

Development and evaluation of a Primary Healthcare-based Physiotherapy Intervention and its effects on selected indices of stroke recovery

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Aim: To develop a Primary Healthcare-Based Physiotherapy Intervention (PHCPI) that requires simple, inexpensive, easy-to-use equipment for stroke rehabilitation and evaluate its effects on selected clinical indices of recovery among post-acute stroke survivors over a 10-week period.

Methods: Three databases (Medline, Pubmed and PEDro) were used to identify treatment approaches with proven efficacy. The authors synthesised these treatment approaches to develop the PHCPI, which was used in a repeated measure design involving 25 (mean age=60.6 ± 10.2 years) consenting individuals with first-incident stroke. These individuals were treated at a primary health centre, twice weekly for 10 consecutive weeks. Outcomes were assessed using the Modified Motor Assessment Scale (MMAS), the Short Form Postural Assessment Scale for Stroke (SF-PASS) and the Reintegration to Normal Living Index (RNLI), before the intervention and fortnightly thereafter. Walking speed and quality of life were also assessed before the intervention and at week 10 of it.

Results: Within-subject multivariate analysis, after controlling for gender, showed a significant increase in motor function, postural balance, walking speed and quality of life. Their community reintegration scores also improved over the period.

Conclusion: The PHCPI resulted in improved motor function, community reintegration, walking speed, postural balance and quality of life among community-dwelling stroke survivors. This intervention can be used for stroke rehabilitation at primary health centres.

Key words: ■ Stroke ■ Rehabilitation ■ Primary health care ■ Physiotherapy intervention

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Stroke is a major health problem in low- and middle-income countries, and has risen to constitute almost 50% of total disease burden over the last decade (Strong et al, 2007). The age-standardised mortality, case fatality and prevalence of disabling stroke in Africa are similar to or higher than those measured in most high-income regions (Mensah, 2008). It has been reported that about 87% of total losses due to stroke in terms of Disability Adjusted Life Years (DALYS) are from low- and middle-income countries (Lopez et al, 2006). Therefore, the true impact of stroke must not be viewed in terms of incidence and mortality rates only, but also in terms of the frequently long-term and sometimes permanent stroke-related disability (Norrving and Kissela, 2013).

Although efforts have been made in the US

and other high-income countries to address the causes of stroke and implement appropriate follow-up treatment to reduce stroke-related disability, the situation in low- and middle-income countries has markedly worsened over the last four decades (Feigin et al, 2009). Resources for stroke care and rehabilitation are deficient in developing countries (Wasserman et al, 2009), including Nigeria. Yet the incidence and prevalence of disabling stroke is increasing in Nigeria (Wahab, 2008) and therapies are typically not available or affordable in low- and middle-income countries (Mendis, 2010).

The hospitals traditionally providing stroke services in developing countries are often urban-based and were perceived as benefitting a minority and draining a substantial share of scarce resources (Cueto, 2004). Therefore, there is a

need to develop adaptable, cost-effective models that implement best-practice recommendations for community-based stroke management (Joubert et al, 2008; Wasserman et al, 2009).

The suggested ideal recommendation for stroke rehabilitation in developing countries, such as Nigeria is one tailored to be cost-effective (Brainin et al, 2007). This requires the implementation of existing public health programmes developed by WHO, among others, for stroke prevention and post-stroke treatment (Norrving and Kissela, 2013). One such programme is the primary health care (PHC) resolution and its community-based rehabilitation counterpart (WHO, 1978). PHC models are effective for improving clients' access to the care they need, and for improving care efficiency, coordination, and continuity. PHC models also help health needs to be met in the right place, at the right time by the most appropriate health care providers (Soever, 2006). With the global emphasis on PHC in stroke rehabilitation, **which should include physiotherapy**. Such rehabilitation may become more community based (Hale, 2004).

