Scholars Journal of Applied Medical Sciences
Abbreviated Key Title: Sch J App Med Sci
ISSN 2347-954X (Print) | ISSN 2320-6691 (Online)
Journal homepage: https://saspublishers.com

OPEN ACCESS

Medicine

Comparison between Home-Based Exercise and Hospital-Based Supervised Exercise in the Early Rehabilitation of Stroke Patients

Dr. Palash Nag[1*], Dr. Shahadath Hossain Ripon[2], Dr. Jahidul Islam[3], Dr. Aparajeya Bibav Bikash Baral[4], Dr. MD. Aminul Alam[5], Dr. Md. Uzzal Hossain[6], Dr. Md. Tanzim Hasan Refat[7], Dr. Parag Dey[8]

[1]Junior Consultant, Department of Physical Medicine and Rehabilitation, 250 Bedded General Hospital, Chittagong, Bangladesh
[2]Professor & Director, HIS & E-Health at Directorate General of Health Services, Dhaka, Bangladesh
[3]Professor & Head, Department of Physical Medicine and Rehabilitation, Dhaka Medical College Hospital, Dhaka, Bangladesh
[4]Assistant Professor, Department of Physical Medicine and Rehabilitation, Dhaka Medical College Hospital, Dhaka, Bangladesh
[5]Registrar, Department of Sports Medicine and Arthroscopy, National Institute of Traumatology and Orthopaedic Rehabilitation (NITRO), Dhaka, Bangladesh
[6]Medical Officer, Adamdighi Upazila Health Complex, Bogura, Bangladesh
[7]Medical Officer, Hathazari Upazila Health Complex, Chittagong, Bangladesh
[8]Medical Officer, Department of Psychiatry OPD, Chittagong Medical College Hospital, Chittagong, Bangladesh

DOI: 10.36347/sjams.2024.v12i04.012 | **Received:** 28.02.2024 | **Accepted:** 07.04.2024 | **Published:** 09.04.2024

***Corresponding author:** Dr. Palash Nag
Junior Consultant, Department of Physical Medicine and Rehabilitation, 250 Bedded General Hospital, Chittagong, Bangladesh

Abstract **Original Research Article**

***Introduction*:** Stroke is one of the leading causes of death and disability worldwide and more so in underdeveloped countries like Bangladesh, where health support systems including rehabilitation not expectedly available. Early initiation of rehabilitation procedures can enable a greater return of neurological function and improve long-term outcomes and quality of life. In this study, we aimed to compare the effects of home-based exercise and hospital-based supervised exercise in the early rehabilitation of stroke patients. ***Methods*:** This was a prospective observational study and was conducted in the Department of Physical Medicine and Rehabilitation, Dhaka Medical College Hospital, Dhaka, Bangladesh during the period from January, 2014 to June, 2014. In our study, we included 250 patients, and the patients were divided into two groups – Group A (Patients who got home-based exercise) and Group B (Patients who got hospital-based exercise). ***Result*:** We found the mean age of the patients of Group A & Group B was 56.75± 9.45 and 55.46± 10.58 years respectively. Among the patients, 41% were female,59% were male and 168 (67.2%) patients had been suffering from ischemic stroke and 82 (32.8%) patients from hemorrhagic stroke. The most common risk factors were HTN, dyslipidemia, and obesity. Mean FIM gain in Group A was 37.97 ± 17.52 and in Group B was 48.56 ± 21.22 which was significantly higher than that of Group A patients. ***Conclusion*:** In our study, we found that hospital-based supervised exercise is superior to home-based exercise within 4 weeks of stroke in early rehabilitation of stroke patients.

Keywords: Stroke, FIM, Home-based exercise, Hospital-based exercise.

