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Clinical Short Communication

Pilot trial of a tele-rehab intervention to improve outcomes after stroke in Ghana: A feasibility and user satisfaction study

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ABSTRACT

Background: Tele-rehabilitation after stroke holds promise for under-resourced settings, especially sub-Saharan Africa (SSA), with its immense stroke burden and severely limited physical therapy services.
Objective: To preliminarily assess the feasibility and outcomes of mobile technology-assisted physical therapy exercises for stroke survivors in Ghana.
Methods: We conducted a prospective, single arm, pre-post study involving 20 stroke survivors recruited from a tertiary medical center, who received a Smartphone with the 9zest Stroke App® to deliver individualized, goal-targeted 5-days-a-week exercise program that was remotely supervised by a tele-therapist for 12 weeks. Outcome measures included changes in stroke levity scale scores (SLS), Modified Rankin score (MRS), Montreal Cognitive Assessment (MOCA), and feasibility indicators.
Results: Among study participants, mean ± SD age was 54.6 ± 10.2 years, 11 (55%) were men, average time from stroke onset was 6 months. No participants dropped out. Compared with baseline status, mean ± SD scores on SLS improved from 7.5 ± 3.1 to 11.8 ± 2.2 at month 1 ($p < 0.0001$) and 12.2 ± 2.4 at month 3 ($p < 0.0001$), MOCA scores improved from 18.2 ± 4.3 to 20.4 ± 4.7 at month 1 ($p = 0.14$), and 22.2 ± 7.6 at month 3 ($p = 0.047$). Mean ± SD weekly sessions performed by participants per month was 5.7 ± 5.8 and duration of sessions was 25.5 ± 16.2 min. Erratic internet connectivity negatively affected full compliance with the intervention, although satisfaction ratings by study participants were excellent.
Conclusion: It is feasible to administer an m-health delivered physical therapy intervention in SSA, with high user satisfaction. Randomized trials to assess the efficacy and cost-effectiveness of this intervention are warranted.

1. Introduction

Rehabilitation after stroke in sub-Saharan Africa (SSA) is challenged by lack of trained rehabilitation personnel, with 2.5 physiotherapists 100,000 people served [1]. Stroke survivors often resort to alternative forms of treatment and refuse orthodox care due to highly prevalent stroke related stigma [2]. Furthermore, 70% of individuals in SSA reside in rural settings [3] with limited geographic access to rehabilitation services which coupled with the prohibitive costs make post-stroke rehabilitation a major challenge.

One promising avenue for effective mobilization and utilization of the scanty health professionals available to meeting the huge population demand in LMICs for neurology care is via the agency of telemedicine [4,5]. Tele-rehabilitation has been evaluated for feasibility and efficacy and data pooled from 7 studies provided limited, moderate evidence that tele-rehabilitation had equal effects with conventional rehabilitation in improving abilities of activities of daily living and motor function for stroke survivors [6].

However, the feasibility of m-health administered rehabilitation for stroke survivors has not been tested in SSA. Hence the objective of the present study was to preliminarily assess the feasibility of and satisfaction with a comprehensive physical therapy tele-rehabilitation intervention for post-stroke rehabilitation among 20 recent Ghanaian stroke survivors.

2. Methods

2.1. Study design and site

This is a single site, single arm, observational prospective pilot study

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to assess the feasibility of a mobile phone administered physical therapy intervention administered remotely at home of Ghanaian stroke survivors. The study was conducted at the Neurology Clinic of the Komfo Anokye Teaching Hospital (KATH), a tertiary medical center in Kumasi, Ghana [7].

2.2. Study participants

Consecutive stroke survivors attending the Neurology service at KATH were approached for enrollment into the study after obtaining informed consent. Eligible subjects should have had a stroke within 6 months with a Modified Rankin score of 1 to 4. Subjects were excluded if they had serious medical co-morbidities such as [1] recent hospitalization for myocardial infarction, stage IV heart failure, unstable cardiac arrhythmias, [2] history of severe chronic obstructive pulmonary disease on Long term oxygen Therapy (LTOT), [3] pre-existing neurological disorders such as severe dementia, Parkinson's disease, [4] severe uncontrolled psychiatric illness such as schizophrenia or medication refractory depression, [5] uncontrolled hypertension with systolic blood pressure (BP) > 220 and Diastolic BP > 120 mmHg refractory on optimal anti-hypertensive therapy, [6] history of sustained alcoholism or drug abuse in the last six months, [7] severe arthritis or orthopedic problems that limit passive ranges of motion, [8] unable to ambulate at least 50 m prior to stroke, or intermittent claudication while walking < 200 m.