International models have demonstrated the feasibility and cost-saving role of primary care physiotherapy in providing the public with easy access to physiotherapy services (Fricke, 2005). Introducing rehabilitation services at a local or community level may also remove or minimise the many obstacles associated with institution-based care, such as the difficulty and expense of travel (Boyce et al, 2002). Wider availability of local services eliminates barriers that limit resumption of past activities and helps improve quality of life (Stanton, 2000). While PHC reforms have continued in many countries (Soever, 2006), there appears to be a heavy dependence on costly, specialised hospital settings with expensive equipment for stroke survivor rehabilitation in Nigeria. The majority of this care cost is borne by individuals' families (Ogungbo et al, 2005), many of whom are poor. Medis (2010) suggested that secondary prevention components of an equitable stroke service in low- and middle-income countries should also be provided through a PHC approach. PHC-level services could also provide tertiary prevention strategies, which aim to reduce stroke-related disabilities.

Stroke survivors needing physiotherapy services in Nigeria face many challenges. These challenges include: poor accessibility to physiotherapy services due to environmental factors, eg. transport, and the availability of physiotherapy clinics; inadequate facilities at physiotherapy clinics which are usually in urban centres; non-affordability of physiotherapy; problems associated with low levels of education; and African socio-cultural beliefs

and perceptions. One way of enhancing stroke survivors' accessibility to physiotherapy services in Nigeria could be to provide services in alternative care environments, e.g. at patients' own home or at PHC level, which is regarded as the lowest unit of healthcare. However, scientific evidence is needed to make informed recommendations on these two alternative care environment options and provide guidelines on treatment.

This study was undertaken to develop a Primary Healthcare-Based Physiotherapy Intervention (PHCPI) that requires simple, readily-available and easy-to-use equipment for community stroke rehabilitation. This study evaluated the efficacy of the PHCPI on selected clinical indices of recovery among post-acute stroke survivors over a 10-week period. The authors tested the hypothesis that the PHCPI will be an effective intervention for rehabilitating stroke survivors at primary healthcare centres.

METHODS

The Primary Healthcare-Based Physiotherapy Intervention (PHCPI)

A comprehensive literature review preceded the development of the PHCPI. Three databases (Medline, PubMed and PEDro) were searched using the search terms: 'physiotherapy in primary health care', 'stroke rehabilitation in primary health care', 'current trends in stroke rehabilitation' and 'physiotherapy best practice in stroke rehabilitation'. The date limit was set from 2004 to 2008.

The literature search using the above terms retrieved 134 journal articles. Forty-seven articles (free full text articles, articles in **electronic [AQ: this did say portable, did you mean electronic?] format—PDF and abstracts**) provided information on the areas of interest in stroke rehabilitation that do not require any equipment that is not usually available in a primary health centre. The general recommendation is that the alleviation of motor impairments and the restoration of motor function post-stroke should be focused on high-intensity, repetitive, task-specific interventions (Langhorne, 2009; Michael et al, 2009; Wevers et al, 2009). Most community-based rehabilitation programmes involved exercises targeted at improving strength, balance, gait, and upper extremity function (Lexell and Flansbjerg, 2008; Wevers et al, 2009).

The literature search combined with independent observation in Nigerian physiotherapy clinics formed the foundation of the synthesis of the PHCPI. The PHCPI comprises of exercises targeted at improving muscle strength in the paretic limbs as a pre-requisite for ambulation activi-

ties, restoration of postural balance, gait re-training and functional use of the arm and hand (see *Appendix 1*).

Study design

This study had a repeated-measure design, which involved evaluating the effects of the PHCPI on selected clinical indices of recovery among post-acute stroke survivors. Ethical approval was obtained from the local Health Research Ethics Committee.

Participants

Consenting stroke survivors were recruited at the point of discharge from medical wards and from the physiotherapy outpatient clinics of a tertiary health facility (University College Hospital) and a secondary health facility (Adeoyo State Hospital) for this study. Both hospitals are located in Ibadan Metropolis and are the two referral centres for stroke rehabilitation in Ibadan. Eligibility criteria included a Neurologist-diagnosed first incident stroke, controlled hypertension and being discharged from inpatient care. Exclusion criteria included that prospective participants must not be aphasic, and should be able to comprehend instruction, i.e. minimal or no cognitive impairment.