INTRODUCTION

Stroke is a very diverse condition with several subtypes that each have unique clinical and epidemiological features. It continues to be the primary cause of adult-onset physical disability and the second greatest cause of death worldwide [1]. Stroke syndrome is defined by the World Health Organization as rapidly developing clinical indications of localized or widespread impairment of brain function that last for at least 24 hours or result in death with no evident cause other than vascular origin [2]. Strokes can be either hemorrhagic or ischemic, and they typically affect middle-aged and older people. Young adult strokes are rather rare [3]. The global stroke incidence rate is approximately 2/1000, meaning that for every 10,000 people, there will be about 200 new cases each year [4, 5].

Stroke is one of the leading causes of death and disability worldwide and more so in underdeveloped countries like Bangladesh, where health support systems including rehabilitation not expectedly available [6]. Early initiation of rehabilitation procedures can enable a greater return of neurological function and improve long-term outcomes and quality of life [7].

Rehabilitation after stroke is a continuum, starting within days of stroke onset and ending only when it no longer produces any positive effect. Effective

rehabilitation relies on a coordinated multidisciplinary approach [8]. Proper rehabilitation of stroke patients includes early physical, occupational and speech therapy [9].

A clear consensus exists that the purpose of rehabilitation is to limit the impact of stroke related brain damage on daily life by using a mixture of therapeutic and problem-solving approaches. A stroke is not simply a brain disease but affects the whole person and the family [10].

Different approaches have been used to improve functional status following stroke. Studies focused on training mobility and mobility related activities were demonstrated improvements and functional gains in stroke patients [11]. Current research shows recovery is related to neuroplasticity of the brain in which the function of damaged systems is taken on other neural systems. Neuroplastic change is encouraged by progressive physical exercise programs during which patients relearn how to use impaired parts of their body [12].

Patient progress and the rehabilitation outcome are assessed by different functional status measures; among them FIM (Functional Independent Measures) score is the most common [13]. The FIM is constructed with seven levels of function, two in which no human helper is required and five in which progressive degrees of help are required. Eighteen items are defined within six areas of functioning: Self-care, Sphincter control, mobility, locomotion, communication and Social Cognition. It is a reliable measure and can be easily administered for periodic assessment of changes in patient's performance [14].

Recent studies have demonstrated that exercise can improve mobility and balance in stroke patients [11]. The results of a recent controlled trial in Bradford indicate that physiotherapy for stroke patients at home is more effective in reducing disability than rehabilitation at a day hospital [15].

A review of all types of home-based stroke rehabilitation however, concluded that home-based stroke rehabilitation per se appears to improve independence in personal activities and extended daily livings activities and minimizes the chances of deterioration or death [16] It is generally well established that supervised exercise programs (SE) administered over several weeks improve physical ability in the short term, although little is known about long term effectiveness. In addition, there is a lack of home-based studies demonstrating the long-term influences on functional level where they are more feasible and cost-effective than supervised training [16].

So, therefore, this study was done to see the effects of hospital-based and home-based rehabilitation and find out which will favor the patients to perform the therapeutic exercise and daily activities according to their capability.

METHODOLOGY & MATERIALS

This was a prospective observational study and was conducted in the Department of Physical Medicine and Rehabilitation, Dhaka Medical College Hospital, Dhaka, Bangladesh during the period from January, 2014 to June ,2014. In our study, we included 250 patients with strokes who attended the Department of Physical Medicine and Rehabilitation. The patients were divided into two groups – Group A (125 patients who got home-based exercise) and Group B (125 patients who got hospital-based exercise).

These are the following criteria to be eligible for the enrollment as our study participants: a) Patients aged 40-65 years; b)Patients with well controlled DM, HTN; c) Patients with first episode of stroke; d) Patients with duration of stroke less than 4 weeks; e) Patients who were willing to participate were included in the study And a) Patients with recurrent stroke; b) Patients with infections like TB, meningitis; c) Patients with previous surgical history; d) Patients having Subarachnoid hemorrhage; e) Patients with any history acute illness (e.g., unconsciousness, recent MI, Atrial fibrillation etc.) were excluded from our study.

