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RESEARCH REPORT

Community reintegration in stroke survivors: Relationship with motor function and depression

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KEYWORDS
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Abstract Stroke survivors show a variety of physical and psychosocial problems, which can affect their reintegration into the community. This study explored the association of community reintegration with motor function and post-stroke depression (PSD). Ninety community-dwelling stroke survivors with mean age of 58.3 ± 7.8 years participated in this study. Participants were 56 men and 34 women attending the physiotherapy clinics of selected hospitals in southwestern Nigeria. Motor function was assessed using the Motor Assessment Scale (MAS), PSD by the Hamilton Depression Scale, and community reintegration by the Reintegration to Normal Living Index (RNLI). The mean RNLI, MAS, and PSD scores were 57.3 ± 23.5, 34.9 ± 10.9, and 9.4 ± 4.8, respectively. RNLI scores were significantly associated with MAS ($r = 0.584$, $p = 0.001$) and PSD ($r = -0.373$, $p = 0.006$) scores. Multiple regression analysis showed that age, depression, and motor function were associated with RNLI scores, which accounted for 41% of the variance. This study concluded that the higher the community reintegration, the higher the motor function, and the lower the PSD. Motor function and depression are factors that influence community reintegration and should be properly assessed and adequately treated before stroke survivors return to the community.
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Introduction

Stroke is a leading cause of death and permanent disability [1]. Stroke survivors are often left with physical impairments that limit functional abilities [2]. A stroke can be devastating to individuals and their family members, robbing them of their independence. Case fatality in Africa averages about 35% but could be as low as 14.9% or as high as 77% when due to cerebral haemorrhage [3]. In Nigeria, stroke is a major cause of neurological admissions and its incidence may be on the increase [4]. Case fatality rates are as high as 45% [5].

Community reintegration is one of the most important elements of stroke rehabilitation and likely the most underestimated area [6]. It has been defined as the 're-organization of physical, psychological and social characteristics so that the individual can resume well-readjusted living after incapacitating illness or trauma' [7]. It is also the term used to refer to returning to the mainstream of family and community life, engaging in normal roles and responsibilities, actively contributing to one's social groups and the society as a whole [8]. Self-perceived participation in community activities represents an individual's perception of and satisfaction with his or her involvement in life situations. Many people with stroke have a low level of satisfaction with community reintegration after they are discharged from the hospital and return to the community [9]. The effects of some stroke-related factors (e.g., physical impairments and mental status) on satisfaction with community reintegration have been examined in some studies [10,11].

Physical impairment has immense impact on community reintegration of stroke patients and emotional alterations are very frequent after stroke [12]. In the study by Carter et al [10], two factors that contributed most to impairment of community reintegration were depression and physical disability. Moreover, home rehabilitation intervention has been shown to induce motor and functional gains, which translate into a greater degree of higher-level function and satisfaction with community reintegration [13].

Mood disorder may be a specific complication of stroke, and failure to recognize and treat the disorder may be an important unmet need of survivors of stroke [14]. Depression manifests itself as a combination of feelings of sadness, loneliness, irritability, worthlessness, hopelessness, agitation, and guilt accompanied by an array of physical symptoms [15]. It is the most common mental health condition after stroke [16] and has been linked to worse functional outcome, slower recovery, and lower quality of life [17]. Depression affects 25—40% of patients within the 1st year after a stroke [18] and is most evident within the first 2 years post stroke [19]. Studies in Nigeria have reported 9.2—38.8% prevalence of depression among stroke survivors [20—22]. Some studies have suggested that stroke and depression often occur together [23—25]. Depression also has potentially long-lasting impact on functioning among stroke survivors [26].

Motor impairment is a frequent complication after stroke. The ability of patients to live independently after stroke depends largely on the reduction of motor impairment and the recovery of motor function [27]. Two-thirds of stroke survivors have residual neurological deficits that persistently impair function [28]. Impairment of motor function often involves paralysis or paresis of the muscles on the side of the body contralateral to the side of the lesion. In the stroke survivor population, 50% have some level of hemiparesis, 30% are unable to walk without some assistance and 20% are dependent in activities of daily living. The result of this disability is a significant impact on independence, quality of life, and lost productivity [29].

Stroke rehabilitation is a complex field that covers a wide continuum of care from the acute phase of stroke to community reintegration [19]. However, community reintegration, being an important aspect of stroke rehabilitation, has received relatively less attention from clinicians and researchers. A previous Nigerian study [30] assessed the community reintegration and walking ability of stroke survivors, but the mental health condition of the participants were not taken into consideration. This study therefore aimed to determine the association of community reintegration with motor function and post-stroke depression (PSD).