Participant recruitment spanned the 12 months from August 2009 to July 2010. The two study centres received a monthly combined average of 11 new referrals from physiotherapy. Out of this, only five would have satisfied the inclusion criteria and 29 of those who met the inclusion criteria agreed to participate in the study. Participants who gave consent were required to report for outpatient physical rehabilitation at the Oniyarin Primary Health Centre in Ibadan South East Local Government Area of Oyo State not later than 2 weeks after discharge from the inpatient facility.

Intervention

The PHCPI, which consists of exercises to strengthen the extremities, improve balance, enhance walking ability and encourage arm and hand function, constituted the intervention or treatment for all participants. Each treatment session lasted about 60 minutes. Intervention was twice a week with a 2-day interval between treatment days for 10 consecutive weeks. Participants were encouraged to maximise their efforts but were allowed to rest during therapy when necessary. As motor recovery after stroke varies among individuals, treatment progression was patient-determined, based on an individual's tolerance and performance. Guides on rate of progression were provided with the exercises.

Measurements and evaluations

Baseline and follow-up assessments (fortnightly) of motor function, postural balance, community reintegration, quality of life and walking speed were carried out by a physiotherapist. This tester was not involved in any other aspect of the study and was blinded to the outcome.

Modified Motor Assessment Scale (MMAS)

The MMAS assesses motor recovery post-stroke and is based on motor components of activities of daily living (Loewen and Anderson, 1988). It comprises eight items that score upper extremity motor recovery, balance and function from 0 (not possible) to 6 (not difficult). It renders a range of scores from 0 to 48. Higher scores reflect better motor performance.

Short Form-Postural Assessment Scale for Stroke (SF-PASS)

The SFPASS is a measure of postural balance in stroke patients (Chien et al, 2007). Ability to maintain balance while performing five balance-related tasks was measured on a 3-point scale of 0, 1.5 and 3. Obtainable scores ranged from 0 to 15. Higher scores reflect higher balance ability.

Reintegration to Normal Living Index (RNLI)

The RNLI (Wood-Dauphinee et al, 1988) was used to measure participants' post-stroke level of reintegration into the community. It comprises of 11 declarative statements on participation in recreational and social activities, movement within the community and the individual role in family and other relationships. The tester graded the extent to which each statement described the participants' situation from 0 to 10 on a visual scale. It generated a range of scores from 0 to 110, which was subsequently converted into a percentage.

Six-metre walk (SMW)

The SMW (Butler et al, 2009) was used to compute participants' walking speed. Participants were instructed to walk a distance of 10 metres at their individual comfortable pace. Ambulation over the central 6-metre section was timed using a stopwatch. The tester measured walking speed (m/s) at baseline and week 10.

Health-related quality of life (HRQOL) in stroke patients

The authors used the HRQOL to assess participants' health-related quality of life (Owolabi and Ogunniyi, 2009). (AQ: changed from HRQLISP to HRQOL, which is the more common acro-

nym; ok?) The HRQOL is a stroke-specific, patient-centred measure with two dimensions and seven domains. Scores are computed for each domain based on equations. Higher scores reflect better quality of life.

Data analyses

The authors analysed the data using SPSS version 13.0. Descriptive statistics of mean and percentages summarised the participants' demographic and clinical characteristics. Paired t tests were used to compare the pre- (baseline) and

Table 1. Demographic and clinical characteristics of participants (n=25)

Characteristics	n	%
Gender		
Male	7	28.0
Female	18	72.0
Marital status		
Single	1	4.0
Married	21	84.0
Widowed	3	12.0
Highest education level		
None	4	16.0
Primary	9	36.0
Secondary	7	28.0
Tertiary	5	20.0
Limb dominance		
Right	24	96.0
Left	1	4.0
Affected side		
Left	18	68.0
Right	8	32.0
Mean Age (years)	60.6 ± 10.2	

Table 2. Comparison of motor function, postural balance and community reintegration scores of participants from baseline to week 10 using Friedman's test (n=25)

