# Factors Determining Functional Ability of Individuals with Stroke in Community

Mantana Vongsirinavarat PhD*,
Vimonwan Hiengkaew PhD*

**Faculty of physical Therapy, Mahidol University, Nakhon Pathom, Thailand*

***Objective:*** *The present study was conducted to assess the factors explaining functional ability in community-dwelling individuals with stroke.*

***Material and Method:*** *In all, 758 persons with acute stroke who lived in the community and joined the home physical therapy program were recruited. The personal characteristics and clinical measures were recorded at the first home visit. Measures included Glasgow coma score, Stroke Rehabilitation Assessment of Movement (STREAM), Postural Assessment Scale for Stroke Patients (PASS) including PASS-maintaining position and PASS-changing position and Barthel index.*

***Results:*** *Five variables: the PASS-maintain, PASS-change, STREAM, Glasgow coma score, and age were selected by stepwise multiple regression analysis to explain 85.6% of the variance of the Barthel Index score. The strongest predictor was the PASS-maintain, which explained 81.5% of functional score.*

***Conclusion:*** *The ability to maintain sitting and standing were the main contributors of activity daily living (ADL) ability. Physical therapists should emphasize treatment to improve these abilities in persons with acute stroke to promote independent ADL.*

***Keywords:*** *Stroke, Functional ability, Predictors, Community, Physical Therapy*

***J Med Assoc Thai 2014; 97 (Suppl. 7): S60-S64***
***Full text. e-Journal:*** *http://www.jmatonline.com*

Stroke is the leading cause of disability worldwide. It also causes the greatest burden of disease in Thailand, i.e. 12.4% for females and 11.4% for males[1,2]. The prevalence of stroke among Thai adults aged 60 and over is reported to be 4% for males and 3% for females[1].

The first two months after stroke is considered the "golden period" for stroke rehabilitation when most functional recovery is likely to happen. Physical therapy in this period is considered most beneficial and effective[3]. The rehabilitation goal of stroke is to improve activities of daily living (ADL) function. Knowing the factors that explain the ability to perform independent ADL will improve the development of an effective rehabilitation program. Some reported predictors of ADL after stroke include age, sex, marital status, lesion size and location, complete or bilateral limb paralysis, urinary and bowel incontinence, visual deficits, communication impairments, decreased level of consciousness, depression, cognitive dysfunction, motivation and admission functional score[3-6]. Studies also found that trunk control and sitting balance at an early stage could predict ADL outcome at a later stage in patients after a stroke[7-9].

Studies in Thailand have shown that the Barthel index score of patients with stroke was improved after the rehabilitation program. The younger group and ones who started the rehabilitation program within three months after onset, and those who had a greater number of rehabilitation sessions, had greater functional outcome improvement[10,11].

Most studies that reported predictors of ADL function have been undertaken in inpatient or outpatient rehabilitation settings[3-11]. In Thailand, home rehabilitation has been shown to be cost-effective and practical[12]. Measuring ADL function in the home rather than in the hospital may provide a more accurate assessment because patients are performing in their actual living environment. The factors influencing ADL function of patients in their homes compared with those in a rehabilitation setting might be different. Understanding the factors that explain ADL function at home is still lacking. The objective of this study was to identify factors explaining activities of daily living

***Correspondence to:***
*Vongsirinavarat M, Faculty of Physical Therapy, Mahidol University, Nakhon Pathom 73170, Thailand.*
*Phone: 0-2441-5450 ext. 20803, Fax: 0-2441-5454*
*E-mail: mantana.von@mahidol.ac.th*

function in patients with acute stroke in their home.

## Material and Method

The subjects comprised participants of the Stroke Care in Community Project, conducted by the Faculty of Physical Therapy, Mahidol University. They registered in the program from September 2011 to October 2012. In this project, patients received physical therapy at home for six months. Physical therapists evaluated the patients and provided intervention in the home according to the examination results. Physical therapists working for the project were trained to conduct all clinical measures, and provided the treatment intervention. The participants were examined at the first home visit. They were recruited in the study if the following criteria were met: 1) First onset of cerebrovascular accident with diagnosis of cerebral infarction or hemorrhage, 2) The duration of onset less than three months before registering in the program, 3) No other major debilitating diseases, 4) Ability to give informed consent personally or by proxy.

Participant's personal characteristics and clinical measures were assessed during the first visit. The variables recorded included age, sex, affected side, education, marital status, duration of stroke, Glasgow coma score, Stroke Rehabilitation Assessment of Movement (STREAM), Postural Assessment Scale for Stroke Patients (PASS) including PASS-maintaining position and PASS-changing position, Barthel Index and the presence of dyslipidemia, diabetes mellitus or hypertension.