Study Procedure: Patients with stroke within 4 weeks of attending the OPD of PM&R, DMCH were registered by junior postgraduate trainee doctors. Then registered patients were referred to the investigator. Written consent was taken from the patient. Detailed history was taken and clinical examination were done systematically. CT scan was done for the patients. Functional assessment of the patients was done by FIM score. Patients were given home-based exercises which were done by family caregivers who were trained by physiotherapists at first and follow-up visits in hospital and follow-up 2 weekly. FIM gain score was analyzed. Then, FIM gain score between Group A and Group B was compared. Exercises of different types were prescribed according to muscle power. Each exercise was advised to be done 6-10 repetitions at least twice daily.

Statistical Analysis: All data were recorded systematically in preformed data collection form and quantitative data was expressed as mean and standard deviation and qualitative data was expressed as frequency distribution and percentage. Data were analyzed by SPSS (Statistical Package for Social Sciences) 15 version. Descriptive statistics were analyzed by the 't' test. Probability value <0.05 was considered as level of significance. Important tables,

charts, and diagrams were prepared based on findings relevant to risk factors and impairments. The study was approved by the Ethical Review Committee of Dhaka Medical College Hospital, Dhaka, Bangladesh.

RESULTS

Table 1: Age distribution of our study patients

Age	Group-A		Group-B		Total
	N	P(%)	N	P(%)	
45-49	15	12	45	36	60 (24%)
50-54	33	26.4	28	22.4	61(24.4%)
55-59	28	22.4	19	15.2	47 (18.8%)
60-64	49	39.2	33	26.4	82 (32.8%)
Total	125	100	125	100	250 (100%)

In table 1 we found the highest number of patients 82(32.8%) were within the 60-64 years age group, followed by 61(24.4%) in the 50-54 age group and 60 (24%) in the age group 45-49 years. In the other age group, the numbers of the patients were considerably low.

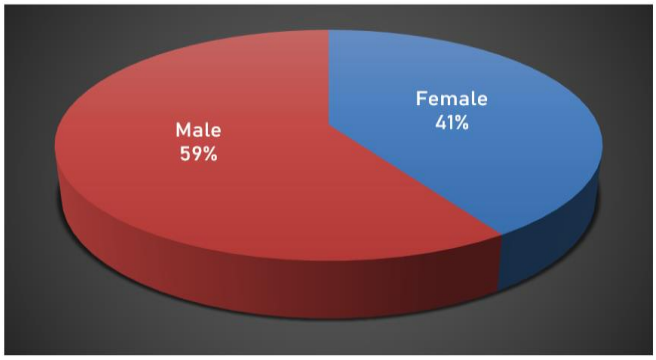


Figure 1: Gender distribution of our study patients

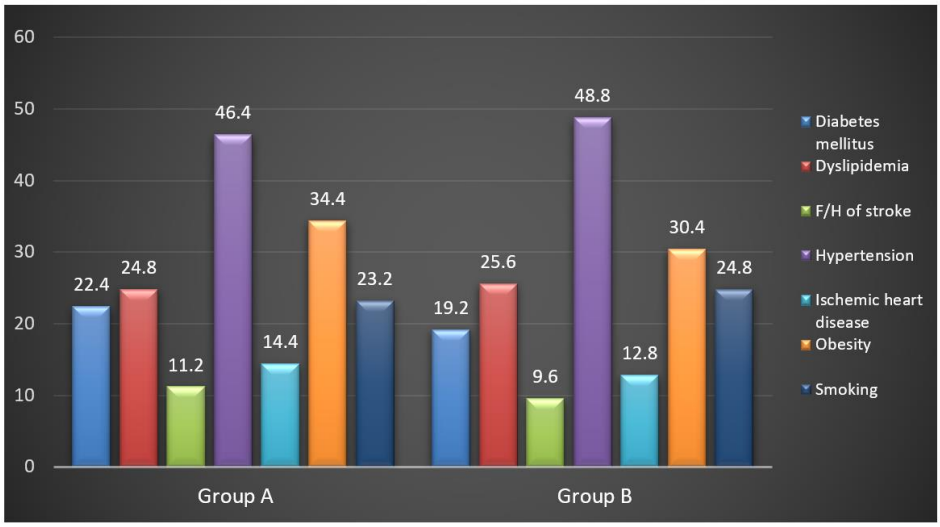
Figure 1 shows the gender distribution of our study. The pie chart showed that most of our patients were male (59%) compared to female (41%). The male and female ratio was 1.45:1 in our study.