Timeframe	Motor function $\chi \pm SD$	Postural balance $\chi \pm SD$	Community reintegration $\chi \pm SD$
Baseline	22.9±15.2	8.6±5.0	30.1±22.9
Week 2	26.3±13.9	9.1±4.4	36.5±23.8
Week 4	29.5±13.2	10.1±3.7	45.8±24.4
Week 6	30.8±12.8	11.1±3.6	52.8±24.6
Week 8	32.4±12.7	11.7±3.2	57.6±25.1
Week 10	34.7±11.7	12.3±3.2	58.7±25.4
χ^2	112.31	89.58	122.89
P value	0.01*	0.01*	0.01*

* Significant at $P < 0.05$

post-10-week quality of life and walking speed scores. Friedman's test was used to compare motor function, postural balance and community reintegration over the 10-week study period. The level of significance was set at 0.05 alpha.

RESULTS

Out of the 29 (11 males, 18 females) consenting stroke survivors who met the inclusion criteria and were consecutively recruited for this study, 25 patients (7 males, 18 females) completed the study. This gives a drop-out rate of 13.8%. Participants were considered to have dropped out and were excluded from the study if they missed two or more consecutive therapy sessions. Those who dropped out were similar in demographic and clinical characteristics to those who completed the study (Table 1).

The motor function scores showed a statistically significant increase ($\chi^2=112.31$; $P=0.01$) from 22.9 ± 15.2 at week 0 (baseline) to 34.7 ± 11.7 at week 10. The postural balance scores similarly increased significantly from 8.6 ± 5.0 at baseline to 12.3 ± 3.2 at week 10. A statistically significant increase ($\chi^2=122.89$; $P=0.01$) was found in the level of community reintegration from 30.1 ± 22.9 at week 0 of assessment to 58.7 ± 25.4 at week 10 (Table 2).

The quality of life of the participants also significantly increased from baseline to week 10. The observed increase in QoL was from the physical, emotional, spirit and spiritual interaction domains scores on the HRQOL, which significantly increased from 63.4 ± 15.1 , 64.2 ± 12.2 , 72.1 ± 4.9 and 77.6 ± 9.3 respectively at baseline to 75.6 ± 14.9 , 72.6 ± 17.4 , 77.1 ± 4.4 and 84.9 ± 6.1 respectively at week 10 (Table 3). A similar statistically significant increase from 0.30 ± 0.20 m/s at baseline to 0.60 ± 0.40 m/s at week 10 was recorded in participants' walking speed (Table 4).

DISCUSSION

The mean age of the stroke survivors who participated in this study (60.6 ± 10.2 years) was similar to those commonly found in stroke studies. Chen et al (2010) reported that over 80% of strokes occur in the elderly with a mean age of ≥ 65 years. This has been attributed to the fact that age is an important non-modifiable risk factor for stroke (Russo et al, 2011). There are more females in this study than males. However, studies often reported higher incidence rate of strokes among males. Our findings may be related to the tendency of women to live longer than men,

which is making the burden of stroke increasingly heavy in women than initially reported. It could also be that more women reported at the hospital after suffering a stroke.

There was a significant improvement in participants' motor function ability during the 10 weeks. This suggests that the PHCPI might have positively influenced the stroke survivors' motor function. This result trend may be attributed to inclusion of task-oriented exercises that are focused on functional activities of daily living. Evidence has shown that task-oriented training is effective in stroke rehabilitation compared with training at impairment level (Rensik et al, 2009).

Participants' postural balance scores also improved significantly over the 10-week period. This could be because the Berg Balance Scale (BBS) tasks, a component of the intervention, enabled participants to undertake balance activities similar to those performed during daily life. Hamzat and Fashoyin (2007) showed that the BBS items are a reliable, low-cost tool for training patients' balance post-stroke, supporting findings in the report by Bayouk et al (2006) stating that balance training is more effective when it is task related than non-task related.

The participants' level of handicap as measured by the RNLI reduced after 10 weeks of intervention. This is contrary to the findings from Lord et al (2008) and Markle-Reid et al (2011) who found no significant difference in community reintegration of stroke survivors who participated in a community-based exercise programme compared to those who did not participate (AQ: ok?).

