin, calling to consider these psychological disorders in the design and implementation of rehabilitation programs.

### Acknowledgements

The authors thank the hospital staff who facilitated the data collection and all stroke survivors who participated in this study.

### Author contributions

All authors contributed to the study conception and design. Data collection and analysis were performed by Fatimata Ouédraogo, Orthelo Léonel G. Atigossou, Aristide S. Honado, and Charles S. Batcho. The first draft of the manuscript was written by Orthelo Léonel G. Atigossou and Charles S. Batcho. All authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

### Disclosure statement

No potential conflict of interest was reported by the author(s).

### Funding

The author(s) reported there is no funding associated with the work featured in this article.

### References

- [1] Stein LA, Goldmann E, Zamzam A, et al. Association between anxiety, depression, and post-traumatic stress disorder and outcomes after ischemic stroke. *Front Neurol*. 2018;9:890.

- [2] Kolominsky-Rabas PL, Weber M, Gefeller O, et al. Epidemiology of ischemic stroke subtypes according to TOAST criteria: incidence, recurrence, and long-term survival in ischemic stroke subtypes: a population-based study. *Stroke*. 2001;32(12):2735–2740.
- [3] D'Souza CE, Greenway MR, Graff-Radford J, et al. Cognitive impairment in patients with stroke. *Semin Neurol*. 2021; 41(1):75–84.
- [4] Meyer S, De Bruyn N, Krumlinde-Sundholm L, et al. Associations between sensorimotor impairments in the upper limb at 1 week and 6 months after stroke. *J Neurol Phys Ther*. 2016;40(3):186–195.
- [5] Broussy S, Saillour-Glenisson F, García-Lorenzo B, et al. Sequelae and quality of life in patients living at home 1 year after a stroke managed in stroke units. *Front Neurol*. 2019;10:907.
- [6] Maaibwee NA, Rutten-Jacobs LC, Schaapsmeeders P, et al. Ischaemic stroke in young adults: risk factors and long-term consequences. *Nat Rev Neurol*. 2014;10(6):315–325.
- [7] Zahuranec DB, Skolarus LE, Feng C, et al. Activity limitations and subjective well-being after stroke. *Neurology*. 2017;89(9):944–950.
- [8] Musa KI, Keegan TJ. The change of Barthel index scores from the time of discharge until 3-month post-discharge among acute stroke patients in Malaysia: a random intercept model. *PLOS One*. 2018;13(12):e0208594.
- [9] Boden-Albala B, Litwak E, Elkind M, et al. Social isolation and outcomes post stroke. *Neurology*. 2005;64(11): 1888–1892.
- [10] Cacioppo JT, Hughes ME, Waite LJ, et al. Loneliness as a specific risk factor for depressive symptoms: cross-sectional and longitudinal analyses. *Psychol Aging*. 2006;21(1): 140–151.
- [11] Petite T, Mallow J, Barnes E, et al. A systematic review of loneliness and common chronic physical conditions in adults. *Open Psychol J*. 2015;8(Suppl. 2):113–132.
- [12] Zhang Y, Yu P, Liu H, et al. Hyperforin improves post-stroke social isolation-induced exaggeration of PSD and PSA via TGF- $\beta$ . *Int J Mol Med*. 2019;43(1):413–425.
- [13] Sargin D, Oliver DK, Lambe EK. Chronic social isolation reduces 5-HT neuronal activity via upregulated SK3 calcium-activated potassium channels. *Elife*. 2016;5:e21416.
- [14] Schöttke H, Giabbiconi C-M. Post-stroke depression and post-stroke anxiety: prevalence and predictors. *Int Psychogeriatr*. 2015;27(11):1805–1812.
- [15] Thayabaranathan T, Andrew NE, Kilkenney MF, et al. Factors influencing self-reported anxiety or depression following stroke or TIA using linked registry and hospital data. *Qual Life Res*. 2018;27(12):3145–3155.
- [16] Ayerbe L, Ayis S, Crichton S, et al. The natural history of depression up to 15 years after stroke: the South London Stroke Register. *Stroke*. 2013;44(4):1105–1110.
