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以病患女兒數目預測腦中風急性期後住院復健之返家障礙研究

Association between Number of Daughters and Failure of Home Discharge of Stroke Patients after Post-acute Inpatient Rehabilitation

謝曉芙

Shiau-Fu Hsieh

指導教授 簡國龍教授

Professor Kuo-Liong Chien

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論文中文題目

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論文英文題目

Association between Number of Daughters and Failure of Home Discharge of Stroke Patients after Post-acute Inpatient Rehabilitation

本論文係 謝曉芙 君（學號 R01849018 ）在國立臺灣大學流行病學與預防醫學研究所完成之碩士學位論文，於民國 103 年 06 月 17 日承下列考試委員審查通過及口試及格，特此證明。

口試委員：簡國龍 （簽名）

（指導教授）

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Abstract

Background: Discharge disposition has been important for stroke patients after post-acute inpatient rehabilitation. The rate of failure of home discharge in Taiwan was still unknown. In addition, whether the number of daughters affected patients' home discharge needs investigation.

Methods: We conducted a retrospective case-control study in a tertiary hospital between July 2011 and Sep 2013, investigating stroke patients consecutively discharged from post-acute rehabilitation. Factors regarding patient demographics, family information, as well as disease and function information were collected. We defined the outcome, failure of home discharge or home discharge, from the discharge chart.

Results: One hundred and eighteen of 297 stroke patients (mean age 63 years, 37% women) failed to discharge to home after post-acute inpatient rehabilitation, including 109 admitting to other rehabilitation hospitals and 9 to long-term care facilities. Patients with more daughters tended to be older, female, married, to have ischemic stroke, to receive fewer years of formal education, to have no job, to have homes without stairs, and to have more sons and children. A trend existed between having

more daughters and a lower risk of failure of home discharge: having three or more daughters reduced 77 percent of the risk (odds ratio [OR] 0.23, 95% confidence interval [CI] 0.07-0.72), compared with those without daughters (test for trend, p=0.002). Other protective factors included a higher age (OR 0.97, 95%CI 0.95-0.99) and a better function at discharge (OR 0.97, 95%CI 0.95-0.98).

Conclusion: The rate of failure of home discharge after post-acute inpatient rehabilitation was high in Taiwan and having more daughters lowered the risk.

Keywords: stroke, patient discharge, family support, social factor, daughter

摘要

背景： 出院安置對急性期後住院復健之腦中風病患是一重要健康問題。台灣目前無相關資料，亦不清楚病患女兒數目是否影響病患返家安置之成功率。

方法：於 2011 年 7 月至 2013 年 9 月間台灣一都會區醫院進行回溯性臨床研究，追蹤所有於接受急性期後住院復健治療之腦中風病患。研究收集病人基本性質、家屬狀況、疾病影響及功能狀況。主要結果為病患是否無法返家安置，資料來源為病歷記錄。

結果：297 位病患，平均年齡 63 歲，37%為女性，其中 118 位無法返家安置，包括 109 名入住其他醫院復健科及 9 名至養護機構安置。女兒數目較多的病患，相較於沒有或僅一個女兒者，其年齡較高，女性較多，已婚比例較高，梗塞性中風較多，接受正式教育年數較短，無工作比例較高，居家有樓梯比例較高，同時兒子數目較多，小孩數目也較多。 女兒數目較多的病患，無法返家安置的機會較低：有三個女兒以上的病患，相較於沒有女兒者，無法返家安置的風險降低 77% (勝算比 0.23，95%信賴區間 0.07-0.72)。年齡較高與自理功能較佳者，無法返家安置之風險亦較低（前者勝算比 0.97，95%信賴區間 0.95-0.99，後者勝算比 0.97，95%信賴區間 0.95-0.98）。

結論：在台灣目前接受急性期後住院復健之腦中風病患中，有很高比例無法返家安置。而其中如病患女兒數目較多，無法返家安置之風險顯著下降。

關鍵字：**腦中風、出院安置、家庭支持、社會因素、女兒**

Abbreviations

ADL	Activity of daily life
BI	Barthel Index
BMI	Body mass index
CI	Confidence interval
ED-5Q	EuroQol instruments for health-related quality of life
FIM	Functional Independence Measures
FIM-c	The cognitive subscale of the FIM
FIM-m	The motor subscale of the FIM
IQR	Interquartile range
NA	Not applicable/not available
NIHSS	National Institute of Health Stroke Severity
OR	Odds ratio
SD	Standard deviation
VS	Versus

Contents

1. Introduction and literature review

1.1. Discharge disposition at the participation level of new health model

Health models evolve as disease patterns change over time. As non-communicable chronic diseases cause more and more health problems in both developed and developing countries,[1] in 2001, the World Health Organization proposed a new health model, the International Classification of Functioning, Disability and Health model.[2] This framework emphasized the "participation" level of health. Participation describes how an individual interacts with the environmental and social contexts under his/her body function impairment and functional disability. Only with good interactions with one's surrounding people and environment, this individual can obtain more complete well-being (Figure 1).

Discharge disposition is a real-world challenge at such participation level. It is defined as the further residential places where a patient reside in after being discharged from inpatient medical service. Discharge disposition is also one of the indicators of effectiveness of inpatient care.[3, 4] In addition, discharge disposition is important for medical care providers, public health workers and health policy

administrators since poor discharge disposition leads to elevated medical and welfare costs to compensate for individuals' unmet needs in the long run.

1.2. Failure of home discharge is the poor outcome for discharge disposition

Home is the favored discharge destination because home provides familiar and meticulous social and environmental supports. Whether the individual can return to home affects the lives of patients and their families. On the contrary, failure of home discharge impacts one's health as the individual is separated from the original social networks and has to adapt to the new environment, to build up new social networks and to cope with the residual disabilities with less support. It is easy to understand that discharge to places other than home is less desirable.

1.3. Stroke and rehabilitation in the acute, post-acute, chronic stages

Stroke results from disruption of sufficient perfusion of the brain. This hypoperfusion may lead to ischemic penumbra to part of the brain tissue but other neurons may suffer from irreversible damage. It mostly presents as one of the detrimental outcomes of systemic atherosclerosis, or it can result from bleeding from anomalies of the

vascular system or be caused by embolic events from the heart or great vessels.[5]

Stroke rehabilitation is an obligatory part of stroke care based on guidelines and evidences.[5, 6] It is designed based on the disease course and the special needs in different stages (Figure 2).[7-9] During the acute stage, rehabilitation aims to prevent complications such as pressure sores by instructing patients and caregivers to perform tolerated active and intensive passive limb mobilization. As medical conditions stabilize, the post-acute stage starts, when multidisciplinary rehabilitation starts. The goals are emphasizing secondary prevention of stroke, facilitating neurological recovery, minimizing impairments and maximizing function. The multidisciplinary care team consists of physiatrists, physical therapists, occupational therapists, speech/swallowing therapists, nursing staff, social workers and other specialists. The plan and goal of training are personalized. Studies have no consensus on the definition of this time frame. Usually the stage starts as early as several hours after stroke onset. Most studies define the post-acute stage can be no later than 3 months or 6 months from the onset of latest stroke. Training in post-acute stage can be either hospital-based (the inpatient form) or home-based (the outpatient form). The chronic

stage of stroke rehabilitation starts when the neurologic recovery reaches the plateau or even its best possible level and when compensation skills of self-care are fully acquired by the patient. Stroke rehabilitation in the chronic stage aims to maintain patients' self-care function, to prevent and solve late complications. Usually it is defined to start sixth months after stroke onset. It is usually community- or home-based.

