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RESEARCH ARTICLE

Stroke rehabilitation: should physiotherapy intervention be provided at a primary health care centre or the patients' place of domicile?

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Abstract

Purpose: This randomized controlled trial compared the outcomes of physiotherapy intervention on selected indices of recovery for stroke survivors treated at a primary health centre group (PHCG) with those treated in their respective places of domicile group (DG). *Methods*: Participants were 52 individuals comprising 24 males and 28 females who had suffered a stroke and were recently discharged from two inpatient health facilities in Ibadan, Nigeria. They were randomly assigned into either the PHCG ($n = 25$) or DG ($n = 27$) and treated twice weekly for 10 consecutive weeks using a physiotherapy intervention protocol comprising a battery of task-specific exercises. The outcomes measured were motor function, balance and handicap assessed using the modified motor assessment scale (MMAS), short-form postural assessment scale for stroke (SF-PASS) and reintegration to normal living index (RNLI), respectively, as well as walking speed which was assessed using a standard technique. *Results*: Between-group comparison using the General Linear Model revealed no statistically significant difference in both the pre- and post-intervention scores of the two groups on the MMAS, SF-PASS, RNLI and walking speed in both PHCG and DG ($p > 0.05$). However, within-group comparison yielded a statistically significant difference in each of the indices of stroke recovery measured across the 10-week period in both groups. *Conclusion*: Physiotherapy intervention at the primary health care centre and respective homes of stroke survivors similarly improved clinical outcomes. Treatment at any of these locations may enhance access to physiotherapy after stroke in a low-income community like Nigeria.

➤ Implications for Rehabilitation

- Physiotherapy protocol comprising 10-week task-specific battery of exercises produced significant improvement in walking speed, balance, motor function and community reintegration of stroke survivors.
- Physiotherapy post-stroke can be provided at either a primary health centre or the domicile of the individual.
- In a low-income country like Nigeria, this will enhance access to this important service.

Keywords

Cerebrovascular disease, community reintegration, motor function, physiotherapy, stroke

History

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Introduction

Stroke is one of the major causes of morbidity and mortality globally [1]. Although there are limited data on stroke mortality in the middle- and low-income countries, it is well documented to be a major cause of death [2]. It is predicted that stroke incidence would further increase as a result of ageing world population [3], and the fact that more people now survive stroke because of improved health care. However, many of the survivors have to cope with the challenges of physical, psychological, social and functional sequelae of stroke resulting in increased personal and public costs [4,5]. Nigeria, the most populous black nation, stands the risk of further straining of its resources as a result of the increasing prevalence of stroke and cerebrovascular diseases [6]. The resultant high-economic costs have made the reduction of stroke-related disability a priority [4]; and this is attainable through rehabilitation.

Stroke rehabilitation starts in the hospital and continues after the individual has returned to the community [7]. There is no universally accepted definition of community rehabilitation [8]. As a result, the term can be used to describe any therapeutic service provided outside of the hospital. The increasing cost of hospital-based rehabilitation in the post-acute phase of stroke also makes home-based rehabilitation (HBR) more attractive [9]. Some studies that compared institution-based rehabilitation with home-based interventions generally indicated more positive benefits among the home-based groups in terms of functional outcomes and societal participation [10,11]. An important similarity between hospital-based rehabilitation and HBR is that both being individualized are equally expensive and may on the long term put a financial strain on the patient and their family. Introducing rehabilitation services at a local or community level helps overcome the obstacles such as difficulty of travel and its

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expenses, surmount barriers that limit resumption of past activities and improve quality of life, which are associated with traditional institution-based care [12,13]. Evidence has shown that rehabilitation is more effective when given in patients' own environment [8].