- [17] Knapp P, Dunn-Roberts A, Sahib N, et al. Frequency of anxiety after stroke: an updated systematic review and meta-analysis of observational studies. *Int J Stroke*. 2020;15(3): 244–255.
- [18] Kotila M, Numminen H, Waltimo O, et al. Post-stroke depression and functional recovery in a population-based stroke register. The Finnstroke study. *Eur J Neurol*. 1999; 6(3):309–312.
- [19] Qin B, Chen H, Gao W, et al. Efficacy, acceptability, and tolerability of antidepressant treatments for patients with post-stroke depression: a network meta-analysis. *Braz J Med Biol Res*. 2018;51(7):e7218.
- [20] Rafsten L, Danielsson A, Sunnerhagen KS. Anxiety after stroke: a systematic review and meta-analysis. *J Rehabil Med*. 2018;50(9):769–778.
- [21] Charfi N, Trabelsi S, Turki M, et al. Impact of physical disability and concomitant emotional disturbances on post-stroke quality of life. *L'Encephale*. 2017;43(5):429–434.
- [22] Kossi O, Batcho CS, Adoukonou T, et al. Functional recovery after stroke in Benin: a six-month follow-up study. *J Rehabil Med*. 2016;48(8):671–675.
- [23] Niama Natta DD, Alagnide HE, Kpadonou GH, et al. Feasibility of a self-rehabilitation program for the upper limb for stroke patients in Benin. *Ann Phys Rehabil Med*. 2015;58(6):322–325.
- [24] Sogbossi ES, Kakpoussa C, Niama-Natta DD, et al. Comparison between self-reported and observed locomotion ability scores in patients with stroke: a cross-sectional study. *Int J Rehabil Res*. 2018;41(4):358–363.
- [25] Ntsiea MV. Current stroke rehabilitation services and physiotherapy research in South Africa. *S Afr J Physiother*. 2019;75(1):475.
- [26] Knox M, Stewart A, Richards CL. Six hours of task-oriented training optimizes walking competency post stroke: a randomized controlled trial in the public health-care system of South Africa. *Clin Rehabil*. 2018;32(8):1057–1068.
- [27] Gittler M, Davis AM. Guidelines for adult stroke rehabilitation and recovery. *JAMA*. 2018;319(8):820–821.
- [28] Folstein MF, Folstein SE, McHugh PR. "Mini-mental state". A practical method for grading the cognitive state of patients for the clinician. *J Psychiatr Res*. 1975;12(3):189–198.
- [29] Prieto L, Sacristán JA. What is the value of social values? The uselessness of assessing health-related quality of life through preference measures. *BMC Med Res Methodol*. 2004;4(1):10.
- [30] Dolan P. Modeling valuations for EuroQol health states. *Med Care*. 1997;35:1095–1108.
- [31] Sharp R. The Hamilton Rating Scale for Depression. *Occup Med*. 2015;65(4):340.
- [32] Gündüz N, Ahmet Ü, Atar EA. The impact of perceived social support on anxiety, depression and severity of pain and burnout among Turkish females with fibromyalgia. *Arch Rheumatol*. 2019;34(2):186–195.
- [33] Hamilton M. The assessment of anxiety states by rating. *Br J Med Psychol*. 1959;32(1):50–55.
- [34] Ezema CI, Akusoba PC, Nweke MC, et al. Influence of post-stroke depression on functional independence in activities of daily living. *Ethiop J Health Sci*. 1970;29(1):841–846.
- [35] Oni OD, Olagunju AT, Olisah VO, et al. Post-stroke depression: prevalence, associated factors and impact on quality of life among outpatients in a Nigerian hospital. *S Afr J Psychiatr*. 2018;24:1058.
- [36] Sarfo FS, Jenkins C, Singh A, et al. Post-stroke depression in Ghana: characteristics and correlates. *J Neurol Sci*. 2017; 379:261–265.
- [37] Robinson RG, Spalletta G. Poststroke depression: a review. *Can J Psychiatry*. 2010;55(6):341–349.
- [38] Li W, Xiao W-M, Chen Y-K, et al. Anxiety in patients with acute ischemic stroke: risk factors and effects on functional status. *Front Psychiatry*. 2019;10:257.
- [39] D'Aniello GE, Scarpina F, Mauro A, et al. Characteristics of anxiety and psychological well-being in chronic post-stroke patients. *J Neurol Sci*. 2014;338(1–2):191–196.