1.4. Post-acute inpatient stage, an important stage of stroke

Post-acute inpatient stroke rehabilitation is proved the most intensive form of rehabilitation and most powerful in confining disability.[6] Because post-acute inpatient rehabilitation is costly, time-consuming and instructor intensive, in order to allocate this limited resource, evidence-based guidance is required for clinicians and policy makers. Patients who enter this training program are different from the rest of the stroke rehabilitation population considering that they are carefully selected and they receive special training programs.

1.5. The rate of failure of home discharge after post-acute stroke inpatient rehabilitation

When post-acute inpatient rehabilitation ends, patients face a difficult question, “can I successfully return to home and care for myself safely?” The outcome affects the whole family. For patients and their caregivers, knowing a realistic goal of discharge disposition helps them to accept the goal and prepare themselves mentally and physically for returning home or transferring to other accommodations. They can also work on the modifiable factors early. For rehabilitation teams, they need to know the overall picture and associated factors of discharge disposition to set goals and to design trainings.

Discharge disposition have great variations in different health care systems, different cultures and in different eras.[10, 11] The rate of home discharge after post-acute inpatient rehabilitation ranged from 45% in the United States to as high as 81.5% in Spain (Table 1).[12, 13]

1.6. Predictors for failure of home discharge after post-acute stroke inpatient rehabilitation

Failure of home discharge is affected by various factors.[14-16] A framework has been proposed in 2003 to help categorize the predictors for discharge disposition in this setting (Figure 3).[15] Among the identified predictors for home discharge after post-acute inpatient rehabilitation, some are more consistent throughout previous studies: younger age [17-21] and better early physical functional ability [12, 13, 15, 17, 19-22]. Others are less consistent, including gender [16, 19-21, 23], etiology of stroke [16], visuospatial disturbance [16, 21], communication ability [21, 24], urinary incontinence [16, 21], cognitive function [14, 20, 21], independent sitting balance [21], comorbidities [13, 23], quality of life [23], environmental factors [15] and more .

1.7. Social and environmental factors as predictors

Some studies revealed that “contextual factors”, including social and environmental factors, play important roles in stroke patients’ discharge destination. Living with a partner is shown most consistently protecting against failure of home discharge.[14, 17, 18, 20, 21, 24] Being married and good social support are also protective (Table 2,3). [13, 14,

17, 19, 22

1.8. Will number of daughters influence failure of home discharge?

The common essence of three identified social protecting factors is having committed caregivers at home. Female family members still take most responsibility to look after their families who have chronic disabling diseases,[25, 26] especially in the Asian countries. By clinical observations and findings in previous studies, daughters of these chronic patients are common caregivers while sons are not. We therefore were interested in the association between numbers of daughters and patients' failure of home discharge. Currently no studies have investigated this topic.

1.9. Research gaps

- **The rate of failure of home discharge in Taiwan after post-acute inpatient stroke rehabilitation is unclear. Through careful literature review, we found that this rate can vary in different countries, different cultures and even in different eras. Therefore, an updated investigation regarding post-acute stroke rehabilitation in Taiwan is**

needed.

- **The importance of number of daughters as a determinant for failure of home discharge lacks previous evidence. Through careful literature review, we found that social determinants of post-acute discharge disposition lacks clear definition, were less understood and the results were controversial. The role of daughters, being common caregivers in families with stroke disabled patients, has not been studied before.**

2. Hypotheses and study aims

- **We postulated that the rate of failure of home discharge after post-acute inpatient stroke rehabilitation in Taiwan is higher than in other countries.**

- **We postulated that in Taiwan, number of daughters of patients independently predicts failure of home discharge. A patient with more daughters has a lower risk for failure of home discharge compared with a patient with fewer daughters if other factors are comparable.**

3. Materials and methods

3.1. Study design

A case-control study

3.2. Study participants

3.2.1. Inclusion criteria

Consecutive patients discharged from the rehabilitation ward between July 2011 and December 2013 were evaluated. Patients had ischemic stroke or intracerebral hemorrhage. These patients should be in the post-acute phase of the target stroke onset, defined as less than 90 days.

3.2.2. Exclusion criteria

The patients with concomitant traumatic brain injury, subarachnoid hemorrhage, subdural hemorrhage, brain tumor or other non-brain lesions were excluded. Also, if patients were referred back to acute medical or neurologic services for recurrent stroke or death happened during treatment, they were excluded.

3.3. Study setting

We retrospectively collected data from a single-center database of Mackay Memorial Hospital, Taipei, Taiwan. The study hospital was located in an urban area and was equipped with a 20-bed multidisciplinary stroke rehabilitation unit. Diagnosis of stroke, determination of stroke type and acute care were done by neurologists and neurosurgeons based on guidelines.[5] Brain imaging was used to help confirming stroke etiology or exclusion criteria. Patients were referred to physiatrists from neurologists and neurosurgeons. Physiatrists decided the eligibility of admission for post-acute inpatient rehabilitation training (Figure 4).

An experienced multidisciplinary team provided stroke rehabilitation. Physiatrists were in charge of goal setting, interdisciplinary communication and counseling for discharge disposition. Structured physical, occupational, speech/swallowing therapies, each 30 minutes a day, were provided in 2 to 5 days every week. Patients were encouraged to do extra practice. Training goals were individualized. Length of stay for inpatient rehabilitation was usually confined to around 30 days due to restrictions from the government medical payment system (Figure 4).

3.4. Outcome variables

Data of discharge disposition was coded according to patients and families' decision recorded in the discharge chart. The failure of home discharge group included the patients who went to other rehabilitation hospitals or wards and the patients admitted to long-term care facilities after being discharge. The control group was the home discharge group. During hospitalization, physiatrist provided counseling to patients and family members who decided discharge disposition.

3.5. Predictors

Four categories of potential predictors were collected (Figure 5),[15] including:

1) Patient factors: age, gender, length of stay

2) Disease factors: stroke type, stroke severity, with cognitive impairment or not, having aphasia or not

3) Functional status: functional ability on admission and at discharge

4) Social and environmental factors: years of formal education, having a job or not, needing financial support or not, having stairs at home or not, living with families or

not, being married or not, having children or not, number of children, number of daughters, number of sons.

3.5.1. Patient factors

Age at admission, male or female gender, length of stay, which was the number of days between one's admission and discharge of the rehabilitation ward, were collected.

3.5.2. Disease factors

Stroke severity was assessed with the National Institute of Health Stroke Severity (NIHSS) score by neurologist or neurosurgeons on they first evaluation of these stroke patients.[27] It is a validated, reliable tool which covers the influences of stroke on consciousness, motor, sensory, coordination, cognitive, speech, visuospatial functions. Item scores are 0, 1, 2 and in some items can be given a 3 or 4 point, with 0 meaning no symptoms and higher score meaning more severe symptoms. Total score ranges from 0 to 42. We analyzed the NIHSS score as a continuous variable.

The Cog-4 scale is a newly proposed composite score using four items (1b, 1c, 9, 11) from the NIHSS.[28] It is designed to evaluate patients' cognitive function in acute stroke setting. A 0 point means no cognitive disturbance and a maximum of 9 points indicates severe cognitive impairment. The Cog-4 score was treated as a continuous variable in the analysis. Presence of aphasia was recorded as positive based on documentation in medical records.

3.5.3. Functional status

Functional status was scored using the Barthel index (BI) on the admission day and before discharge.[29] The BI is a widely used and validated scale for basic self-care function, also in stroke rehabilitation setting. It is comprised of 10 items, including feeding, grooming, dressing, toilet use, bathing, bladder control, bowel control, transfers, flat surface mobility, stair climbing. Each item is given 0 to 10. Scores for each item are summed into a total score for the BI, ranging from 0 (total dependence) to 100 (basic independence). The BI score was treated as a continuous variable.