Table 2: Demographic characteristics of our study patients

Parameters	Group A		Group B	
	N=125	P(%)	N=125	P(%)
Mean age(years)	56.75± 9.45		55.46± 10.58	
Gender				
Male	66	52.80	65	52.00
Female	59	47.20	60	48.00
Occupation				
Businessman	40	32.00	44	35.20
Service holder	35	28.00	38	30.40
Teacher	18	14.40	16	12.80
Housewife	20	16.00	14	11.20
Others	12	9.60	13	10.40
Stroke type				
Ischemic	83	66.40	85	68.00
Hemorrhagic	42	33.60	40	32.00
Side of hemiplegia				
Right	49	39.20	51	40.80
Left	76	60.80	74	59.20
Handedness				
Right	125	100.00	125	100.00
Left	0	0.00	0	0.00

A total of 250 patients with stroke were included in the study. The mean age of the patients of both groups was 56.75± 9.45 and 55.46± 10.58 years respectively. Among the patients, 168 (67.2%) had been suffering from ischemic stroke and 150 (60%) had left-sided hemiplegia. All the patients 250 (100%) were right-handed.

Table 3: Major risk factors among study patients



The most common risk factor was HTN, we found 58(46.4%) patients in Group A and 61(48.8%) patients in Group B. The next most common was Dyslipidemia, 31(24.8%) and 32(25.6%) patients found in Group A and Group B respectively, the third most common was obesity, total 81 patients, 43(34.4%) patients in Group A and 38 (30.4%) patients in Group B. We also found risk factors like smoking, DM, and IHD in our study.

Table 4: FIM score on admission, at discharge and FIM gain in study patients

FIM item	FIM admission score (Mean)		FIM discharge (Mean)		FIM Gain (Mean)		P-value
	Group A	Group B	Group A	Group B	Group A	Group B	
Self-care 6-42	13.1	14.72	27.41	28.59	14.31	13.87	
Sphincter control 2-14	5.33	5.82	10.10	10.97	4.77	5.15	
Mobility 3-21	7.10	7.74	13.77	14.23	6.67	6.49	
Locomotion 2-14	3.05	3.92	8.10	8.15	5.05	5.77	
Communication 2-14	6.90	7.95	12.54	12.59	5.64	4.64	
Social Cognition 3-21	11.79	11.62	18.77	19.13	6.98	7.51	
Total 18-126	42.69	47.90	80.67	96.46	37.98	48.59	

FIM admission score was 42.69 ± 20.74 in Group A and in Group B was 47.90 ± 29.18 out of a total of 126 (max). In Group-A stroke patients FIM admission score was highest in the self-care domain and was lowest in the locomotion and sphincter control. In Group-B stroke patients FIM admission score was highest in the self-care domain and was lowest in the locomotion and sphincter control.

Table 5: FIM gain in different age groups of study patients

Age	No. of patients	FIM admission (Mean)		FIM discharge (mean)		FIM gain (mean)	
		Group-A	Group-B	Group-A	Group-B	Group-A	Group-B
45-49	18	37	43.92	76.33	90	39.33	46.08
50-54	19	51.42	26.86	87.50	89.86	36.08	63

55-59	14	58.50	55.50	70	103.5	18.5	48
60-64	27	37.32	60.88	78.11	101.38	40.79	40.50

In Group A of patients, FIM admission score was highest in the 55-59 years age group, and in Group B the highest was in the age group of 60-64 years. The highest FIM discharge score in Group A was 87.50 between the age group 50-54 years and in Group B, the highest was 103.5 among the age group 55-59 years. Maximum FIM gain in Group A was 40.79 among the age group 60-64 years and Group B was 63 among age group 50-54 years.