- [40] Ponchel A, Labreuche J, Bombois S, et al. Influence of medication on fatigue six months after stroke. *Stroke Res Treatment*. 2016;2016:1–9.
- [41] Ojagbemi A, Akinyemi J, Owolabi M, et al. Predictors and prognoses of new onset post-stroke anxiety at one year in Black Africans. *J Stroke Cerebrovasc Dis*. 2020;29(9):105082.
- [42] Hackett ML, Yapa C, Parag V, et al. Frequency of depression after stroke: a systematic review of observational studies. *Stroke*. 2005;36(6):1330–1340.
- [43] Lincoln NB, Brinkmann N, Cunningham S, et al. Anxiety and depression after stroke: a 5 year follow-up. *Disabil Rehabil*. 2013;35(2):140–145.
- [44] Eum Y, Yim J. Literature and art therapy in post-stroke psychological disorders. *Tohoku J Exp Med*. 2015;235(1):17–23.
- [45] Naess H, Waje-Andreassen U, Thomassen L, et al. Health-related quality of life among young adults with ischemic stroke on long-term follow-up. *Stroke*. 2006;37(5):1232–1236.
- [46] Pan JH, Song XY, Lee SY, et al. Longitudinal analysis of quality of life for stroke survivors using latent curve models. *Stroke*. 2008;39(10):2795–2802.
- [47] Raju RS, Sarma PS, Pandian JD. Psychosocial problems, quality of life, and functional independence among Indian stroke survivors. *Stroke*. 2010;41(12):2932–2937.
- [48] Natta DDN, Batcho CS, Gaëtan GS, et al. Evaluation of manual ability in stroke patients in Benin: cultural adaptation and Rasch validation of the ABILHAND-Stroke questionnaire. *Eur J Phys Rehabil Med*. 2019;55(1):19–28.
- [49] Honado AS, Roy J-S, Daneault J-F, et al. Test–retest reliability of an adapted version of the International Physical Activity Questionnaire for healthy individuals and stroke survivors. *Ann Phys Rehabil Med*. 2020;63(6):581–583.
- [50] Cossi MJ, Gobron C, Preux PM, et al. Stroke: prevalence and disability in Cotonou, Benin. *Cerebrovasc Dis*. 2012;33(2):166–172.
- [51] Adoukonou T, Yahouédéou B, Agbétou M, et al. Prevalence of stroke survivors in Parakou in Northern Benin: a door-to-door community survey. *Rev Neurol*. 2020;176(10):839–845.
- [52] Ezejimofor MC, Uthman OA, Maduka O, et al. Stroke survivors in Nigeria: a door-to-door prevalence survey from the Niger Delta region. *J Neurol Sci*. 2017;372:262–269.
- [53] Namale G, Kamacooko O, Kinengyere A, et al. Risk factors for hemorrhagic and ischemic stroke in sub-Saharan Africa. *J Trop Med*. 2018;2018:1–11.
- [54] Singhpoo K, Charentanyarak L, Ngamroop R, et al. Factors related to quality of life of stroke survivors. *J Stroke Cerebrovasc Dis*. 2012;21(8):776–781.
- [55] Westerlind E, Persson HC, Eriksson M, et al. Return to work after stroke: a Swedish Nationwide Registry-Based Study. *Acta Neurol Scand*. 2020;141(1):56–64.
- [56] Radford KA, et al. An individually randomised controlled multi-centre pragmatic trial with embedded economic and process evaluations of early vocational rehabilitation compared with usual care for stroke survivors: study protocol for the RETurn to work after strokE (RETAKE) trial. *Trials*. 2020;21(1):1–17.
- [57] Vincent-Onabajo G, Musa HY, Joseph E. Prevalence of balance impairment among stroke survivors undergoing neurorehabilitation in Nigeria. *J Stroke Cerebrovasc Dis*. 2018;27(12):3487–3492.
- [58] Sarfo FS, Berchie P, Singh A, et al. Prevalence, trajectory, and predictors of poststroke fatigue among Ghanaians. *J Stroke Cerebrovasc Dis*. 2019;28(5):1353–1361.
- [59] O'Donnell MJ, Chin SL, Rangarajan S, et al. Global and regional effects of potentially modifiable risk factors associated with acute stroke in 32 countries (INTERSTROKE): a case-control study. *Lancet*. 2016;388(10046):761–775.
- [60] Strong K, Mathers C, Bonita R. Preventing stroke: saving lives around the world. *Lancet Neurol*. 2007;6(2):182–187.
- [61] Akpalu A, Gebregziabher M, Ovbiagele B, et al. Differential impact of risk factors on stroke occurrence among men versus women in West Africa: the SIREN study. *Stroke*. 2019;50(4):820–827.
- [62] Baker C, Worrall L, Rose M, et al. A systematic review of rehabilitation interventions to prevent and treat depression in post-stroke aphasia. *Disabil Rehabil*. 2018;40(16):1870–1892.
- [63] Morris R, Eccles A, Ryan B, et al. Prevalence of anxiety in people with aphasia after stroke. *Aphasiology*. 2017;31(12):1410–1415.
- [64] Brady MC, Fredrick A, Williams B. People with aphasia: capacity to consent, research participation and intervention inequalities. *Int J Stroke*. 2013;8(3):193–196.
- [65] van Dijk MJ, de Man-van Ginkel JM, Hafsteinsdóttir TB, et al. Identifying depression post-stroke in patients with aphasia: a systematic review of the reliability, validity and feasibility of available instruments. *Clin Rehabil*. 2016;30(8):795–810.
- [66] Eccles A, Morris R, Kneebone I. Psychometric properties of the behavioural outcomes of anxiety questionnaire in stroke patients with aphasia. *Clin Rehabil*. 2017;31(3):369–378.