With the emphasis on global health now shifting to primary health care (PHC), it is possible that the rehabilitation of people with stroke will become progressively more community based [14]. PHC is essential health care based on practical, scientifically sound and socially acceptable methods and appropriate technology made universally accessible to individuals and families in the community through their full participation and at a cost that the community and country can afford to maintain [15]. PHC eliminates the almost overwhelming focus on hospitals and breaks the barriers that exist between patients and health care providers [16]. It has been reported that physiotherapy intervention within a PHC framework can have an important impact on system-level, provider-level and client-level outcomes [17]. Rehabilitation programmes based in the community may result in better outcomes compared to home-based stroke rehabilitation [14]. This trend may be associated with the isolation or the decreased social interaction in patients receiving HBR resulting in increased possibility of depression or lack of adequate floor space for exercises [14,18]. Studies have shown that community-based exercise programmes can preserve and improve mobility, functional capacity and balance resulting in a significant impact on performance of the activities that are considered meaningful to the stroke subjects [19–21].

Patients with stroke in Ibadan, Nigeria, have limited rehabilitative support and do not enjoy the luxury of early supported discharge programmes found in developed countries. Physiotherapy services in Nigeria are essentially through private, secondary and tertiary health care centres and this makes cost a barrier to accessing this important service. Since HBR has been shown to have functional outcome similar to hospital rehabilitation [22,23], it can be postulated that PHC rehabilitation is likely to be equally effective in terms of clinical outcome and possibly more appropriate in a low-income country like Nigeria. This conjecture however needs to be subjected to scientific rigours to establish evidence. The aim of this study was to investigate the feasibility and clinical effectiveness of stroke rehabilitation at a primary health centre compared with domiciliary rehabilitation with a view to enhance access to physiotherapy services in low-income countries.

Methods

The study is a single-blind randomized clinical trial comparing rehabilitation in patients' own home with rehabilitation at a primary health centre. To be eligible to participate in the study, stroke survivors must have had a minimum stroke severity score of 6 on the stroke levity scale (SLS). The SLS is calculated as maximum power (0–5) in the dexterous hand + maximum power in the weaker lower limb + mobility score + 1 (if aphasia present). The score ranges from 0 (most severe stroke) to 15 (mildest stroke). The SLS correlates to the NIHSS ($r = 0.79$, $p < 0.0001$), the modified Rankin Scale ($r = 0.79$, $p < 0.0001$) [24]. Only participants who were able to comprehend and follow a three-step command (minimal or no cognitive impairment) and who were not aphasic were included while those with severe or uncontrolled hypertension were excluded from the study. The three-step command consisted of a three-word statement used to assess the level of cognition, for example ''come and sit''.

Fifty-two stroke survivors were recruited from the medical wards and the physiotherapy clinics of two health facilities in Ibadan. They were allowed into the research not later than 2 weeks after discharge from inpatient facilities. Participants were assigned into either the primary health centre group (PHCG; $n = 25$) or the domiciliary group (DG; $n = 27$) using the fish bowl (lottery sampling) method of random assignment. Sixty 2 cm × 2 cm pieces of paper, 30 bearing the code PG and 30 bearing DG were folded and placed inside a plastic bowl. Each participant was assigned to either the PHCG (papers on which PG is written) or DG depending on what was written on the paper drawn. The PHCG was treated at a primary health centre while the DG was treated at their respective homes.

Ethical approval was obtained from the University of Ibadan/University College Hospital Health Research Ethics Committee (UI/EC/09/0053). The nature and objective of and procedure for the study were explained to the participants before obtaining their informed consents.

Pre-intervention (Baseline) and post 10-week physiotherapy intervention assessment of motor function, postural balance, level of handicap and walking speed were measured by a physiotherapist who was blinded to the group assignment and did not participate in any other aspect of the study. The motor function was assessed using the Modified Motor Assessment Scale (MMAS). The MMAS assesses the motor recovery of patients with stroke and is based on motor components of activities of daily living [25]. It comprises eight items that are assigned a score from 0 to 6 pertaining to upper extremity motor recovery, balance and function. The MMAS is interviewer-administered, brief and easy to administer. It has an inter-rater reliability of 0.95 and a test–retest reliability of 0.98. Assessment was done by requesting each participant to carry out the series of tasks in the instrument. Quality of performance of some items under the tasks and speed of performance of some other items were assessed based on the criteria for scoring each task.

Postural balance was evaluated using the Short Form-Postural Assessment Scale for Stroke (SF-PASS). It consists of five items scored on a 3-level scale ranging from 0 to 3. The SF-PASS has a reliability of 0.93, a concurrent validity of 0.98 with the original PASS and a predictive validity of 0.82 [26]. Participants were required to carry out the five tasks on the scale. Independence in the performance of task was graded on the 3-point scale (0, 1.5, and 3).