The STREAM is an instrument designed for evaluating the motor function of stroke patients. Thirty movements are rated in three areas: upper-limb movement, lower-limb movement, and basic mobility with ten items subscales: The psychometric properties of the STREAM are reported to be satisfactory[13,14].

The PASS contains 12 four-point items grading the difficulty in maintaining or changing posture. Five items measure the ability to maintain posture: sitting with and without support, standing without support, standing on non-paretic and paretic leg. Seven items assess the ability to change posture: supine to side lying on affected and unaffected side, supine to sit, sitting at a table, sit to stand and picking up a pencil from standing). The validity and reliability of the PASS were reported as acceptable[15,16].

The Barthel Index evaluates ten basic ADL items including feeding, transferring, grooming, toileting, bathing, ambulation, stair climbing, dressing, and bowel and bladder control. This measure is reliable and valid for determining the basic ADLof persons with stroke[17,18]. The Thai version of the BI is reliable[19].

Statistical analysis of the data was performed using SPSS version 17.0 with significance set at $p<0.05$ level. Descriptive statistics summarized the demographic data. Pearson's correlation coefficients between the determinants and ADL functional ability indicated by Barthel index score were calculated. Stepwise multiple regression analysis was performed to determine the predictors of functional ability. A forward selection procedure entered variables at *p*-value <0.05.

## Results

The participants comprised 758 individuals with stroke. The characteristics of participants are presented in Table 1. Table 2 shows the correlations between variables and Barthel Index scores. All variables were significantly correlated with functional ability. The results of the multiple regression analysis, the β coefficients and $R^2$ of different models, are shown in Table 3. The PASS-maintain was the strongest

**Table 1.** Descriptive characteristics of subjects (n = 758)

| Characteristics | |
|---|---|
| Side, n (%) | |
| Right | 405 (53.4) |
| Left | 353 (46.6) |
| Sex, n (%) | |
| Male | 410 (54.1) |
| Female | 348 (45.9) |
| Dyslipidemia, n (%) | |
| Yes | 403 (53.2) |
| No | 334 (44.1) |
| No data | 21 (2.8) |
| Diabetes mellitus, n (%) | |
| Yes | 262 (34.6) |
| No | 476 (62.8) |
| No data | 20 (2.6) |
| Hypertension, n (%) | |
| Yes | 617 (81.4) |
| No | 121 (16.0) |
| No data | 20 (2.6) |
| Age, (years), mean (SD) | 64.67 (13.67) |
| Duration of stroke, (months), mean (SD) | 1.61 (0.74) |
| Barthel index score, mean (SD) | 59.03 (33.68) |
| Glasgow coma scale, mean (SD) | 14.27 (1.83) |
| PASS total, mean (SD) | 20.94 (11.69) |
| PASS maintain, mean (SD) | 7.61 (5.28) |
| PASS change, mean (SD) | 13.34 (6.69) |
| STREAM, mean (SD) | 31.30 (22.81) |

predictor of the Barthel index score explaining 81.5% of the variance. PASS-change, Glasgow coma score, STREAM score, and age, completed the 85.6% variance explained.

## Discussion

The PASS-maintain that rated the ability to maintain sitting and standing was very powerful in explaining comprehensive ADL function. The PASS tasks seem to relate directly to and explain the ability to perform activities of daily living as measured by the Barthel index in participants who were early in the post stroke, recovery phase. Hsies et al similarly reported that the score of PASS-maintain accounted for 45% of the variance in explaining ADL function in patients at six months after stroke[9]. Trunk control has great power in explaining ADL function in the early stage after stroke[8,9]. Among our participants, who were earlier in the recovery phase, three months, the PASS maintain explained an even greater percentage, 81.6%, of functional ability. However, since the PASS maintain is highly correlated with the outcome and was selected in the model first, this might cause other variables that also correlated well with the BI to be selected later and did not contribute much to the variance in model 5.

During the early after stroke, recovery period, patients perform basic activities in sitting and standing positions. This may account for the close relationship between the PASS-maintain and Barthel Index scores. In later stages of recovery, when more advanced functions such as ambulation and hand function are expected to improve, different results might be observed. PASS-change and STREAM might then explain a more advanced ADL performance. Additionally, at later recovery phases, other domains such as quality of life and community participation might be more appropriate to monitor rehabilitation goals.