3.5.4. Social and environmental factors

Social factors were recorded based on the interviews by nurses with patients or families on admission. Education level was coded based on self-reported years of formal education into none, 1-6, 7-9, 10-12, >12 years. Patients were inquired if they have a job, if they need extra financial support, if they have stairs at home, if they live with families, have current marriage, and if they have children. Numbers of patients' children, daughters and sons were recorded. We further categorized patients into groups, based on how many daughters they had: without daughters, having one daughter, having two daughters and having three or more daughters. Similarly, based on the number of sons we created four groups: patients without sons, having one son, having two sons, having three or more sons.

3.6. Statistical analysis

The statistical analyses were performed using SAS software 9.3 (SAS Institute, Inc., Cary, NC).

3.6.1. Descriptive analyses

All the data were descriptively presented using mean ± standard deviation (SD), median, interquartile ranges (IQRs), and minimum-maximum for continuous data and provided frequencies for categorical data, using the Chi-squared test or the Student's t test as appropriate. Descriptions of overall population and of patient groups according to numbers of daughters were presented.

3.6.2. Correlations

We checked the correlations between dependent variables, using the Spearman's correlation for two continuous variables and the phi coefficient for two binary variables, and the point-biserial correlation coefficient for one continuously measured variable and another dichotomous variable.

3.6.3. Tests for trend

We used the Cochran–Armitage test for trend to check the trend between increased number of daughters or sons and the rate of failure to discharge to home. It was calculated with the median value in each category based on numbers of daughters or sons.

3.6.4. Simple logistic regressions

Simple logistic regression was performed with failure of home discharge as the dependent factor and to estimate the odds ratios (ORs) and 95% confidence intervals (CIs) for each independent factor.

3.6.5. Multiple logistic regressions

To see the independent associations between factors and outcome, we selected potential confounders to be adjusted for based on prior study findings and results from correlation tests and simple regressions and performed multiple logistic regressions. Model 1 checked the association between number of daughters and failure of home discharge adjusting for age and sex. In model 2, the association was adjusted for age,

sex and function at discharge. In model 3, important factors from simple regression and without strong correlations with other factors in model 2 were added, i.e. type of stroke. All variables were entered as categorical variables except age, length of stay, scores from the NIHSS scale, Cog-4 scale, BI, and numbers of daughters, sons and children. P values < 0.05 were considered to be statistically significant.

3.7. Power calculation and sample size estimation

The significance level was set at 0.05 and power set at 0.9. The effect size used for calculation was derived from a study by Frank and colleagues.[21] The study showed an OR of 3.9 for patients with caregivers living together to return to home, compared with patients without caregivers living together. The probability of having caregiver living together was 0.46. The probability of outcome in those without caregiver at home was 0.72. The result of sample size calculation was 202.[30]

4. Results

One hundred and eighteen of 297 patients (39.7%) failed to discharge to home after post-acute inpatient rehabilitation, including 109 subsequently admitting to other rehabilitation hospitals or wards, and 9 admitting to long-term care facilities (Figure 6). The age of all patients was 63.1±13.4 years, with 37.4% of them were women. The median of length of stay of post-acute inpatient rehabilitation was 35 days (IQR 28-44) (Table 4). These patients' social factors were distributed as following: 90.2% of them lived with others; 70.4% of them were in a marriage and 86.5% had children (Table 4, 5).

Patients with more daughters were more likely to be older (p=0.001), women (p=0.019), married (p=0.001), and were more likely to have ischemic stroke (p=0.001), receive fewer years of formal education (p=0.001), have no job (p=0.001), live in homes without stairs (p=0.007), and have more sons (p=0.001) and children (p=0.001) (Table 8).

Some predictors had significant correlations, including the following pairs of

predictors: numbers of sons/daughters/children, the NIHSS/Cog-4 scores, the BI scores on admission/at discharge. Some correlations were observed between age/number of sons, age/number of daughters, age/number of children, age/NIHSS score, age/BI score on admission, and length of stay/NIHSS score (Table 6, 7).

A trend existed (Figure 7) between having more daughters and a lower risk of failure of home discharge: having three or more daughters reduced 63 percent of the risk (odds ratio [OR] 0.37, 95% confidence interval [CI] 0.15-0.91, p=0.014), compared with those without daughters after adjusting for age and sex (test for trend, p=0.002) (Table 8). Such trend was not seen between the number of sons and the risk of failure of home discharge (p=0.06) (Figure 8). Having three or more daughters (OR 0.23, 95% CI 0.07-0.72, p=0.003) was significantly associated with failure of home discharge after adjusting for age (OR 0.97, 95% CI 0.95-1.00, p=0.029), sex and function at discharge (OR 0.97, 95% CI 0.95-0.98, p=0.001, for every 1 point increase in the BI) (Table 9).

5. Discussion

5.1. Main findings

Nearly forty percent of stroke patients failed to discharge to home after a 1-month post-acute rehabilitation in a medical center in urban Taiwan. Having three or more daughters was the most important protecting factor for this poor outcome in discharge distribution. This protecting effect remained significant after adjusting for age, sex and self-care function at discharge. An older age and a better self-care function were also significant protecting factors.

5.2. Previous studies on the rate of failure of home discharge after post-acute inpatient rehabilitation

In previous studies, the rate of home discharge range between 62 to 82 percent.[10, 13, 17, 19-24] The length of stay of the reported inpatient rehabilitation had a wide range, from 18 to 101 days. A US study by Sandstrom and colleages reported that 45% of their stroke patients had home discharge after inpatient rehabilitation, with another 26% of patients discharged to an affiliated subacute service and 28% discharged to a long-term care facility.[12] This exceptionally low rate of home discharge may be

attributed to the inclusion criteria of severe stroke and to a shorter length of stay (mean 24 days).

In our study, 39 percent of all patients failed to discharge to home after 37 days of multidisciplinary inpatient rehabilitation. This rate of poor discharge distribution was high compared with previous studies and noteworthy. Similar as in the study by Sandstrom, our participants had a shorter length of stay. This high rate of poor outcome was even more noteworthy because unlike the study by Sandstrom, our participants had a wide range of stroke severity, including some with very mild stroke. The BI score at discharge was 46 on average, indicating these patients had severe dependence after inpatient rehabilitation.[31] Moreover, according to the informal interviews with some patients, some contextual factors might contribute to the phenomenon of choosing rehabilitation hospitals as their discharge destination and a higher rate of failure of home discharge. In Taiwan, the National Health Insurance system covered the expanses of further hospital disposition. For inpatients, the expenses for transportation and accommodation were saved. Meanwhile, some patients with private medical insurance might have additional gains for being

hospitalized. In contrast, if the patients return to home, they need to find appropriate caregivers, overcome environmental obstacles at home, and arrange transportation to the hospitals for outpatient rehabilitation without hospitalization compensation from private medical insurance. Evidences from further qualitative researches and formal interviews are warranted to support these explanations.

5.3. Previous findings on social factors

The importance of social factors on home discharge after post-acute inpatient rehabilitation has been recognized. The significant protecting social domain factors included being married (OR 4.1-9.7)[13, 20] and having caregiver at home (OR 3.9-430.0) [18, 21] for home discharge. Koyama and colleagues found that for post-acute stroke patients in Japan, those without a spouse at home and living in households with fewer family members were more likely to fail to return to home after adjusting for the influence of age and function.[17] Of note, they found a negative association between the number of patients' children and home discharge. They explained that in the setting of modern suburban Japan, the stroke patients' married children commonly live in separately from their patients and were less likely to take the caregiver roles

for disabled parents. This phenomenon contributes to the children's lack of impact on parents' discharge outcome.