The level of handicap of the participants was measured using the Reintegration to Normal Living Index (RNLI). The RNLI 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 role in the family and other relationships. Participants responded to the 11 declarative statements using a visual scale. The scale is from 0 to 10, where 0 means ''does not describe my situation'' while 10 means ''fully describes my situation''. Participants indicated the level to which each statement described their individual situation on the scale. The maximum obtainable score was 110. The RNLI score for each participant was calculated by converting the total score divided by the maximum obtainable score into a percentage [27].

Pre-intervention (Baseline) walking speed was also assessed. A 10-metre walkway was mapped on the floor and the participants were then required to step on the walkway and walk it to the end at their preferred speed or fastest speed. Ambulation for the central 6-metre area was timed and recorded with a stopwatch. The stopwatch was started on the first contact of the right foot after the subject has passed the first 2-metre mark and was stopped on the final right heel contact before the subject passed the beginning of the last 2-metre mark [28]. Walking speed was measured by dividing the distance (6 metres) by the time taken to cover the distance. It was recorded in metres per second.

A Physiotherapy Protocol (PP) constituted the intervention for the two groups. The PP comprised structured, task-specific

exercises to improve strength, balance, gait and bimanual activities. Strength training for the affected extremities was carried out using mechanical resistance (free weights). Resistance was increased when patient could complete two sets of 10 repetitions of each movement through the available range of motion. Principle of proprioceptive neuromuscular facilitation (PNF) technique was used only in patients with insufficient muscle strength until there was adequate strength in the extremities for the use of mechanical resistance. Balance training was carried out using the domains of the Berg Balance Scale [29,30]. Functional activities of the affected upper limb were trained using a combination of self-assisted exercises and task-specific functional activities.

Each treatment session lasted about 45–60 min. Participants were allowed to rest in-between exercises and also allowed to stop based on their individual tolerance. The intervention was carried out twice weekly for 10 consecutive weeks. Treatment order and intensity were individualized based on the individual participant's tolerance and performance.

Data analysis

The SPSS version 13.0 software programme (SPSS Inc., Chicago, IL) was used for data entry and analysis. Descriptive statistics of mean and percentages was calculated to summarize the demographic and clinical characteristics of participants in the two groups. Independent *t*-test was used to compare the between-groups walking speed. Between-group comparisons of motor function, postural balance and community reintegration were carried out using the General Linear Model. Level of significance was set at 0.05.

Results

A total of 56 (27 males, 29 females) consenting stroke survivors who met the inclusion criteria were consecutively recruited for this study (Figure 1). They were randomly assigned into either the PHCG ($n = 29$) or the DG ($n = 27$). However, 52 individuals comprising 24 males and 28 females completed the 10-week treatment programme. Twenty-five were in the PHCG (7 males and 18 females) while 27 were in the DG (17 males and 10 females). Four of the participants allocated to the PHCG withdrew their consent after group assignment giving a drop-out rate of 7.14%. The patients dropped out because their preferred group was the DG. Those who completed the study were similar in demographic and clinical characteristics to those who dropped out.

The mean age of the participants in the PHCG and DG was 60.6 ± 10.2 and 61.7 ± 8.4 years, respectively. Table 1 presents their clinical and socio-demographic information. Both the PHCG and DG showed a statistically significant linear increase in motor function scores from 22.9 ± 15.2 at baseline to 34.7 ± 11.7 at week 10 and from 19.9 ± 16.4 at baseline to 36.6 ± 10.3 at week 10 in response to treatment (Table 2).

There was a statistically significant increase in the postural balance scores of participants in the PHCG as shown in Table 3.