Table 6: Mean FIM gain in total patients in two groups Group

FIM gain	FIM admission score (Mean ± SD)	FIM discharge (Mean ± SD)	FIM Gain (Mean ± SD)	P-value
Group A	42.69 ± 20.74	80.67 ± 19.6	37.97 ± 17.52	P< 0.019 (<0.05)
Group B	47.90 ± 29.18	96.46 ± 16.02	48.56 ± 21.22	
Both groups (78)	45.29 ± 25.28	88.56 ± 19.48	43.27 ± 20.06	

The mean FIM gain in both groups was 43.27 ± 20.06. In Group A FIM gain(mean) was 37.97 ± 17.52 and in Group B FIM gain(mean) was 48.56 ± 21.22. Mean FIM gain in Group A (Home based exercise) was significantly higher (37.97 ± 17.52 vs 48.56 ± 21.22) (P<0.05) than that of Group B patients.

DISCUSSION

This study compared the impact of supervised exercise provided in a hospital setting versus at home for stroke patients undergoing early rehabilitation. When rehabilitation began within three weeks of the stroke's onset, functional status was determined using the Validated Bangla Version of the FIM instrument.

The FIM is designed with seven functional levels: two that don't require human assistance, and five that require progressively more assistance. There are eighteen elements classified into six functional areas: self-care, sphincter control, transfer, locomotion, communication, and social cognition. Higher independence and less dependence on help are indicated by higher FIM scores. The global score, which depends on the total of the 18 items, is between 18 and 126 [14].

It was observed in the current study that the mean age of the patients was 54.71 years. We found the highest number of patients 82(32.8%) were within the 60-64 years age group, followed by 61(24.4%) in the 50-54 age group and 60 (24%) in the age group 45-49 years. In the other age group, the numbers of the patients were considerably low.

Nessa *et al.,* found the mean age of stroke patients was 57.81 years in her study [7]. A study by Hossain MS conducted with 62 patients of stroke in Chittagong Medical College Hospital found that mean age of the patients was 54.48 years.[17] This study also revealed mean age of the patients was 54.71 years which is in agreement with the current study.

Yazuver *et al.,* found mean age of stroke was 60.04 ± 11.8 yrs in their study.[18] Inouye *et al.,* found mean age was 64 ± 11 yrs [19]. Manimmanakorn *et al.,* found mean age of the patients was 60.99 ± 12.02 [20].

In this study, most of our patients were male (59%) compared to female (41%). The male and female ratio was 1.45:1 in our study. Nessa *et al.,* found that in her study conducted with 48 stroke, 30(62.50%) patients were male, and 18(37.50%) were female. The male-to-female ratio was 1.66:1.25 [7]. Nahar S found 2.33:1 and Hossain MS found the ratio 2.1:1 [17, 21]. Inouye *et al.,* found 67% of the patients were male and 33% were female.[19] Ozdemir *et al.,* found 67.4% were male and 32.6% were female [22]. The result of the current study correlates with the national and international studies indicating males suffer from stroke more than women worldwide. There was no significant difference in the sex distribution between these two groups of patients.

Among the study patients, 100 (40%) had right-sided hemiplegia, and 150 (60%) had left-sided hemiplegia. All the patients 250 (100%) were right-handed. Hossain MS found that Among 62 patients 66% had left side involvement and 34% had right side involvement [17]. Nessa *et al.,* found among 48 patients 31 (64.58%) had left side involvement and 17(35.41%) had right side involvement [7]. Ozdemir *et al.,* found 67.4% had left sided (right hemisphere) involvement and (32.6%) patients had right sided (left hemisphere) involvement [22]. Current study correlates with the above national and international studies findings.

The most common risk factor was HTN, we found 58(46.4%) patients in Group A and 61(48.8%) patients in Group B. The next most common was Dyslipidemia, 31(24.8%) and 32(25.6%) patients found in Group A and Group B respectively, the third most common was obesity, total 81 patients, 43(34.4%) patients in Group A and 38 (30.4%) patients in Group B. Hossain MS also found hypertension was the most common (67.7%) risk factors among 62 patients [17].