5.4. Number of daughters as a protecting factor for failure of home discharge

Our study was the first to attempt to delineate the influences of patients' daughters and sons separately on the discharge outcome during post-acute stage of stroke. We found that having more daughters was related to a lower rate of failure of home discharge, while number of sons was not related to discharge outcome. Number of daughters remained as an independent determinant for home discharge after adjusting for age and self-care function. This protecting effect was most prominent when patients had three or more daughters.

A devoted caregiver is crucial for home discharge of stroke patients in the post-acute stage, and for their physical and mental health. Primary caregivers need to handle patients' care need and troubleshoot rehabilitation problems. According to a study by Pinquart, Asian families depended more on informal caregiver forces.[32] Female family members, especially daughters, were more likely to become major caregivers,

as shown by a study in Taiwan and another from South Korea.[25,26] Daughters, especially those unmarried, usually take the caregiver roles for parents. The study from Wu had a similar setting as our study. It surveyed 80 primary caregivers of post-acute stroke patients.[25] These caregivers' mean age was 51 years, with 55% of them were female. A total of 71% was unmarried; 50% were patients' daughters/sons.

5.5. The different roles of daughters, sons, daughters-in-law and spouses as caregivers for stroke or chronic disabled patients

The roles of daughters as caregivers compared with spouses, sons, daughters-in-law are different.[33] Stroke patients' spouses, sons and their daughters-in-law might probably share partial responsibility for caregiving but are less likely to be primary caregivers, and therefore may have less influence on patients' discharge distribution. Some studies observed that spouses frequently became primary caregivers. However, we observed that the patients' spouses were elderlies themselves and might have less capacity to take the caregiver responsibility alone. Sons sometimes serve as decision makers for parent care but less often become household caregivers.[18, 19, 34] Sons may be unmarried. If they are married, their wives, the daughter-in-laws of stroke patients,

can sometimes become household caregivers.[34, 35] In modern urban areas in Taiwan, sons and daughters-in-law commonly live separately from their parents and may be less influential on patients' discharge distribution than daughters.

We explained that daughters, being the younger female members in these families, are more capable of providing physical aids to the patients than stroke patients' spouses. Some married daughters provide care for elderly parents and children simultaneously, being recognized as the "Sandwich Generation",[36] while some unmarried daughters live with their parents, having fewer obstacles to start caregiving. Besides caregiving, some daughters in Taiwan can be decision makers and even sources of financial aids for elderly parents' care. We hypothesized that if any of patients' daughters can take such role, these stroke patients may have higher chances to return to home than those without daughters and by this way, number of daughters is influential to parents' chances to home discharge.

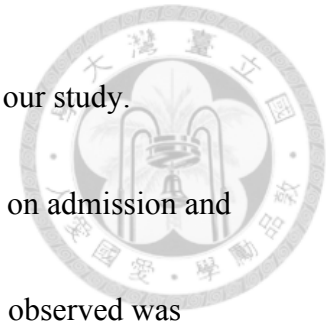
5.6. Other predictors for failure of home discharge after post-acute inpatient rehabilitation

The influence of self-care function on outcome

Stroke patients' functional ability on admission to inpatient rehabilitation is proved to be an important predictor.[12, 13, 16, 17, 19-22] Pohl and colleagues reported that patients with a FIM score lower than their population mean FIM score had an OR of 5.8 for residential care discharge.[19] Other studies using FIM presented ORs between 1 to 3 for the protecting effect of better self-care function against poor outcome of failure of home discharge. The study by Pinedo reported that patients with BI scores between 0 and 20 had a 2.9 fold risk compared with those with higher BI scores to be discharge to residential care.[13] This study confirmed the influence of good patient function on successful home discharge.

The tools of assessing self-care function

In this study, we used the BI to evaluate functional ability for basic activity of daily life.[29] The BI was the most frequently used tool and the FIM being the second.[27] It has strong psychometric properties and is more feasible from a practical standpoint.



Therefore we chose the BI to measure patients' functional ability in our study. Despite that our study population in average had severe dependence on admission and even after they finished the inpatient training, a 10-point BI gain we observed was clinically important.[31,37] This supported that our rehabilitation team in this study setting provided post-acute stroke rehabilitation with desirable and comparable effectiveness compared with other studies. Therefore, our study findings can be reliably compared with the findings from previous studies.

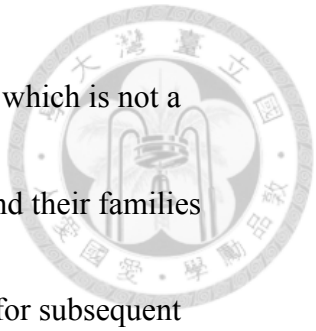
The timing of assessing self-care function

Studies usually assessed patients' function on their admissions since this assessment can be performed in a package of other admission routines. Also an early acquisition of functional information may help early prediction of rehabilitation outcomes. Function at discharge is another popular choice, like we did in our study. It is not only a convenient time point to assess in clinical practice but also a time point of greatest relevance to discharge disposition. Function scores of the same individual measured at different time points have high correlations, as we proved in this study. Therefore, choosing function on admission or at discharge may probably yield similar results.

Some studies tried to determine whether rehabilitation gain, which is the difference between the function on admission and at discharge, predicts rehabilitation outcomes, including discharge disposition.[17, 23] This predictive value is not as established as function on admission and at discharge.

The influence of age on outcome

An older age, in previous researches, is associated with higher risk of not discharging to home.[17-21] However, all reported ORs were around 1-1.5, except in the study by Tanwir.[20] In their study, stroke patients less than 65 years old had an OR of 2.8, patients between 65 and 85 years old an OR of 1.7 for home discharge, compared with patents older than 85 years old. In our study, however, an older age was related with lower risk of failure of home discharge, although the OR was close to 1. One possible explanation is that elderly disabled stroke patients and their family members tend to set low goals for these patients' future self-care abilities. These elder patients also tend to have more prolonged cognitive confusion and more chance of depression after stroke. When arranging for discharge disposition, their key decision makers may choose to bring them home instead of arrange further hospitalization which requires



complicated processes or arrange long-term care facilities admission which is not a popular choice in Taiwan. On the contrary, young stroke survivors and their families expect highly of the patient. So these young patients may tend to go for subsequent inpatient rehabilitation in other hospitals.

The correlations between predicting factors

Functional ability is highly correlated with stroke severity, cognitive impairment, aphasia and age in our study. Therefore, we only adjusted for age and functional status into the proposed models and left the other factors out. Age and functional status, remained statistically significant after adjusting for confounding factors.

5.7. The importance of a comprehensive framework for predictors

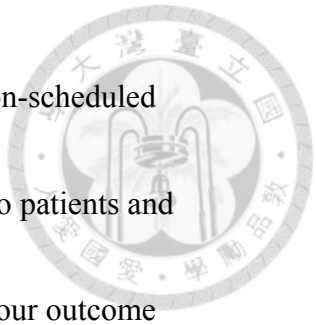
Meijer in 2003 proposed a comprehensive framework for predicting discharge destination 6 to 12 months after stroke onset. Twenty-six selected prognostic factors were categorized into clinical and social sub-domains and then prioritized (Figure5) (Table3).[15] Each of these 26 factors was given clear definition. The social sub-domain was further divided into home front, social situation and residence. In authors'

opinion, this comprehensive framework is of great value for future researches to generate comparable results for subacute prognostic factors especially the poorly defined social factors. However, we didn't identify any relevant study to use this structure except three other studies from the same group of exports and one European research regarding admission criteria for inpatient stroke rehabilitation.[4, 14, 16, 38]

5.8. Strengths and limitations

Our study had several strengths. First, it provided an overview for an increasingly important health issue, discharge disposition. Second, this was the first study to address the role of daughters in predicting failure of home discharge. Third, our study design had a low change of selection bias since we collected data of all consecutive patients admitted for rehabilitation. Last, low rates of missing data and loss to follow-up made the findings less biased.