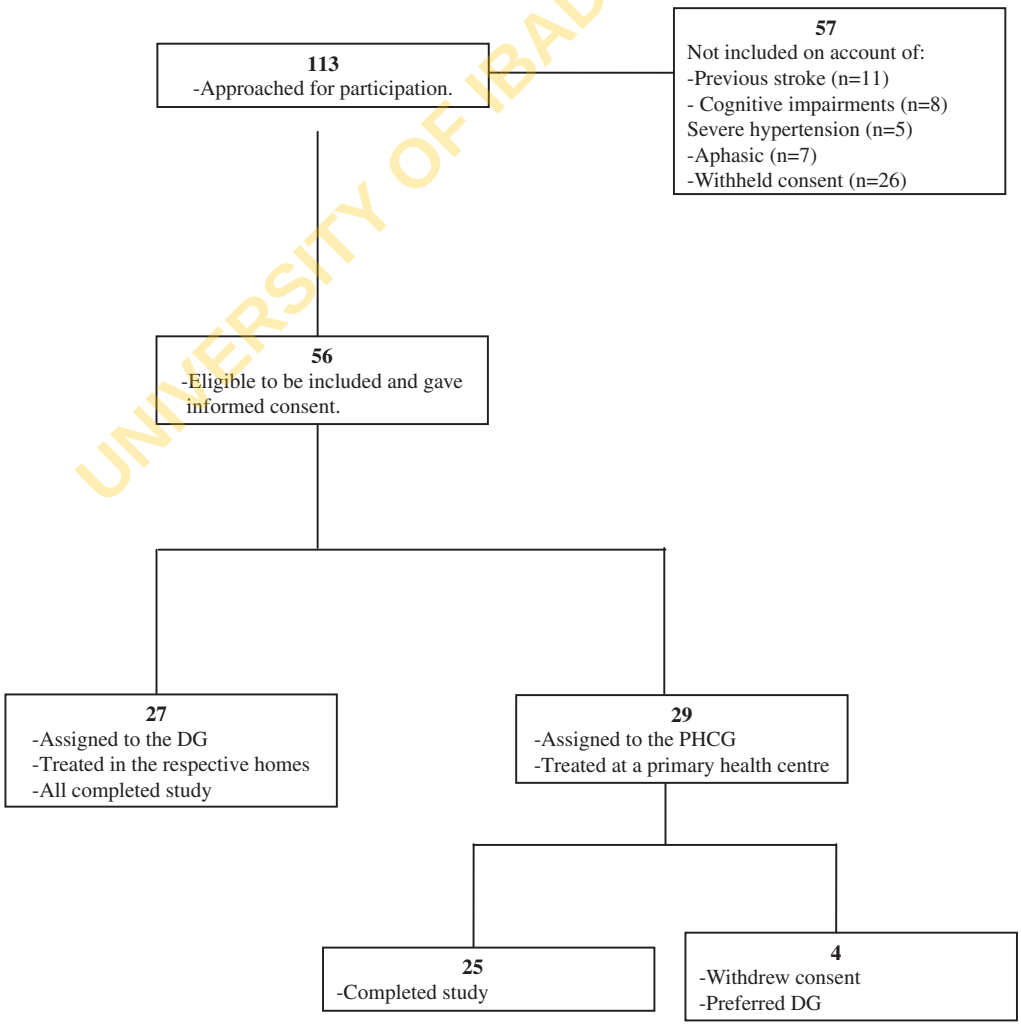

Figure 1. Flow chart of patients.

Table 1. Demographic and clinical characteristics of participants ($N = 52$).

Characteristics	PHC group n (%)	Domiciliary group n (%)	χ^2	p Value
Gender				
Male	7 (28.0)	17 (63.0)	6.38	0.01
Female	18 (72.0)	10 (32.0)		
Marital status				
Single	1 (4.0)	5 (18.5)	5.62	0.06
Married	21 (84.0)	22 (81.5)		
Widowed	3 (12.0)	0 (0.0)		
Highest education				
None	4 (16.0)	5 (18.5)	2.39	0.49
Primary	9 (36.0)	5 (18.5)		
Secondary	7 (28.0)	8 (29.6)		
Tertiary	5 (20.0)	9 (33.5)		
Limb dominance				
Right	24 (96.0)	25 (92.6)	0.27	0.59
Left	1 (4.0)	2 (7.4)		
Side of affectation				
Left	18 (72.0)	18 (66.7)	0.92	1.00
Right	7 (28.0)	9 (33.3)		
Mean age (years)	60.6 ± 10.2	61.7 ± 8.4		0.67

Table 2. Comparison of motor function scores of participants in the primary health care and domiciliary groups from baseline to week 10 using the modified motor assessment scale (0–48) ($N = 52$).