Assessing a person's ability to maintain trunk control and ADL skills in their home environment was

**Table 2.** Correlation between Barthel Index Scores and other variables

| Variables | r | *p*-value |
|---|---|---|
| Age | -0.286** | <0.001 |
| Glasgow coma score | 0.445** | <0.001 |
| Duration before rehabilitation | -0.139** | <0.001 |
| PASS maintain | 0.904** | <0.001 |
| PASS change | 0.895** | <0.001 |
| STREAM | 0.750** | <0.001 |

** Correlation is significant at the 0.01 level (2-tailed)

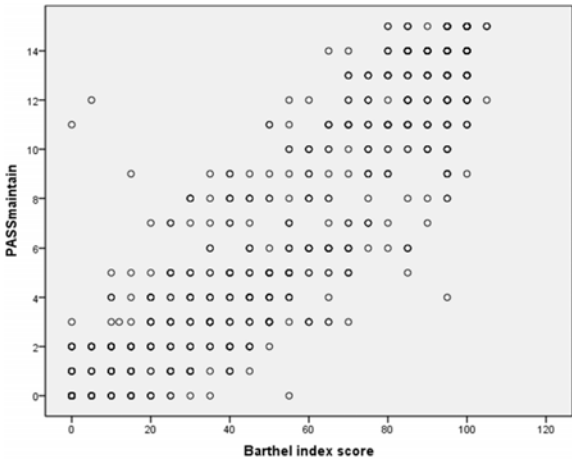


**Fig. 1** Scatter plot between the Barthel index and the main predictor.

**Table 3.** Stepwise Regression analysis β coefficients and $R^2$

| Variables | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 |
|---|---|---|---|---|---|
| Constant | 15.070 (1.11) | 5.541 (1.48) | -18.390 (4.17) | -16.810 (4.09) | -11.000 (4.89) |
| PASS maintain | 5.830 (0.11) | 3.350 (0.29) | 3.570 (0.29) | 3.040 (0.30) | 2.950 (0.30) |
| PASS change | - | 2.120 (0.23) | 1.710 (0.23) | 1.540 (0.23) | 1.520 (0.23) |
| Glasgow | - | - | 1.940 (0.31) | 1.830 (0.31) | 1.850 (0.31) |
| STREAM | - | - | - | 0.200 (0.03) | 0.210 (0.04) |
| Age | - | - | - | - | -0.09 (0.04) |
| $R^2$ | 0.816 | 0.839 | 0.849 | 0.856 | 0.857 |
| Adjusted $R^2$ | 0.815 | 0.838 | 0.848 | 0.855 | 0.856 |
| *p*-value | <0.001 | <0.001 | <0.001 | <0.001 | 0.032 |

Reported as b (SE)

found to be effective. Assessing and treating persons in their homes may be as effective as and less costly than in a hospital or rehabilitation center.

**Conclusion**

The results demonstrated that the ability to maintain the positions in sitting and standing were the main contributors of ADL at the early stage of stroke recovery. Physical therapists should emphasize initial evaluation on trunk control and focus the treatment program to improve these abilities in stroke patients to promote ADL independence.

**What is already known on this topic?**

The functional ability of persons with stroke has been predicted by the several factors including trunk control. Most of the previous studies were conducted in hospital settings.

**What this study adds?**

The present study revealed that trunk control was the most important predictor in persons with three months post stroke in community. Therefore, the physical therapists should emphasize this ability for improving daily activity performances.

**Acknowledgments**

The authors wish to thank all participants for their cooperation and the community physical therapists of Mahidol University for data collection throughout the study. Support for physical therapy home care was provided by the National Health Security Office, Bangkok Branch, Thailand.

**Potential conflicts of interest**

None.