The study limitations included: first, data of the primary outcome was from chart reviewing instead of directly acquiring from post-discharge follow-up. Therefore, patients might be misclassified if they changed their discharge dispositions. The



proportion of such patients was estimated to be small because any non-scheduled change in destination or caregiver arrangement is not cost-effective to patients and families and therefore is avoided if possible. Although the timing of our outcome retrieval was early compared with previous studies which obtained discharge destination 6 to 12 months after patients' discharge, by this setting we not only incorporated data collection in clinical practice, decreased the rate of missing data, but also provided clinically relevant information. Second, demographic data of patients' family members were lacking. Therefore, the explanation that more daughters supported stroke patients' home discharge by acting as primary caregivers may require evidence from prospective cohort studies or by obtaining recall data to support. The third possible limitation was that some known confounding factors were not collected or were collected with suboptimal quality due to the retrospective nature of this study. The methods to record data of aphasia, cognitive impairment, depression, premorbid function and places of residence, comorbidities in clinical and research settings may be improved and updated. Moreover, we didn't analyze socioeconomic factors in depth. Researches regarding socioeconomic status and discharge disposition of stroke patients are few and of insufficient quality.[4] Future works are warranted.

Last, the single-center setting may limit external generalizability. However, through literature review, we found many shared elements for failure of home discharge in studies with different settings and from studies worldwide. We believed our findings could be generalized to some other countries. Multi-center studies and studies from more countries are needed to reflect a global picture.

5.9. Future implications

Regarding discharge disposition or other topics in the post-acute inpatient rehabilitation setting, future studies should report the admission criteria used, the duration between stroke onset and admission, the length of stay, and the guideline or considerations they use to advice about discharge disposition. Cost-effective analyses in patients point-of-view may help delineating their decision making process on discharge disposition. In our future studies, we will perform caregiver interviews and collect caregiver demographics in detail.

Our study had the following clinical implications. First, rehabilitation teams should provide counseling of discharge disposition to stroke patients' and their caregivers

early during hospitalization. Second, at clinical level and in policy making, efforts need to made to provide support for informal caregivers especially patients' daughters during post-acute inpatient stage and other stages of stroke. For those patients' with poor social networks, we should provide them with formal caregiver resources. In the long run, public health workers and policy makers should work on a community model which provides high-quality rehabilitation service for post-acute and chronic stage stroke patients to facilitate their home discharge and reintegration into society.

Conclusion

The rate of failure of home discharge after post-acute inpatient rehabilitation was high in Taiwan and having more daughters was associated with a lower risk.

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39.

Tables and figures

Table 1. Literature review: the rate of home discharge from previous studies

Author	Year	Design	Setting	Nation	Population	N	Age, years	Male gender	Length of stay, days	**Home discharge rate**
Sandstrom	1998	Retrospective cohort study	Single rehabilitation center, 1993-1995	US	All severe stroke patients in acute medical rehabilitation services	292	Median 62	55%	24	**45%**
Nguyen	2007	Clinical follow-up study	Single hospital, Aug 1999-Dec 2004	Australia	Consecutively admitted post-acute stroke patients in the rehabilitation ward	326	NA	NA	30±22	**NA**
Frank	2010	Prospective cohort study	Single hospital; 1996-2007	Switzerland	Consecutively admitted post-acute stroke patients in the neurological rehabilitation ward	1332	Median 76.5	49%	51±37	**62%**
Rinere O'Brien	2010	Systemic review	Twelve stroke studies; 1990-2007	US	Stroke patients of inpatient rehabilitation facilities	113-54914	NA	NA	Mean 18-28	**74, 76, 78, 81%**
Gialanella	2011	Clinical follow-up study	Single hospital; 2001-2007	Italy	Consecutively admitted post-acute stroke patients in the rehabilitation ward	262	65-73	55%	Mean 45-57	**77%, 91.6%**
Koyama	2011	Prospective cohort study	Single rehabilitation hospital; Sep 2007-March 2009	Japan	First-ever supra-tentorial stroke patients with pre-stroke independent walking and self-care abilities admitted for inpatient rehabilitation	163	69±12	60%	101±40	**75%**
Pohl	2013	Retrospective study	Singe research database; Aug 1993-Dec 2008	US	All stroke patients admitted for inpatient rehabilitation	31910	78±7	43%	NA	**75%**
Graessel	2014	Prospective cohort study	Single hospital	Germany	Stroke patients with moderate to severe functional deficits admitted for neurological inpatient rehabilitation	204	69±11	58%	59±29	**75%**
Pereira	2014	Retrospective study	Single rehabilitation unit; Apr 2005-Dec 2009	Canada	Patients admitted to the stroke rehabilitation unit and with severe stroke	189	69±14	54%	54±11	**66%**
Pinedo	2014	Prospective cohort study	Two hospitals	Spain	Patients after stroke over eight months admitted to rehabilitation units	241	72±12	57%	35±22	**82%**
Tanwir	2014	Retrospective cohort study	Single stroke center; Mar 2011-Mar 2012	Canada	Community-dwelling patients admitted to integrated stroke unit	268	NA	51%	NA	**NA**

Abbreviations: NA, not applicable/not available.

Table 2. Literature review: important determinants from previous studies

Author	Year	Outcomes	Significant predictors	Important non-significant factors
Sandstrom	1998	Home discharge vs subacute vs long term care	Higher admission FIM-m, higher discharge FIM-m (Not reporting OR)	NA
Nguyen	2007	Home discharge	Admission FIM ≤75 more likely to go to nursing home; **being married OR 5.0** for home discharge in admission FIM ≤ 75	Immigrant status, side of stroke, type of stroke
Rinere O'Brien	2010	Community discharge	NA	NA
Frank	2010	Home discharge vs failure of home discharge (death, nursing homes, readmission to acute care	**Living with a partner OR 3.9**, independent sitting balance OR 1.8, higher FIM-m OR 1.6, higher FIM-c OR 1.6, younger age (per decade) OR 1.4	Gender, premorbid disability, hypertension, aphasia, hemineglect, urinary catheter
Gialanella	2011	Home alone vs home with caregiver vs home with relatives vs nursing homes	Without aphasia, with committed caregiver. (Not reporting OR)	NA
Koyama	2011	Home discharge vs nursing homes	Younger age, higher admission FIM-m, higher discharge FIM-m, **living with spouse,** more household members. (Not reporting OR)	Number of children in separate households, change in FIM-m
Pohl	2013	Residential care discharge vs home discharge	Lower FIM (lower than mean) OR 5.8, older age (older than mean) OR 1.6, **being non-married OR 1.9**	Gender
Graessel	2014	Death or institutionalization vs home discharge ; 30 months after discharge	Fewer comorbidities OR 1.66, higher BMI OR 0.9, higher change in BI OR 0.96, better health-related quality of life (EQ-5D) at discharge OR 0.95	Age, gender
Pereira	2014	Home discharge vs long term care	Older age OR 0.9, higher admission FIM OR 1.1, **caregiver availability OR 430.0**	NA
Pinedo	2014	Residential care discharge vs home	**Civil status (divorced/unmarried/widow,widower vs married) OR 9.2,** total dependence (BI 0-20) OR 2.9, high comorbidity scores OR 2.7	Social risk (Gijón Scale), dysphagia, urinary incontinence, multiple comorbidity
Tanwir	2014	Home discharge vs. failure of home discharge	Higher admission FIM-m OR 2.5, 4.8, FIM-c OR 2.9, 3.0**, prestroke living arrangement (lived with spouse/partner/other family member vs lived alone OR 4.1**, younger age OR 2.8, 1.7	Gender, onset-to-admission interval, type of stroke, side of stroke

Abbreviations: ADL, activity of daily life; BMI, body mass index; ED-5Q, EuroQol instruments for health-related quality of life; FIM, Functional Independence Measures; FIM-m, the motor subsacale of the FIM; FIM-c, the cognitive subscale of the FIM; NA, not applicable/not available; vs, versus; OR, odds ratio.