Time frame	PHCG ($n = 25$) $\bar{x} \pm$ S.D	DG ($n = 27$) $\bar{x} \pm$ S.D	f Value	p Value
Baseline	22.9 ± 15.2	19.9 ± 16.4		
Week 2	26.3 ± 13.9	24.4 ± 14.5		
Week 4	29.5 ± 13.2	28.4 ± 13.0		
Week 6	30.8 ± 12.8	31.6 ± 11.7	280.31	0.94
Week 8	32.4 ± 12.7	34.2 ± 11.2		
Week 10	34.7 ± 11.7	36.6 ± 10.3		
χ^2	112.31*	117.92*		
p Value	0.01	0.01		

*Significant at $p = 0.05$.

Table 3. Comparison of postural balance scores of participants in the primary health care and domiciliary groups from baseline to week 10 using the short-form postural assessment scale for stroke (0–15) ($N = 52$).

Time frame	PHCG ($n = 25$) $\bar{x} \pm$ S.D	DG ($n = 27$) $\bar{x} \pm$ S.D	f Value	p Value
Baseline	8.6 ± 5.0	7.1 ± 5.6		
Week 2	9.1 ± 4.4	8.4 ± 4.9		
Week 4	10.1 ± 3.7	9.6 ± 4.2		
Week 6	11.1 ± 3.6	10.9 ± 3.6	370.82	0.65
Week 8	11.7 ± 3.2	11.8 ± 3.5		
Week 10	12.3 ± 3.2	12.3 ± 3.3		
χ^2	89.58*	99.53*		
p Value	0.01	0.01		

*Significant at $p = 0.05$.

This table also shows a similar statistically significant increase ($p < 0.05$) in the postural balance scores in DG.

Both groups demonstrated a significant increase in the level of community reintegration from baseline to week 10 (Table 4). The walking speed increased significantly in both groups from baseline to week 10. Table 5 also shows no statistically significant difference in the mean scores for motor function ability, postural balance, community reintegration and walking speed between the PHCG and DG measured at baseline and over the 10-week study period.

Table 4. Comparison of community reintegration scores of participants in the primary health care and domiciliary groups from baseline to week 10 using the reintegration to normal living index (0–100%) ($N = 52$).

Time frame	PHCG ($n = 25$) $\bar{x} \pm$ S.D.	DG ($n = 27$) $\bar{x} \pm$ S.D.	f Value	p Value
Baseline	30.1 ± 22.9	28.4 ± 26.1		
Week 2	36.5 ± 23.8	31.0 ± 26.4		
Week 4	45.8 ± 24.4	36.8 ± 25.9		
Week 6	52.8 ± 24.6	46.3 ± 28.0	3.92	0.90
Week 8	57.6 ± 25.1	51.2 ± 28.6		
Week 10	58.7 ± 25.4	53.9 ± 28.7		
χ^2	122.89*	78.42*		
p Value	0.01	0.01		

*Significant at $p = 0.05$.

Table 5. Comparison of walking speed of the primary health care and domiciliary groups at baseline and week 10 ($N = 52$).

Variable/time	PHC group ($n = 25$) $\bar{x} \pm$ S.D	Domiciliary group ($n = 27$) $\bar{x} \pm$ S.D	t Value	p Value
Walking speed (metre/second)				
Baseline	0.3 ± 0.3	0.3 ± 0.4	0.39	0.69
Week 10	0.6 ± 0.4	0.5 ± 0.4	0.34	0.73
t Value	2.25*	3.71*		
p Value	0.01	0.01		

*Significant at $p = 0.05$.