However, research findings may also relate to the time since stroke onset. Markle-Reid et al (2011) studied community-dwelling stroke survivors up to 1 year post-onset and found that their recovery could have reached a plateau; however, Lord et al (2008) studied stroke survivors in the sub-acute phase. The mean time since stroke onset in our study was 24.1 days at recruitment into the study and the mean time since stroke onset up to the 10th week of this study was 14.9 weeks. Many of the participants had significantly improved motor and balance functions by week 10. Both Pang et al (2007) and Hamzat and Kobiri (2008) reported a direct relationship between improved balance and community participation. Therefore, our findings may relate to participants' improvement in balance and motor function.

Participants' quality of life also improved after the intervention. The increase was particularly notable in the physical, emotional, spirit and spiritual interaction domains of the HRQOL.

(AQ: the HRQOL appears to normally assign the domains the titles: physical, psychological and social. Also, as spirit and spiritual are basically the same thing, could you clarify which domains you are referring to here?) The increase in the physical domain may be associated with the improvement in participants' motor function. Hamzat and Peters (2009) had reported a linear association between health-related quality of life and motor function. Functional ability has been shown to have the largest direct impact on participation restriction (Chau et al, 2009). Participation restriction negatively impacts quality of life and limits patients' involvement in activities considered important to them, which can influence how they perceive themselves. Ability to carry out basic functions, such as dressing, which could have been impaired by stroke may enhance perceived self-worth. The opportunities for socialising with other patients with a similar condition that this intervention provided may be responsible for the improvement in the emotional, spirit and spiritual interaction domains of the HRQOL. These opportunities could have engendered in them a feeling of hope, social interaction and spirituality (Hale et al, 2003) than would otherwise be possible.

Participants' walking speed significantly increased over the 10-week period. The walking speed is a measure of functional gait ability or community ambulation. This may be connected with the improvement in balance func-

Table 3. Comparison of quality of life scores of participants at baseline and week 10 (n=25)

Domains	Baseline $\bar{x} \pm SD$	Week 10 $\bar{x} \pm SD$	t value	P value
Physical	63.4±15.1	75.6±14.9	7.45	0.01*
Emotional	64.2±12.2	72.6±17.4	2.41	0.02*
Intellectual	78.5±12.7	81.6±12.8	1.80	0.08
Soul	72.3±6.9	72.1±7.3	0.27	0.78
Spirit	72.1±4.9	77.1±4.4	3.74	0.01*
Eco-social	64.7±6.0	62.3±6.0	1.85	0.07
Spirit. Interaction	77.6±9.3	84.9±6.1	5.16	0.01*
Total HRQLISP	70.4±4.9	75.2±5.4	5.62	0.01*

*Significant at $P < 0.05$

Table 4: Comparison of walking speed of participants at baseline and week 10 (n=25)

Variable/Time	Baseline $\bar{x} \pm SD$	Week 10 $\bar{x} \pm SD$	t value	P value
Walking speed (metre/second)	0.3±0.3	0.6±0.4	2.25	0.01*

* Significant at $P < 0.05$

tion recorded in this study. Increase in walking speed may also be related to increase in muscle strength in the paretic lower limb. Enhancement of paretic leg muscle strength was reported to be a significant determinant of improvement in walking capacity among chronic stroke survivors (Pang and Eng, 2008). The intervention in this study has a component of muscle strengthening using progressive resistance training.

Limitations

Addition of a separate control group, recruitment of a larger sample size, and involvement of both sexes in equal proportion could have increased the external validity of this study's findings.

CONCLUSION

To optimise PHC and ensure implementation of physiotherapy services, it is important to use appropriate technology that the community and nation can maintain. The PHCPI is one such tool as it requires readily-available materials and is **robust to electricity** (AQ: by 'robust to electricity' do you mean PHCPI doesn't require electricity?). The PHCPI was associated with improvement in motor function ability, postural balance, community reintegration, quality of life and walking speed among post-acute stroke survivors treated at a primary health centre. Given the type and structure of the exercises, they could easily be accomplished in primary health centres thus improving access to physiotherapy in the community. **UJR**

AQ: Could you declare whether you have any conflicts of interest?