Table 3. Literature review: systemic reviews and framework construction regarding predictors of discharge destination

Author	Year	Design	Setting	Nation	Population
Meijer, Ihnenfeldt	2003	Framework construction; the modified Delphi Technique	Predicting discharge disposition	The Netherlands	Subacute stroke patients
		Significant predictors: clinical prognostic factors in the order of importance: disabilities, pre-morbid disabilities, impairments, disease/biology; social predicting factors in the order of importance: home front, social situation, residence; each given definition.			
Meijer, Limbeek	2003	Systemic review	Ten relevant studies after systemically filtering	Multiple countries	Relevant studies regarding subacute predictors of 6-12 months discharge disposition for stroke patients
		Significant predictors: low initial ADL function, high age, cognitive disturbance, paresis of arm and leg, not alert as initial level of consciousness, old hemiplegia, homonymous hemianopia, visual extinction, constructional apraxia, not transfer to the stroke unit, nonlacunar stroke type, visuospatial construction problems, urinary incontinence, female gender			
Meijer, Limbeek	2003	Systemic review	Six relevant studies after systemically filtering	Multiple countries	Relevant studies regarding social predictors of discharge disposition for subacute stroke patients
		Significant predictors: social support, presence of a relative at home, marital status			

Table 4. Characteristics of patients: grouping based on number of daughters: none, one, two, and more than three

	Overall (n=297)		Number of daughters: None (n=82)		One (n=110)		Two (n=54)		More than three (n=51)		p
	N	%	N	%	N	%	N	%	N	%	
Male	186	**62.6**	60	**73.2**	71	**64.6**	31	**57.4**	24	**47.1**	0.019
Ischemic stroke	201	**68.8**	41	**50.0**	77	**70.6**	45	**84.9**	38	**76.0**	0.001
Aphasia	75	**25.3**	20	**24.4**	31	**28.2**	9	**17.0**	15	**29.4**	0.41
Formal education											0.001
No	36	**12.2**	2	**2.4**	18	**16.5**	8	**14.8**	8	**15.7**	
<6 years	107	**36.2**	16	**19.5**	32	**29.4**	28	**51.9**	31	**60.8**	
6-9 years	44	**14.9**	12	**14.6**	15	**13.8**	8	**14.8**	9	**17.7**	
9-12 years	57	**19.3**	24	**29.3**	26	**23.9**	4	**7.4**	3	**5.9**	
>=12 years	52	**17.6**	28	**34.2**	18	**16.5**	6	**11.1**	0	**0.0**	
Having a job	88	**29.9**	40	**48.8**	29	**27.1**	12	**22.2**	7	**13.7**	0.001
Requiring financial support	49	**16.7**	15	**19.0**	18	**16.5**	11	**20.4**	5	**9.8**	0.37
Having stairs at home	127	**43.8**	45	**57.7**	49	**45.4**	17	**31.5**	16	**32.7**	0.007
Living with others	268	**90.2**	69	**84.2**	102	**92.7**	52	**96.3**	45	**88.2**	0.08
Being married	208	**70.4**	39	**47.6**	86	**78.9**	44	**81.5**	39	**76.5**	0.001
Having children	257	**86.5**	42	**51.2**	110	**100.0**	54	**100.0**	51	**100.0**	0.001
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Age	**63.1**	13.4	**52.2**	13.3	**65.7**	11.6	**67.7**	10.8	**70.9**	8.5	0.001
Length of stay	**36.8**	17.0	**37.9**	16.1	**36.4**	19.5	**36.6**	15.9	**36.4**	15.3	0.94
NIHSS	**8.8**	6.0	**9.7**	6.3	**8.7**	6.0	**8.0**	5.6	**8.6**	5.8	0.69
Cog-4	**1.3**	2.3	**1.5**	2.5	**1.1**	2.2	**1.0**	2.2	**1.6**	2.3	0.70
BI score on admission	**36.5**	23.6	**39.9**	25.4	**35.6**	23.8	**38.4**	22.3	**32.6**	22.0	0.40
BI score at discharge	**45.5**	24.4	**49.8**	26.7	**45.3**	23.8	**47.8**	21.3	**38.8**	24.5	0.18
Difference of BI score	**10.0**	9.6	**9.8**	10.7	**10.3**	9.7	**10.4**	9.0	**9.2**	8.4	0.93
Number of sons	**1.5**	1.1	**1.0**	1.2	**1.7**	1.0	**1.7**	1.0	**1.4**	1.2	0.001
Number of daughters	**1.3**	1.3	**0.0**	0.0	**1.0**	0.0	**2.0**	0.0	**3.6**	0.8	0.001
Number of children	**2.8**	1.8	**1.0**	1.2	**2.7**	1.0	**3.7**	1.0	**5.0**	1.4	0.001

Abbreviations; BI, Barthel Index; NIHSS: National Institute of Health Stroke Scale

Table 5. Distributions of patients' daughters, sons, and children

	Mean	Standard deviation	Median	Minimum	First quartile	Third quartile	Maximum
Number of daughters	1.3	1.3	1	0	0	2	7
Number of sons	1.5	1.1	1	0	1	2	6
Number of children	2.8	1.8	3	0	2	4	9

Table 6. Correlations between continuous independent variables

	Numbers of sons	Numbers of daughters	Numbers of children	NIHSS score	Cog-4 score	BI on admission	BI at discharge	BI difference	Age	Length of stay
Numbers of sons	1.00	0.13	0.68	-0.07	0.13	-0.22	-0.18	0.06	0.55	-0.01
		0.16	**<0.01**	0.49	0.15	**0.02**	0.05	0.50	**<0.01**	0.89
Numbers of daughters		1.00	0.82	0.00	0.04	-0.16	-0.07	0.20	0.33	0.10
			<0.01	0.99	0.70	0.08	0.44	**0.03**	**<0.01**	0.28
Numbers of children			1.00	-0.04	0.11	-0.25	-0.16	0.19	0.56	0.07
				0.69	0.26	**0.01**	0.09	**0.05**	**<0.01**	0.48
NIHSS score				1.00	0.80	-0.38	-0.41	-0.09	-0.20	0.24
					<0.01	**<0.01**	**<0.01**	0.34	**0.03**	**0.01**
Cog-4 score					1.00	-0.38	-0.41	-0.10	-0.05	0.15
						<0.01	**<0.01**	0.29	0.61	0.10
BI on admission						1.00	0.91	-0.15	-0.19	-0.08
							<0.01	0.11	**0.04**	0.42
BI at discharge							1.00	0.28	-0.18	-0.14
								<0.01	0.06	0.14
BI difference								1.00	0.02	-0.15
									0.80	0.10
Age									1.00	0.03
										0.74
Length of stay										1.00

Abbreviations: BI, Barthel Index; NIHSS, National Institute of Health Stroke Severity.