Methods

Data were collected from stroke patients seen at the out-patient physiotherapy departments of 4 university teaching hospitals in southwestern Nigeria. The stroke survivors were enrolled from Obafemi Awolowo University Teaching Hospital Ile-Ife and Ilesa units, Ladoke Akintola University of Technology Teaching Hospital Osogbo, University College Hospital Ibadan, and Lagos University Teaching Hospital. The participants in this study were 90 community dwelling stroke survivors between 40 and 65 years of age (mean age: 58.3 ± 7.8 years). Inclusion criteria included a diagnosis of stroke by a neurologist, the first episode of unilateral stroke with hemiparesis, and a stroke duration of 6 months or more. Moreover, the patients included in the study had been diagnosed as having depression by a psychiatrist using the internationally acceptable methods. Patients were excluded if they had history of any other neurological pathology, dementia, and serious musculoskeletal conditions affecting the lower limbs. Moreover, patients who scored 2 or less on the Functional Ambulation Categories (FAC) classification [31] or who were dependent on a walker for ambulation were excluded from the study.

Ethical clearance was sought and obtained from the Ethics and Research Committee of the Obafemi Awolowo Teaching Hospitals Complex, Ile-Ife. Informed consent of all the participants was duly obtained. The participants who met the inclusion criteria were selected and informed of the research protocol. All experiments were conducted in accordance with the Declaration of Helsinki.

The Reintegration to Normal Living Index (RNLI) was used to assess community reintegration. The scale was developed by Wood-Dauphnee and Williams [7] to measure patients' perceptions of their own capabilities. It is an 11-item scale that covers areas such as participation in recreational and social activities, movement within the community, and how comfortable the individual is in his/her role in the family and with other relationships. The items

are essentially declarative statements (e.g., I move around my living quarters as I feel necessary), including the following domains: indoor, community, and distance mobility; self-care; daily activity (work and school); recreational and social activities; family role(s); personal relationships; presentation of self to others; and general coping skills. Each item was rated with a 4-point ordinal scale (1–4) with higher scores indicating a higher level of satisfaction. The scores for each item were summed and then normalised to 100, with a score of 100 indicating that the participants were fully satisfied, scores of 60 through 99 indicating mild-to-moderate restrictions in self-perceived community reintegration, and scores less than 60 indicating severe restrictions in self-perceived community reintegration [9].

Motor function was assessed using the Motor Assessment Scale (MAS) [32]. This is a criterion-based scale assessing eight areas of functional motor activity with each item scored on a 7-point ordinal scale (ranging from 0 = no motor function, to 6 = optimal task performance or performance completed within the set time frame) [33]. The higher the score, the higher functioning the patient is on the affected side.

The Hamilton Depression Scale (HDS) was used to assess depression. It is a 21-item questionnaire that rates the severity of symptoms observed in depression, such as depressed mood, insomnia, agitation, anxiety and weight loss. It was originally published by Max Hamilton in 1960 to measure severity of depression in previously diagnosed depressed patients [34], but was reviewed and evaluated in 1966, 1967, 1969, and 1980. Although the HDS form lists 21 items, the scoring is based on the first 17. It generally takes 15–20 minutes to complete the interview and score the results. Eight items were scored on a 5-point scale (0 = absent, 1 = mild, 2 = moderate, 3 = severe, 4 = very severe). Nine were scored from 0–2 (0 = absent, 1 = mild, 2 = definite). The scores of the 17 items were summed to yield the total score, with a higher score indicating more severe depression (0–7 = normal, 8–13 = mild depression, 14–18 = moderate depression, 19–22 = severe depression, and $\geq$23 = very severe depression). The scale has been used and validated in Nigeria [35,36].

Participants' clinical and socio-demographic characteristics were summarised using descriptive statistics of mean, standard deviations, frequencies, and percentages. Inferential statistics using the Mann-Whitney U test was used to compare the RNLI scores between groups (sex, stroke type, side of paresis). The Pearson Correlation Product Moment Correlation Coefficient (r) was used to determine the association of community reintegration with age, stroke duration, motor function, and PSD. Multiple regression analysis was then used to predict community reintegration. Before the hierarchical multiple regression analysis was performed, the independent variables were examined for multicollinearity by means of Pearson's correlation. In multiple regression analysis, only the factors that were significant in the bivariate correlation analysis were entered into the prediction model (i.e., age, depression, and motor function). Level of significance was set at $p < 0.05$. All statistical procedures were performed with the Statistical Package for Social Sciences (SPSS) 16.0 (SPSS Inc., Chicago, IL, USA).