Qari FA showed in his study hypertension was the most common risk factor for both ischemic, as well as hemorrhagic stroke. Diabetes, smoking, ischemic heart disease, hyperlipidemia, and atrial fibrillation were other common risk factors in that order of frequency [23]. These findings are consistent with the current study.

The FIM score at the time of first attending the rehabilitation unit was considered as FIM admission score. The current study showed mean FIM admission score was 42.69 ± 20.74 in Group A and 47.90 ± 29.18 in Group B. Hossain MS found that among 62 patients mean FIM admission score was 36.5 ± 2.7 [17]. Inouye *et al.,* found FIM admission score was 57 ± 29, Fiedler *et al.,* found FIM admission score was 63.1 in the USA and Lew *et al.,* found FIM admission score was 70.5 in their studies [19, 24, 25]. Our findings are in agreement with the national study but the discrepancy with the international study was probably due to the inclusion of only first-episode stroke patients of acute onset. So naturally disability was more and FIM score was less in the current study.

The current study was done on an outpatient basis and the FIM score taken after 12 weeks i.e.96 days, was considered as FIM discharge score. In this study, FIM discharge score after 12 weeks of rehabilitation was 88.56 ± 19.48 (Group-A 80.67±19.6 and Group-B 96.46 ± 16.02). Hossain MS found that among 62 patients mean FIM discharge score was 85.35 ± 2.9 after 8 weeks [17]. Yazuver *et al.,* found FIM discharge score was 86.7 ± 24.2 after 14 weeks [18]. Inouye *et al.,* found FIM discharge score was 87± 30 after 17 weeks of inpatient rehabilitation [19]. The present study was in agreement with national and international studies. In the current study, there was a significant difference in FIM total score at discharge between Group A (80.67 ± 19.6) and Group B (96.46 ± 16.02). This finding is consistent with that of Olney *et al.,* who also found that supervised exercise programs showed trends to greater improvements in self-reported gains [26]. Studenski *et al.,* also found in their study the benefits of supervised exercise for daily functioning and quality of life after stroke [27].

FIM gain was measured by subtracting the FIM admission score from FIM discharge score. In this study FIM score after 12 weeks.) In Group-A stroke patients FIM gain was maximum in the self-care domain and was lowest in the sphincter control and locomotion. In Group-B stroke patients FIM gain was maximum in the self-care domain and was lowest in communication and sphincter control. These findings are consistent with that of Hossain MS study which also found the same things [17].

The current study showed mean FIM gain was 43.27± 20.06 in the total number of patients. Hossain MS and Nessa *et al.,* found in their study mean FIM gain of 48.85 ± 12.8 and 47.12 ± 19.33 which is in agreement with our studies [7, 17]. Inouye *et al.,* found FIM gain of 29 ± 18, Fiedler *et al.,* found FIM gain of 23.14 in the USA and Lew *et al.,* found FIM gain of 22.9 ± 11.9 in their studies [19, 24, 25].

The discrepancy in the present study was due to variations in FIM admission and FIM discharge scores. Considering mean FIM gain in different age groups, the maximum mean FIM gain in Group A was 40.79, found among age group of 60-64 years. Group B was 63, found among age group of 50-54 years. The minimum mean FIM gain in Group A was 18.5 among age group 55-59 and Group B was 40.50 among age group 60-64 years. Hossain MS found maximum FIM gain was 63.5 and 76 (Ischemic vs. Hemorrhagic) found the age group 31-40 years followed by 56 and 58(Ischemic vs. Hemorrhagic) in the 41-50 years of age group and minimum FIM gain was 26 and 41.5 (Ischemic vs. Hemorrhagic) in the > 70 years of age group 26. This study slightly correlates with our study [17].