Table 7. Correlations between binary independent variables

	Sex	Type	Aphasia	Education	Employment	Financial aid	Barrier	Living with others	Being married	Having children	Number of daughters	Number of sons
Sex	1.00	-0.12	-0.05	**0.32**	0.26	0.12	0.04	-0.04	0.08	-0.14	0.18	0.23
Type		1.00	-0.13	0.29	0.29	0.13	-0.04	0.08	0.08	0.22	0.27	0.12
Aphasia			1.00	0.13	0.04	0.10	0.01	0.11	0.03	0.03	0.10	0.09
Education				1.00	**0.42**	0.17	0.09	0.12	0.05	**0.34**	**0.47**	**0.47**
Employment					1.00	0.14	0.10	0.09	0.10	0.22	0.28	0.24
Financial aid						1.00	0.10	0.13	0.17	0.07	0.15	0.20
Barrier							1.00	0.07	-0.03	-0.08	0.20	0.15
Living with others								1.00	**0.36**	0.20	0.15	0.18
Being married									1.00	**0.46**	**0.31**	**0.32**
Having children										1.00	**0.64**	**0.74**
Number of daughters											1.00	**0.43**
Number of sons												1.00

Table 8. Simple logistic regressions for predictors of failure of home discharge

Variable	Odds ratio	95% confidence interval			p
Male vs female	0.80	0.50	-	1.29	0.36
Ischemic stroke vs hemorrhagic	0.52	0.31	-	0.89	0.018
Aphasia, yes vs no	2.32	1.36	-	3.95	0.002
Formal education, >=12 yrs vs no	2.54	0.92	-	7.01	0.22
Having a job, yes vs no	0.68	0.37	-	1.23	0.97
Requiring financial support, yes vs no	1.11	0.24	-	5.15	0.83
Having stairs at home, yes vs no	1.11	0.68	-	1.80	0.67
Living with others, yes vs no	0.90	0.41	-	1.98	0.79
Being married, yes vs no	0.69	0.41	-	1.16	0.17
Having children, yes vs no	0.75	0.35	-	1.64	0.47
Age, +1 year	0.98	0.96	-	1.00	0.022
Length of stay, +1 day	0.99	0.98	-	1.01	0.21
NIHSS, +1 point	1.10	1.03	-	1.17	0.003
Cog-4, +1 point	1.17	1.01	-	1.36	0.042
BI score on admission, + 1 point	0.97	0.96	-	0.98`	0.001
BI score at discharge, +1 point	0.97	0.96	-	0.98	0.001
Difference of BI score, + 1 point	0.98	0.95	-	1.01	0.18
Number of sons, +1 person	0.92	0.72	-	1.17	0.47
Number of daughters, +1 person	0.75	0.59	-	0.94	0.012
One daughter vs none	1.00	0.53	-	1.91	0.14
Two daughters vs none	0.86	0.40	-	1.86	0.59
Three daughters vs none	0.37	0.15	-	0.91	0.014
Number of children, +1 person	0.79	0.66	-	0.94	0.009

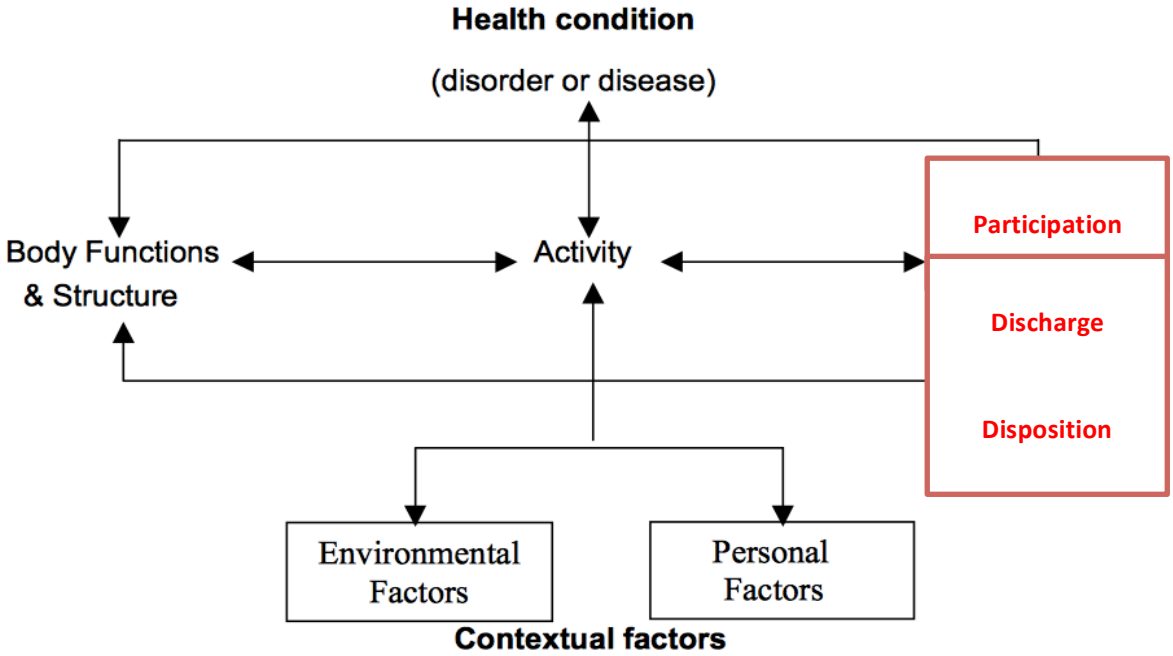
Abbreviations; BI, Barthel Index; NIHSS: National Institute of Health Stroke Scale

Table 9. Multiple logistic regressions for predictors of failure of home discharge

	Variable	Odds ratio	95% confidence interval	p
Model 1	Age, +1 year	0.98	0.96 - 1.00	0.10
	Sex, male vs female	0.67	0.40 - 1.11	0.12
	Number of daughters, one vs none	1.00	0.53 - 1.91	0.14
	Number of daughters, two vs none	0.86	0.40 - 1.86	0.59
	Number of daughters, more than three vs none	0.37	0.15 - 0.91	0.014
Model 2	Age, +1 year	0.97	0.95 - 1.00	0.029
	Sex, male vs female	0.86	0.45 - 1.65	0.64
	Number of daughters, one vs none	0.91	0.40 - 2.08	0.30
	Number of daughters, two vs none	1.20	0.46 - 3.14	0.08
	Number of daughters, more than three vs none	0.23	0.07 - 0.72	0.003
	BI score at discharge, +1 point	0.97	0.95 - 0.98	0.001
Model 3	Age, +1 year	0.98	0.95 - 1.00	0.08
	Sex, male vs female	0.84	0.43 - 1.61	0.59
	Number of daughters, one vs none	0.92	0.40 - 2.10	0.37
	Number of daughters, two vs none	1.33	0.50 - 3.54	0.06
	Number of daughters, more than three vs none	0.24	0.08 - 0.77	0.003
	BI score at discharge, +1 point	0.97	0.95 - 0.98	0.001
	Type, ischemic vs hemorrhagic	0.68	0.33 - 1.37	0.28

Abbreviations; BI, Barthel Index; NIHSS: National Institute of Health Stroke Scale

Figure 1. Discharge disposition in the health model of World Health Organization



Reference: WHO I. International Classification of Functioning. *Disability and Health, Geneva, Switzerland: World Health Organization*. 2001.