KEY POINTS

- Stroke is a major cause of disability in low-income countries where resources for stroke care and rehabilitation are inadequate.
- Ideal recommendation for stroke rehabilitation in developing countries (such as Nigeria) should be one that is tailored to meet the requirements of cost-effectiveness.
- Development of the Primary Health Care-based Physiotherapy Intervention (PHCPI) that requires simple, readily-available and easy-to-use equipment for stroke rehabilitation in the community can be used to achieve this objective.
- The PHCPI consisted of exercises to strengthen the extremities, improve balance, enhance walking ability and encourage arm and hand function.
- The PHCPI produced improvements in motor function, postural balance, community reintegration, quality of life and walking speed of post-acute stroke survivors.
- The PHCPI may be beneficial to recovery of stroke survivors.

- Boyouk JF, Boucher JP, Leroux A (2006) Balance training following a stroke: effects of task-oriented exercises with and without altered sensory input. *Int J Rehabil Res* **29**(1): 51–9
- Boyce W, Koros M, Hodgson J (2002) Community based rehabilitation: a strategy for peace building. *BMC Int Health Hum Rights* **2**(1): 6
- Brainin M, Teuschl Y, Kalra L (2007) Acute treatment and long-term management of stroke in developing countries. *Lancet Neurol* **6**(6): 553–61
- Butler AA, Menant JC, Tiedemann AC, Lord SR (2009) Age and gender differences in seven tests of functional mobility. *J Neuroeng Rehabil* **6**: 31
- Chau JPC, Thompson DR, Twinn S, Chang AM, Woo J (2009) Determinants of participation restriction among community dwelling stroke survivors: a path analysis. *BMC Neurol* **9**: 49
- Chen R, Balami JS, Esiri MM, Chen L, Buchan AM. (2010) Ischaemic stroke in the elderly: an overview of evidence. *Nat Rev Neurol* **6**(5): 256–65
- Chien C, Lin J, Wang C, Hsueh I, Sheu C, Hsieh C (2007) Developing a short form of the postural assessment scale for people with stroke. *Neurorehabil Neural Repair* **21**(1): 81–90
- Cueto M (2004) The origins of primary health care and selective primary health care. *Am J Public Health* **94**(11): 1864–74
- Feigin VL, Lawes CM, Bennett DA, Barker-Collo SL, Parag V (2009) Worldwide stroke incidence and early case fatality reported in 56 population-based studies: a systematic review. *Lancet Neurol* **8**(4): 355–69
- Fricke M (2005) *Physiotherapy and primary health care: evolving opportunities*. A paper submitted to the Manitoba branch of the Canadian Physiotherapy Association, College of Physiotherapy of Manitoba
- Hale L, Bennet D, Bentley M, Crawshaw A, Davis H (2003) Stroke rehabilitation – comparing hospital and home-based physiotherapy: the patient's perception. *New Zealand J Physiother* **31**(2): 84–92
- Hamzat TK, Fashoyin OF (2007) Balance retraining in post stroke patients using a simple, effective and affordable technique. *Afr J Neurol Sci* **26**(2): 39–47
- Hamzat TK, Kobiri A (2008) Effects of walking with a cane on balance and social participation among community-dwelling post-stroke individuals. *Eur J Phys Rehabil Med* **44**(2): 121–6
- Hamzat TK, Peters GO (2009) Motor function recovery and quality of life among stroke survivors in Ibadan, Nigeria: a 6-month follow-up study. *Eur J Phys Rehabil Med* **45**(2): 179–83
- Joubert J, Prentice LF, Moulin T, Liaw ST, Joubert LB, Preux PM et al (2008) Stroke in rural areas and small communities. *Stroke* **39**(6): 1920–8
- Langhorne P, Coupar F, Pollock A (2009) Motor recovery after stroke: a systematic review. *Lancet Neurol* **8**(8): 741–54
- Lexell J, Flansbjerg UB (2008) Muscle strengthening, gait performance and physiotherapy after stroke. *Minerva Medica* **99**(4): 353–68
- Loewen SC, Anderson BA (1988) Reliability of the Modified Motor Assessment Scale and the Barthel Index. *Phys Ther* **68**(7): 1077–81
- Lopez AD, Mathers CD, Ezzati M, Jamison DT, Murray CJ (2006) Global and regional burden of diseases and risk factors, 2001: systematic analysis of population health data. *Lancet* **367** (9524): 1747–57
- Lord S, McPherson KM, McNaughton HK, Rochester L, Weatherall M (2008) How feasible is the attainment of community ambulation after stroke? a pilot randomized controlled trial to evaluate community-based physiotherapy in subacute stroke. *Clin Rehabil* **22**(3): 215–25
- Markle-Reid M, Orridge C, Weir R, Browne G, Gafni A, Lewis M et al (2011) Interprofessional stroke rehabilitation for stroke survivors using home care. *Can J Neurol Sci* **38**(2): 317–34
- Mendis S. (2010) Prevention and care of stroke in low- and middle-income countries: the need for a public health perspective. *Int J Stroke* **5**(2): 86–91
- Mensah GA (2008) Epidemiology of stroke and high blood pressure in Africa. *Heart* **94**(6): 697–705
- Michael K, Goldberg AP, Treuth MS, Beans J, Normandt P, Macko RF (2009) Progressive adaptive physical activity in stroke improves balance, gait and fitness: Preliminary results. *Top Stroke Rehabil* **16**(2):133–9