Results

The participants were 56 (62.2%) men and 34 (37.8%) women. The stroke duration ranged from 1 to 5 years (mean: 2.2 ± 1.2 years). Seventy-four (82.2%) stroke survivors had a diagnosis of hemiparesis after ischaemic stroke, and 16 (17.8%) had haemorrhagic stroke. The characteristics of the 90 stroke survivors with respect to age, sex, stroke type, side of paresis, and dominant side before stroke are presented in Table 1.

The mean RNLI score was 57.3 ± 23.5 (range: 39–90). Eighteen (20%) participants were severely restricted (RNLI score < 60) and 72 (80%) participants were mildly to moderately restricted (RNLI score = 60–99) in community reintegration. The mean PSD was 15.4 ± 4.8 (range 2–38). None of the participants had severe PSD (HDS score = 23–50). Only four male participants in the age category of 50 years and below had moderate PSD (HDS score = 14–18), while majority of the participants (96%) had mild PSD (HDS score = 8–13). The mean MAS score was 34.9 ± 10.9 (range: 18–42).

Table 2 shows the result of the correlation analysis between RNLI scores, MAS scores and PSD; and the Mann-Whitney U test comparing RNLI scores according to sex, stroke type, and side of paresis. Community reintegration had a significant correlation with age ($r = -0.221$, $p = 0.036$), motor function ($r = 0.584$, $p = 0.001$), and PSD ($r = -0.373$, $p = 0.006$). There were no significant differences in RNLI scores between male and female stroke survivors ($p = 0.335$), ischaemic and haemorrhagic stroke survivors ($p = 0.885$), and between stroke survivors with right-sided hemiparesis and those with left-sided hemiparesis ($p = 0.073$).

Table 1 Characteristics of participants	
Characteristics	
Age (y), n (%)	
$\leq$50	28 (31.1)
51–60	28 (31.1)
$\geq$61	34 (37.8)
Sex, n (%)	
Male	56 (62.2)
Female	34 (37.8)
Dominant side, n (%)	
Right	84 (93.3)
Left	6 (6.7)
Side of paresis, n (%)	
Right	48 (53.3)
Left	42 (46.7)
Types of stroke, n (%)	
Ischaemic	74 (82.2)
Haemorrhagic	16 (17.8)
RNLI score, mean ± SD	57.3 ± 23.5
MAS score, mean ± SD	34.9 ± 10.9
HDS score, mean ± SD	15.4 ± 4.8

HDS = Hamilton Depression Scale; MAS = Motor Assessment Scale; RNLI = Reintegration to Normal Living Index.

Table 2 Correlation analysis and comparison of RNLI scores according to sex, stroke type and side of paresis

	Correlation with RNLI scores (r)	Comparison of RNLI scores (z)[a]	p
Age	−0.221		0.036*
Stroke duration	−0.174		0.101
Motor function	0.584		0.001*
Depression	−0.373		0.006*
Sex (men vs. women)		−0.972	0.335
Stroke type (ischaemic vs. haemorrhagic)		−0.147	0.885
Side of paresis (left vs. right)		1.816	0.073

*Statistically significant ($p < 0.05$).
RNLI = Reintegration to Normal Living Index
[a] Derived from Mann-Whitney U test.

Age, motor function, and depression were then entered into the multiple regression model. The results showed that age ($p = 0.016$), motor function ($p = 0.000$), and depression ($p = 0.008$) were significant predictors of community reintegration. The final regression model predicted 41% of the variance in the RNLI scores ($F_{3,86} = 19.904$, $p < 0.001$). Moreover, among the independent variables, motor function had the greatest effect on community reintegration (standardised regression coefficient = 0.457) (Table 3).

Discussion

Community reintegration, being the final stage of rehabilitation, is very important. The concept of reintegrating to one's previous roles and relationships with family, co-workers, and the community, if considered at all, has been presumed to be hinged on physical and functional recovery in stroke survivors.

Satisfaction with community reintegration among stroke survivors

In this study, none of the stroke survivors was fully satisfied with their community reintegration. The mean RNLI score of the stroke survivors in this present study is lower than that of the findings in previous studies [9,12,30]. There may be some reasons for the differences in the results. First, the

study environment was different. Second, the previous studies involved stroke survivors with onset of 1 year or more, whereas our sample consisted of some patients who had a post-stroke duration of 6 months to 1 year. Similar to previous studies [9,30], this study showed that men were less satisfied with their reintegration to normal living than women, although the difference did not quite reach statistical significance, probably owing to reduced statistical power related to the small sample size.