2.3. Intervention

Patients received a Smartphone with internet capabilities (on loan if they did not have one already – taken from inventory of a previously conducted mHealth study [8]) and equipped with (or downloaded on to their phone) the 9zest Stroke Rehab App® (https://9zest.com/stroke) to deliver individualized, goal-targeted 5-days-a-week exercise program that was progressively graduated by a tele-therapist for 12 weeks. A typical session lasted for 30–60 min. The mobile-phone system allowed for recording of daily exercise with video and weekly telephone-conference call with tele-therapist after data review. The stroke survivors received a standardized rehabilitation program comprising of 4 categories of physiotherapy components namely (I) mobility, upper and lower limb strengthening, (II) dexterity to improve fine motor movements, (III) seated and standing balance exercise and (IV) Walking endurance. Each category of physiotherapy has levels of increasing difficulty chosen based on level of disability and modifiable based on progress. Where indicated and for ethical reasons, patients in the intervention arm are allowed to supplement their tele-rehab sessions with hospital-based rehab if they wished and were allowed to contact a physiotherapist or a physician if there were any difficulties. Research assistants (RA) and physiotherapist serving as tele-therapists received training provided by the study coordinator before commencement of the study. The tele-therapist were trained in the use of the 9zest Stroke Rehab App® tele-rehabilitation system from the tele-therapist user interface, exercise progression protocols and documenting patients' progress. RAs were trained in assessing the eligibility of potential participants. The tele-therapist and RAs attained a competency level of > 90% in their respective study related responsibilities at the end of training prior to initiation of study.

2.4. Baseline data collected

We first collected demographic information including age, gender, educational status, monthly income level as well as location of residence. Vascular risk factor profile, stroke type, stroke severity was assessed using National Institute of Health Stroke Scale (NIHSS), and functional status assessed using the Modified Rankin scale were collected by the two trained Research Assistants through review of medical charts and interview of stroke survivors and/or their proxy. Stroke type was defined radiologically into ischemic and hemorrhagic based on cranial CT scan done at onset of stroke symptoms.

2.5. Outcome measures

We measured the following outcome measures: (i) Stroke Levity Scale (SLS) [9], a concise, valid and reliable stroke impairment scale used to monitor outcomes of stroke patients by calculating the maximum power (0–5) in the dexterous hand, maximum power in the weaker lower limb (0–5), mobility score (0–4) and aphasia score (0–1), (ii) Modified Rankin score, (iii) Barthel's Index of Activities of Daily living, (iv) National Institute of Health Stroke Scale, (v) Montreal Cognitive assessment, (vi) Fatigue severity scale [10] (vii) visual analogue scale for pain and (viii) feasibility outcomes such as fidelity checklist including internet connectivity issues and App functionality. Finally, patient satisfaction assessed at the end of the intervention via a telephone survey was performed using a telehealth satisfaction instrument designed for the study. The satisfaction measure consisted of 12 items corresponding to aspects of the telerehabilitation experience with 11 items using five-point Likert rating scales and one item used a “yes” or “no” response.

2.6. Statistical analysis

Descriptive statistics comprised of frequency counts with their respective percentages for discrete variables and means with standard deviation. Means and medians were compared using the Student's *t*-test or the Mann-Whitney's *U* test for paired comparisons or Analysis of variance for month 0, 1 and 3 comparisons of study outcomes. Correlations between changes in outcome measures between baseline and 12 weeks versus average duration of telerehabilitation sessions were explored using the Spearman's correlation. In all analysis, two-tailed *p*-values < 0.05 were considered statistically significant with no adjustments for multiple comparisons. Statistical analysis was performed using GraphPad Prism version 7.

3. Results

3.1. Demographic and clinical characteristics of study participants

Of the 24 stroke patients approached, 20 were eligible for this feasibility study. Of those excluded, 3 had fully recovered from stroke without demonstrable motor deficits and 1 declined enrollment into the study. The mean ± SD age of study subjects was 54.6 ± 10.2 years, 11 of whom were male participants and 15 (75%) resided in urban settings and other characteristics are shown in Table 1.

3.2. Outcomes

The mean score on the stroke levity scale at enrollment was 7.5 ± 3.1 which increased to 11.8 ± 2.2 at month 1 and to 12.2 ± 2.4 ($p < 0.0001$) with higher score suggesting lower functional impairment on this scale. Modified Rankin score at month 0 was 2.2 ± 0.6 at enrollment, 2.2 ± 1.1 at month 1 and improved non-significantly to 1.8 ± 0.7 at month 3 ($p = 0.06$, comparing baseline with month 3). The mean ± SD baseline Barthel's index score was 94.4% ± 6.4 at month 0, 95.8% ± 6.3 at month 1 and 96.1% ± 6.4 at month 3. There was an improvement in the Montreal cognitive assessment scores from a baseline mean value of 18.2 ± 4.3 to 20.4 ± 4.7 at month 1 and 22.2 ± 7.6 ($p = 0.047$, comparing month 3 with baseline), (Fig. 1A–C). There were no significant changes in the NIHSS score, fatigue or pain scores during follow-up.

3.3. Adherence to intervention protocol

The mean ± SD number of weekly rehabilitation sessions