Discussion

The two study groups were comparable in terms of the clinical indices of stroke recovery measured over the 10-week period. The absence of a significant difference between the two groups at any point in time over the period of assessment suggests that rehabilitation in primary health centre results in similar outcomes to home rehabilitation. In a study to evaluate the feasibility of community-based physiotherapy in subacute stroke, no significant difference in the pre- and post-intervention activities was found between the community and domiciliary groups [29]. Home rehabilitation or domiciliary rehabilitation has always been a preferred, but unaffordable option to hospital rehabilitation by many stroke survivors in this environment. Primary health centres are community-based hospitals that are easily accessible and affordable to the majority of the stroke population in the community. These centres can be used for the provision of physiotherapy services for stroke survivors, many of who are lost to the community after inpatient discharge due to inability to afford outpatient physiotherapy.

The stroke survivors in both groups of study recorded a significant improvement in motor function ability across the 10 weeks, suggesting the effectiveness of the treatment modality used. The treatment protocol comprised battery of exercises that are task-oriented in nature. Evidence has shown that task-specific training is effective in stroke rehabilitation compared with training at impairment level [31]. The DG showed a higher time-trend compared with the PHCG from week 6 to week 10. This implies that the rate of improvement appears to be higher in the DG from 6 weeks. A similar finding was reported in a systematic review of 11 trials comparing functional benefits of HBR versus centre-based rehabilitation for community dwelling people with stroke where a significant improvement in function was noted at 6 weeks in HBR [32]. This may be because patients who receive rehabilitation in the home have a better adjustment to

residual disability [23]. Stroke-related disability is more apparent in patients' own home environment or real life situations and it is easier to tailor rehabilitation programme towards the expressed needs of patients in their homes. It could also be that patients are better able to develop adaptation strategies to compensate for the apparent impairments when at home that in other environments.

A statistically significant improvement was observed in the postural balance in the two groups over the 10-week period. Balance is an important clinical item in rehabilitation of stroke survivors and specificity of training is important to achieve good postural control. Balance training is reportedly more effective when related to a task [33]. The premise for using the domains of the Berg balance scales (BBS) to train balance is to ensure a task-specific approach. Studies have shown that the BBS can successfully be used to train balance in stroke survivors [29,30].

There was a statistically significant improvement in the within-group scores on the RNLI over the 10-week period. The community reintegration level of the participants improved more in the PHC group than in the DG. Earlier studies have also reported no significant difference in community reintegration between the participants in a community and home exercise programmes [34,35]. It may be because the participants in one of the studies [35] have had stroke for preceding 1 year before the study and were already community-dwelling and could be said to have been reintegrated into the community. Differences in this and previous study include the fact that the participants in the other study were post-acute stroke survivors and the study period was 7 weeks compared to 10 weeks in the present study [34]. Another earlier study concluded that improving the balance function promotes community reintegration [36]; a trend that may be because improvement in balance after stroke facilitates recovery of activities and improves participation. Functional status is also one of the highly significant predictors of social integration after stroke [37]. The improvement observed in community reintegration of the participants may therefore be related to the significant improvement in their motor function ability.

There was a significant increase in the walking speed of both groups of participants over the 10-week period. Studies have shown the interdependency or relationship between asymmetry ratio and walking speed [38,39]. A decrease in the degree of asymmetry, which is a reflection of improvement in balance function, translates to improvement in the quality of gait [39]. Increased walking speed obtained post-treatment in this study may thus be connected with the improvement in balance function recorded in the study. Inclusion of strengthening exercises in the treatment protocol could also have accounted for this result. A significant association has been reported between gain in paretic leg muscle strength and gain in walking capacity and that enhancement of paretic leg muscle strength is a significant determinant in improving walking capacity among chronic stroke survivors [40].

Conclusion

The findings of this study have shown that provision of physiotherapy services at a primary health centre produces similar outcomes in comparison to the place of domicile of the patients. In Nigeria, health care at the PHC level enjoys Federal Government funding and strategically located within the communities. With a study like this which has demonstrated that the DG showed no significant advantage over the PHCG, primary health centres seem to be practicable and affordable alternative for home physiotherapy. It is also observed that a physiotherapy intervention protocol comprising task-specific exercises is associated with significant improvement in the clinical profile of the stroke survivors.

Limitations

It was possible that some of the patients could have received other forms of orthodox or unorthodox treatment for their stroke. These could have had some impact on the outcomes reported in this study.

Declaration of interest

The authors report no conflicts of interests.

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