Age is independently associated with community reintegration

Age was also found to be a significant predictor of the RNLI scores. The association is a negative one, indicating that older participants had lower level of satisfaction with community reintegration. None of the participants in the age category of ≤50 years was restricted in reintegration to normal living, but the age category ≥60 years, despite being able to walk unassisted, had the most number of stroke survivors restricted in their community reintegration. This is in agreement with the findings in the study by Murtezani et al [12], who reported that regardless of the unassisted walking, older chronic stroke patients were not satisfied with their level of social reintegration. The older patients may have less self-perceived reintegration to normal living because most of them have decreased social participation. In contrast, other studies [9,12] have found a positive association between age and community reintegration. The reason for the discrepancy in results is uncertain. It was postulated that the younger stroke survivors may be more educated and have higher expectation of their recovery and community reintegration than their older counterparts [9].

Depression is independently associated with community reintegration

Our results showed that depression is independently associated with RNLI scores. The higher the level of depression, the lower the level of satisfaction with community reintegration. Previous studies have also identified depression [9,10,37] as a determinant of satisfaction with community reintegration in stroke survivors. Stroke severity or physical disability and functional impairment have been associated with depression [38,39]. Post-stroke depression has been reported to slow down the process of rehabilitation, exerting a negative influence on all aspects of the process of recovery [38,40], and remission has been associated with

Table 3 Regression analysis to predict community reintegration

	Unstandardised coefficient (B)	Standardised coefficient (β)	95% CI	p
Age	−0.658	−0.217	−1.192 − −0.125	0.016
Depression	−1.256	−0.255	−2.183 − −0.329	0.008
Motor function	0.988	0.457	0.590−1.387	<0.001

Final regression model ($R^2 = 0.410$, $F_{3,86} = 19.904$, $p < 0.001$).

recovery in activities of daily living [41]. Patients with stronger reintegration to normal living have been found to have better outcomes in anxiety, depression, daily activity and quality of life [12]. These reasons may be used to explain the relationship found between community reintegration and PSD in this study. Taken together, the results suggest that relieving symptoms of depression may be essential in enhancing community reintegration among stroke survivors but will require further investigations.

Since PSD can be treated, it should be assessed for and managed in stroke survivors before they return to the community. Clinicians should work with the patient and caregivers to avoid negative effects, promote problem solving, and facilitate reintegration of the patients into valued family and social roles [42]. Physiotherapists and occupational therapists should work with clinical psychologists to minimise the effects of depression in patients who are diagnosed with the condition during rehabilitation. All professionals in the care of patients with stroke should be aware of the possibilities of depression and trained to look out for it and refer appropriately.

Motor function is independently associated with community reintegration

The results of our study showed a positive association between community reintegration and motor function. The ultimate goal for many stroke survivors is to achieve a level of functional independence that enables them to return to their homes and reintegrate into community life as much as possible [43]. Recovery of function to pre-stroke level of motor ability and independence in activities of daily living has long been the gold standard by which success in rehabilitation after stroke is measured [44]. In a study conducted by Belanger et al [45] on social integration in stroke survivors, the determining factors relating to social integration are motor functions and autonomy, personal perception of health conditions, proximity of children and relatives, relatively low age, regular presence of another person in the home, and proximity of friends. The authors found that the presence of motor problems is the main factor in determining the living environment after stroke.

The results of our study showed that motor function is an independent predictor of the RNLI scores. These findings are consistent with those of a previous study of stroke survivors, which showed an association between social integration and motor function [42]. These findings highlight the potential importance of improving motor function in enhancing community reintegration.

Research on stroke rehabilitation has focused on physical/functional recovery as the predominant measure of outcome [42,46]. There is a gap in knowledge of social issues and integration into societal, family, and community roles after stroke [43], despite that assessment of community reintegration has been emphasised in stroke rehabilitation reviews and guidelines [42,47,48]. While a lot of studies have examined the effect of different exercise programs to improve motor function [49−51], community reintegration is not often used as an outcome. Since improvement in motor function is directly associated with community reintegration, community reintegration should be assessed alongside motor function in community-dwelling stroke survivors with neuromuscular deficits during rehabilitation.

Limitations of the study and future directions

As the stroke survivors in the present study were able to ambulate independently, the findings of this study may not be generalised to stroke survivors who cannot ambulate independently. Another limitation of this study was related to sampling bias as the participants were recruited consecutively as they became available based on the study criteria (e.g., convenience sampling). The participants may have very different characteristics compared with other stroke survivors who did not take part in this study. Furthermore, this was a hospital-based study. Authors therefore recommend that further studies address the problem of external validity. Community reintegration as part of stroke recovery has been understudied in Nigeria. Further research is necessary to explore other factors that may affect community reintegration in Nigerian stroke survivors with varying degrees of recovery.

Conclusion

In summary, this study found a significant association of community reintegration with motor function and PSD. Motor function and depression should be properly assessed and adequately treated before stroke survivors return to the community to promote successful reintegration.

Acknowledgements

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