Norrving B, Kissela B (2013) The global burden of stroke and the need for a continuum of care. *Neurology* **80**(3): S5–12

Ogunbo B, Ogun SA, Ushewokunze S, Mendelow AD, Rogers H, Walker R (2005) How can we improve the management of stroke in Nigeria, Africa. *Afr J Neurol Sci* **24**(2): 9–19

Owolabi MO, Ogunniyi A (2009) Profile of health-related quality of life in Nigerian stroke survivors. *Eur J Neurol* **16**(1): 54–62

Pang MY, Eng JJ, Miller WC (2007) Determinants of satisfaction with community reintegration in older adults with chronic stroke: role of balance self-efficacy. *Phys Ther* **87**(3): 282–91

Pang MY, Eng JJ (2008) Determinants of improvement in walking capacity among individuals with chronic stroke following a multidimensional exercise program. *J Rehabil Med* **40**(4): 284–90

Rensink M, Schuurmans M, Lindeman E, Hafsteinsdottir T (2009) Task-oriented training in rehabilitation after stroke: systematic review. *J Adv Nurs* **65**(4): 737–54

Russo T, Felzani G, Marini C (2011) Stroke in the very old: a systematic review of studies on incidence, outcome and resource use. *J Ageing Res* doi **2011**:108785

Soever L (2006) *Primary health care and Physical Therapists – moving the profession's agenda forward: A discussion paper prepared for The College of Physical Therapists of Alberta*. Physiotherapy Association and The Canadian Physiotherapy Association, Alberta

Stanton SJ (2000) The role of client-partner relationships in adaptation post-stroke: Exploring the perspectives of couples. In: Hammell K, Carpenter C, Dyck I (Eds) *Using qualitative research: A practical introduction for occupational therapists and physical therapists*. Churchill Livingstone, London: 47–57

Strong K, Mathers C, Bonita R (2007) Preventing stroke: saving lives around the world. *Lancet Neurol* **6**(2): 182–7

Thomas C, Parry A (1996) Research on users' views about stroke services: towards an empowerment research paradigm or more of the same? *Physiotherapy* **82**(1): 6–12

Wahab KW (2008) The burden of stroke in Nigeria. *Int J Stroke* **3**(4): 290–2

Wasserman S, DeVilliers L, Bryers A (2009) Community-based care of stroke patients in a rural African setting. *S Afr Med J* **99**(8): 579–83

Wevers L, van de Port I, Vermue M, Mead G, Kwakkel G (2009) Effects of task-oriented circuit class training on walking competency after stroke: a systematic review. *Stroke* **40**(7): 2450–9