**References**

1. The health aging in Thailand 2009-2012, 4th National Health Examination Survey 2008-2009 [Internet]. 2012 [cited 2013 Feb 28]. Available from: http://www.hiso.or.th/hiso/picture/reportHealth/report/report1.pdf
2. Thamanavat N. Institute of Geriatric Medicine, Ministry of Public Health. Trends in the health of the elderly in Thailand [Internet]. 2012 [cited 2013 Feb 22]. Available from: www.udo.moph.go.th/
3. Kwakkel G, Wagenaar RC, Kollen BJ, Lankhorst GJ. Predicting disability in stroke—a critical review of the literature. Age Ageing 1996; 25: 479-89.
4. Saeki S, Ogata H, Hachisuka K, Okubo T, Takahashi, Hoshuyama T. Prediction of Discharge Barthel Index Score for Stroke Patients at Rehabilitation Commencement. Jpn J Rehabil Med 1993; 30: 717-20.
5. Loewen SC, Anderson BA. Predictors of stroke outcome using objective measurement scales. Stroke 1990; 21: 78-81.
6. Wade DT, Skilbeck CE, Hewer RL. Predicting Barthel ADL score at 6 months after an acute stroke. Arch Phys Med Rehabil 1983; 64: 24-8.
7. Sandin KJ, Smith BS. The measure of balance in sitting in stroke rehabilitation prognosis. Stroke 1990; 21: 82-6.
8. Franchignoni FP, Tesio L, Ricupero C, Martino MT. Trunk control test as an early predictor of stroke rehabilitation outcome. Stroke 1997; 28: 1382-5.
9. Hsieh CL, Sheu CF, Hsueh IP, Wang CH. Trunk control as an early predictor of comprehensive activities of daily living function in stroke patients. Stroke 2002; 33: 2626-30.
10. Leethochawalit N. Functional Assessment using Barthel Index in outpatient stroke rehabilitation. J Health Sci 2008; 17: 74-80.
11. Manimmanakorn N, Arrayawichanon P, Wattanapun P, Nuntharuksa C, Kuptniratsaikul V. Age-related rehabilitation outcome in stroke patients. J Med Assoc Thai 2008; 91: 388-93.
12. Sritipsukho P, Riewpaiboon A, Chaiyawat P, Kulkantrakorn K. Cost-effectiveness analysis of home rehabilitation programs for Thai stroke patients. J Med Assoc Thai 2010; 93 (Suppl 7): S262-70.
13. Daley K, Mayo N, Wood-Dauphinee S. Reliability of scores on the Stroke Rehabilitation Assessment of Movement (STREAM) measure. Phys Ther 1999; 79: 8-19.
14. Wang CH, Hsieh CL, Dai MH, Chen CH, Lai YF. Inter-rater reliability and validity of the stroke rehabilitation assessment of movement (stream) instrument. J Rehabil Med 2002; 34: 20-4.
15. Benaim C, Perennou DA, Villy J, Rousseaux M, Pelissier JY. Validation of a standardized assessment of postural control in stroke patients: the Postural Assessment Scale for Stroke Patients (PASS). Stroke 1999; 30: 1862-8.
16. Wang CH, Hsueh IP, Sheu CF, Hsieh CL. Discriminative, predictive, and evaluative properties of a trunk control measure in patients with stroke. Phys Ther 2005; 85: 887-94.
17. Duffy L, Gajree S, Langhorne P, Stott DJ, Quinn TJ. Reliability (inter-rater agreement) of the Barthel

Index for assessment of stroke survivors: systematic review and meta-analysis. Stroke 2013; 44: 462-8.
18. Hsueh IP, Lin JH, Jeng JS, Hsieh CL. Comparison of the psychometric characteristics of the functional independence measure, 5 item Barthel index, and 10 item Barthel index in patients with stroke. J Neurol Neurosurg Psychiatry 2002; 73: 188-90.
19. Loharjun B, Wannapira P, Palivanit J, Cumjun K. Reliability of modified barthel index (Thai version) assessmentin stroke Patients. Buddhachinaraj Med J 2008; 25: 842-51.

## *ปัจจัยกำหนดความสามารถในการทำกิจวัตรประจำวันของผู้ป่วยโรคหลอดเลือดสมองในชุมชน*

*มัณฑนา วงศ์ศิรินวรัตน์, วิมลวรรณ เหียงแก้ว*

***วัตถุประสงค์:*** *การศึกษานี้ทำเพื่อค้นหาปัจจัยอธิบายความสามารถในการทำกิจวัตรประจำวันของผู้ป่วยโรคหลอดเลือดสมองในชุมชน*

***วัสดุและวิธีการ:*** *ผู้ป่วยโรคหลอดเลือดสมองเฉียบพลัน 658 คน ซึ่งอาศัยในชุมชนและเข้าร่วมโปรแกรมการรักษาทางกายภาพบำบัดที่บ้าน ถูกเชิญเข้าร่วมการศึกษา ข้อมูลลักษณะส่วนตัวและค่าคะแนนแบบทดสอบทางคลินิกต่างๆ ถูกบันทึกในการเยี่ยมบ้านวันแรก ตัววัดได้แก่ Glasgow coma score, PASS, STREAM, และ Barthel index*

***ผลการศึกษา:*** *ตัวแปรต้น 5 ตัวได้แก่ คะแนน PASS maintain, คะแนน PASS change, คะแนน STREAM, คะแนน Glasgow coma, และอายุถูกเลือกเข้าเมื่อวิเคราะห์ความถดถอยเชิงซ้อนแบบเป็นขั้นตอน ตัวแปรเหล่านี้อธิบายความแปรปรวนของคะแนนความสามารถในการทำกิจวัตรประจำวัน Barthel index ได้ร้อยละ 85.6 ตัวแปรที่ทำนายได้มากที่สุดคือ ค่าคะแนน PASS-maintain ซึ่งอธิบายความแปรปรวนของคะแนนการทำกิจวัตรถึงร้อยละ 81.5*

***สรุป:*** *ความสามารถในการทรงท่านั่งและยืนเป็นปัจจัยหลักที่มีผลต่อความสามารถในการทำกิจวัตรประจำวัน นักกายภาพบำบัดจึงควรเน้นโปรแกรมการฝึกความสามารถเหล่านี้เพื่อส่งเสริมให้ผู้ป่วยพึ่งพาตนเองในการทำกิจวัตรประจำวันได้*