In the current study mean FIM gain in Group B (Hospital-based supervised exercise) after 12 weeks of rehabilitation was significantly higher (48.56 ± 21.22 vs. 37.97±17.52) ($p<.005$) than that of Group A (Home-based supervised exercise).

Limitations of the Study

Our study was not a population-based study, so the findings could not be extrapolated generally all over the country. We recruited only the patients with the first episode of stroke, patients with hemiplegia due to stroke within 40-65 years, duration < 4 weeks, and no history of serious co-morbidity like unconsciousness, recent MI, atrial fibrillation, and patients having a subarachnoid hemorrhage. After evaluating those patients, we did a follow-up with them only for 6 months and then did not know other possible interference that may happen in the long term with these patients.

CONCLUSION AND RECOMMENDATIONS

In our study, we found that hospital-based supervised exercise is superior to home-based exercise within 4 weeks of stroke in early rehabilitation of stroke patients. There are inadequate facilities for inpatient rehabilitation in our country and also a lack of qualified personnel for domiciliary treatment. If we increase the resources for domiciliary rehabilitation, the short hospital stay will be an advantage for quicker turnover of patients in the hospital. More new patients will have the chance to have hospital-based rehabilitation which will eventually facilitate home-based rehabilitation in stroke patients.

So further study with a prospective and longitudinal study design including a larger sample size needs to be done to validate the findings of our study.

Funding: No funding sources.

Conflict of Interest: None declared.

Ethical Approval: The study was approved by the Institutional Ethics Committee.