Wood-Dauphinee S, Opzomer MA, Williams JL, Marchand B, Spitzer WO (1988) Assessment of global function: The Reintegration to Normal Living Index. *Arch Phys Med Rehabil* **69**(8): 583–90

World Health Organisation (1978) *Report of the International Conference on Primary Health Care*. Alma-Ata, USSR. 6–12 Sept

Appendix 1. Description of the interventions from the papers retrieved in the literature search

Target	Description and progression
Strength Training (Langhorne, 2009; Michael et al, 2009, Wevers et al, 2009)	Assistive and resistive exercises using proprioceptive neuromuscular facilitation (PNF) patterns for the muscle groups of the affected upper and lower limbs. Assistance and resistance were manually and subjectively offered, based on what each participant could tolerate. The PNF patterns were used until there was adequate strength (as assessed by the physiotherapist) in the extremities for the use of mechanical resistance (free weights). Resistance was increased when the patient could complete two sets of ten repetitions of each movement through the available range of motion.
Balance Training (Wevers et al, 2009; Lexell and Flansbjerg, 2008)	<p>i) Sitting-to-standing unsupported: The patient stood from sitting without holding on to anything and remained standing unsupported for 2 minutes. Progression was by increasing the activity by one repetition and the duration of standing by 10 seconds weekly.</p> <p>ii) Standing-to-sitting unsupported with feet on the floor which entailed the patient sitting with back unsupported and arms folded for 2 minutes. This was progressed by a 10 second increase weekly.</p> <p>iii) Transfer activities: Moving from chair to bed and back again—with and without armrests. This was increased by one repetition weekly.</p> <p>iv) Standing unsupported with eyes closed for 10 seconds, which was increased by 2 seconds weekly.</p> <p>v) Standing unsupported with feet together. Patient placed feet together and stood without holding on to anything for 10 seconds. The duration was increased by 10 seconds weekly.</p> <p>vi) Reaching forward with outstretched arms while standing. Patient lifted arms to 90°, stretched fingers out, and reached forward as far as possible. This was increased by one repetition weekly.</p> <p>vii) Retrieving object from floor: Involved picking up shoe/slipper in front of feet with standing as the starting position. It was increased by one repetition weekly.</p> <p>viii) Turning to look behind over left and right shoulders while standing which was increased by one repetition weekly.</p> <p>ix) Turning 360°, pausing and then turning in a full circle in the other direction within 4 seconds. Progression was by increasing the activity by one repetition weekly.</p> <p>x) Stool stepping: This was done by placing each foot alternately on the stool until each foot has stepped the stool four times. This was increased by one repetition weekly.</p> <p>xi) Tandem stance: Involved standing unsupported with one foot in front of the other. Where this was not possible, the foot in front was moved ahead of the one at the back as much as possible with the heel of the forward foot directly in front of the toes of the backward foot for 30 seconds. It was increased by 5 seconds weekly.</p> <p>xii) Standing on one leg without holding on to anything for 15 seconds, which was increased by 3 seconds weekly.</p>
Ambulation training (Lexell and Flansbjerg, 2008)	This was done by mapping out a 6-metre walkway with alternate footprints drawn on the walkway. Participants were required to walk on the walkway ensuring heel strike of each foot alternately in the footprints. The activity is carried out for 5mins. Focus was on placement of the foot on the right print using the right pattern and balancing of the body weight over the feet as well as control of the knee-ankle-foot motion through swing. Progression is by increasing the duration of walking by 2minutes weekly.
Unaffected extremity functional training (AQ: which paper is this from?)	Consisted of a combination of self-assisted exercises and task-oriented functional activities. Self-assisted exercises were exercises the patient could carry out by himself or herself using the unaffected extremities. Task-oriented activities consisted of a battery of tasks that encouraged the use of the arm and hand in patterns needed for normal activities of daily living, such as opening doors, buttoning and un-buttoning clothes, screwing and unscrewing bolts and nuts. Progression of activity was by withdrawing the amount of assistance given, increasing the complexity of task and increasing the speed of carrying out the task.