REFERENCES

1. Sudlow, C. L., & Warlow, C. P. O. (1997). Comparable studies of the incidence of stroke and its pathological subtypes:results from an international collaboration. *Stroke*, *28*, 491-9.
2. Aho, K., Harmsen, P., Hatano, S., Marquardsen, J., Smirnov, V. E., & Strasser, T. (1980). Cerebrovascular disease in the community: results of a WHO collaborative study. *Bulletin of the World Health Organization*, *58*(1), 113.
3. Hossain, M. Z., Ahmed, S. U., Sarder, M. H., Dasgupta, R., Das, A., Sarker, R. N., ... & Mohammad, Q. D. (2009). Analysis of risk factors associated with stroke in young adults: a prospective study. *Journal of Dhaka Medical College*, *18*(2), 95-99.
4. Hewer, R. L. The epidemiology of disabling neurological conditions. In: Green wood R, Barners MP, Mcmillan RM, Ward CD, editors. Neurological rehabilitation. New York: Churchill Livingstone, 1993} Bangladeshi male populations in rural areas are found to have stroke more than urban people.
5. Steward, D. G. (1999). Stroke rehabilitation: Epidemiologic aspects and acute management. *Arch Phy Med Rehabil*, *80*, 54-57.
6. Alam, B., Habib, M., Qurashi, F. A., Badrul, H., Haque, A., & Mohammed, Q. D. (1999). Stroke-Evaluation of risk factors. *Bangladesh journal of Neuroscience*, *15*(1/2), 14-18.
7. Nessa, J., Khaleque, M. A., Begum, S., Ahmed, A. H., Islam, S., & Afsan, M. (2009). Rehabilitation of stroke patients-effects of early intervention of physical therapy on functional outcome. *Bangladesh J Anat*, *7*(1), 62-7.
8. Dev, K., & Joshi, M. (2013). Functional outcome of stroke patients, correlation with scandinavian stroke scale. *Age Journal*, *40*, 13-9.
9. Smith, W. S., Hauser, S. L., & Easton, J. D. (2001). Cerebrovascular diseases. In: Brunwal E, Fauci AS, kasper DL, Hauser SL, Longo Dl, Jameson JL, editors. Harrison's Principles of Internal Medicine. 15th ed. USA: McGraw-Hill Inc., 2369- 2391.
10. Mahmood, K., Hossain, M. S., & Rahman, S. (2009). Review of rehabilitation of ischaemic stroke patients. *Journal of Dhaka Medical College*, *18*(2), 169-173.
11. Altin Ertekın, Ö., Gelecek, N., Yilririm, Y., & Akdal, G. (2009). Supervised Versus Home Physiotherapy Outcomes in Stroke Patients with Unilateral Visual Neglect: A Randomized Controlled Follow-Up Study. *Journal of Neurological Sciences*, *26*(3), 325-334.
12. Pomery, V. M., & Tallis, R. C. (2002). Restoring movement and functional ability poststroke: now and the future. *Physiotherapy*, *88*, 3-17.
13. Demarin, V. (2004). Moidani udar - rastuCi medicinski i socijalno ekonomski problem. *Acta Clin Croat*, *43*, 9-13.
14. Granger, C. V. (1990). Health Accounting-functional assessment of the long term patients. In: Kottke FJ, Lehman JF, editors. Krusen's Handbook of Physical Medicine and Rehabilitation. 4th ed. Philadelphia: W.B. Saunder's Company.
15. Young, J. B., & Forster, A. (1992). The Bradford community stroke trial: results at six months. *BMJ*, *304*, 1085-6.
16. Hale, L. A. (2004). Community-based or home-based stroke rehabilitation: confusion or common sense? *New Zealand Journal of Physiotherapy-November*, *32*(3), 131-139.
17. Hossain, M. S. (2008). Comparative study of functional outcome in the rehabilitation of patients with ischemic and haemorrhagic stroke. A dissertation. Bangladesh College Physicians and Surgeons (BCPS), Dhaka, Bangladesh.
18. Yavuzer, G., Küçükdeveci, A., Arasil, T., & Elhan, A. (2001). Rehabilitation of stroke patients: clinical profile and functional outcome. *American journal of physical medicine & rehabilitation*, *80*(4), 250-255.
19. Inouye, M., Hashimoto, H., Mio, T., & Sumino, K. (2001). Influence of admission functional status on functional change after stroke rehabilitation. *American journal of physical medicine & rehabilitation*, *80*(2), 121-125.
20. Nuttaset Manimmanakorn, M., Vichiansiri, R., Nuntharuksa, C., Permsirivanich, W., & Vilai Kuptniratsaikul, M. (2008). Quality of life after stroke rehabilitation among urban vs. rural patients in Thailand. *J Med Assoc Thai*, *9*(3), 394-9.
21. Nahar, S. (1996). Effect of physiotherapy on hemiplegia due to stroke. A dissertation. *Bangladesh College Physicians and Surgeons (BCPS), Dhaka, Bangladesh*, *113*.
22. Özdemir, F., Birtane, M., Tabatabaei, R., Ekuklu, G., & Kokino, S. (2001). Cognitive evaluation and functional outcome after stroke. *American journal of physical medicine & rehabilitation*, *80*(6), 410-415.
23. Quari, F. A. (2000). Profile of stroke in a teaching university hospital in the western region. *Saudi Medical Journal*, *57*, 81-88.
24. Fiedler, R. C., Granger, C. V., & Russell, C. F. (1998). UNIFORM DATA SYSTEM FOR MEDICAL REHABILITATION: Report of First Admissions for 1997: 1. *American journal of physical medicine & rehabilitation*, *77*(5), 444-450.
25. Lew, H. L., Lee, E., Date, E. S., & Zeiner, H. (2002). Influence of medical comorbidities and complications on FIM™ change and length of stay during inpatient

rehabilitation. *American journal of physical medicine & rehabilitation*, *81*(11), 830-837.

26. Olney, S. J., Nymark, J., Brouwer, B., Culham, E., Day, A., Heard, J., ... & Parvataneni, K. (2006). A randomized controlled trial of supervised versus unsupervised exercise programs for ambulatory stroke survivors. *Stroke*, *37*(2), 476-481.
27. Studenski, S., Duncan, P. W., Perera, S., Reker, D., Lai, S. M., & Richards, L. (2005). Daily functioning and quality of life in a randomized controlled trial of therapeutic exercise for subacute stroke survivors. *Stroke*, *36*(8), 1764-1770.