http://www.who.int/classifications/icf/en/

Figure 2. Stages of stroke rehabilitation

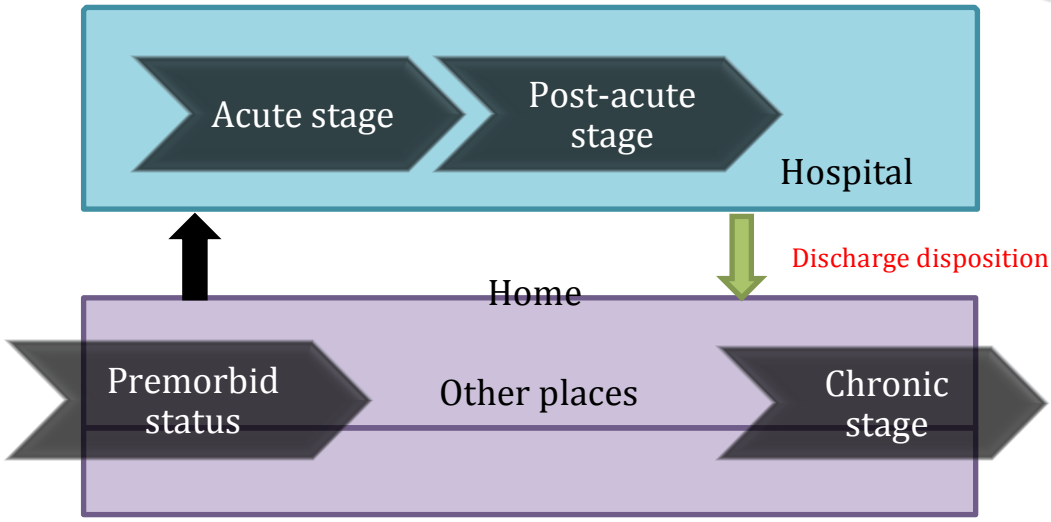
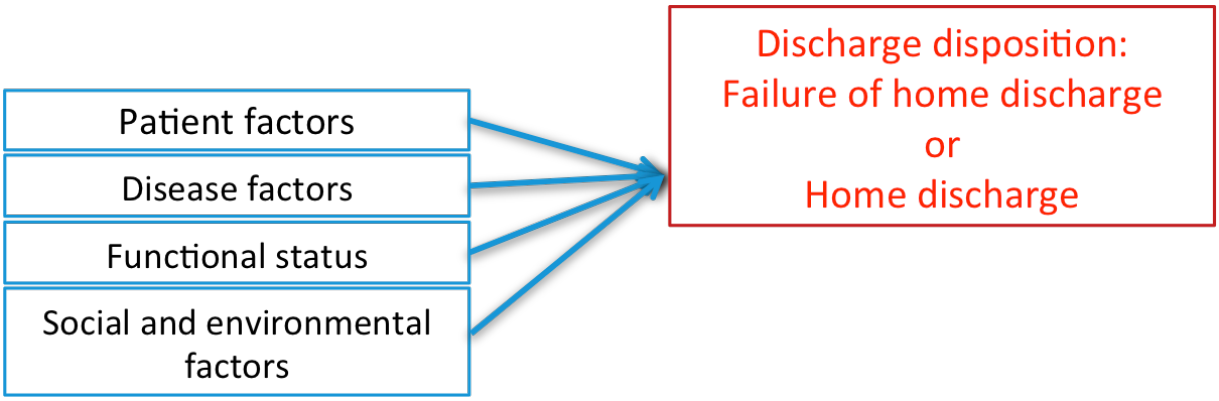


Figure 3. Structure of predictors for discharge disposition



Reference: Meijer R, Ihnenfeldt D, Vermeulen M, De Haan R and Van Limbeek J. The use of a modified Delphi procedure for the determination of 26 prognostic factors in the sub-acute stage of stroke. *International journal of rehabilitation research Internationale Zeitschrift fur Rehabilitationsforschung Revue internationale de recherches de readaptation*. 2003;26:265-70.

Figure 4. Diagram of study setting

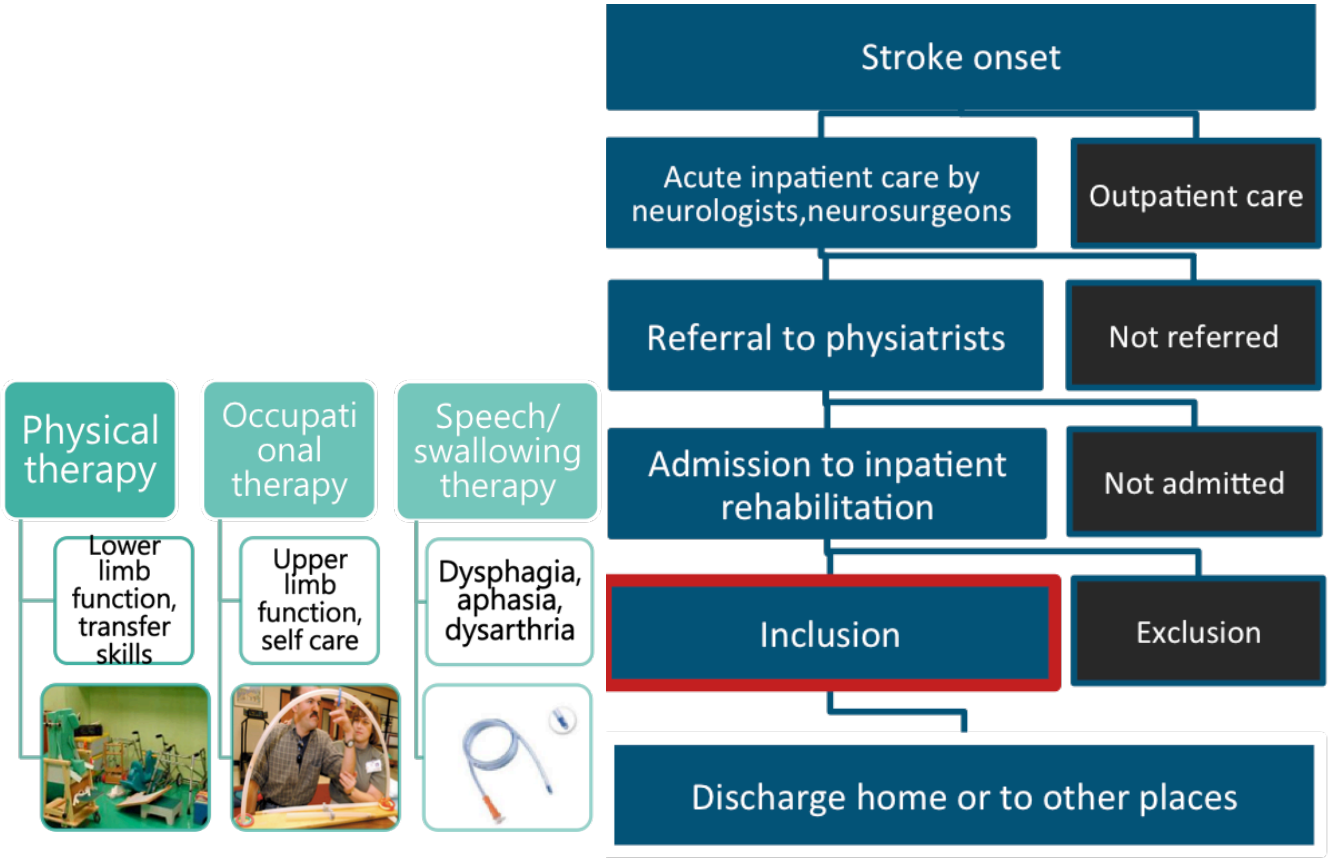
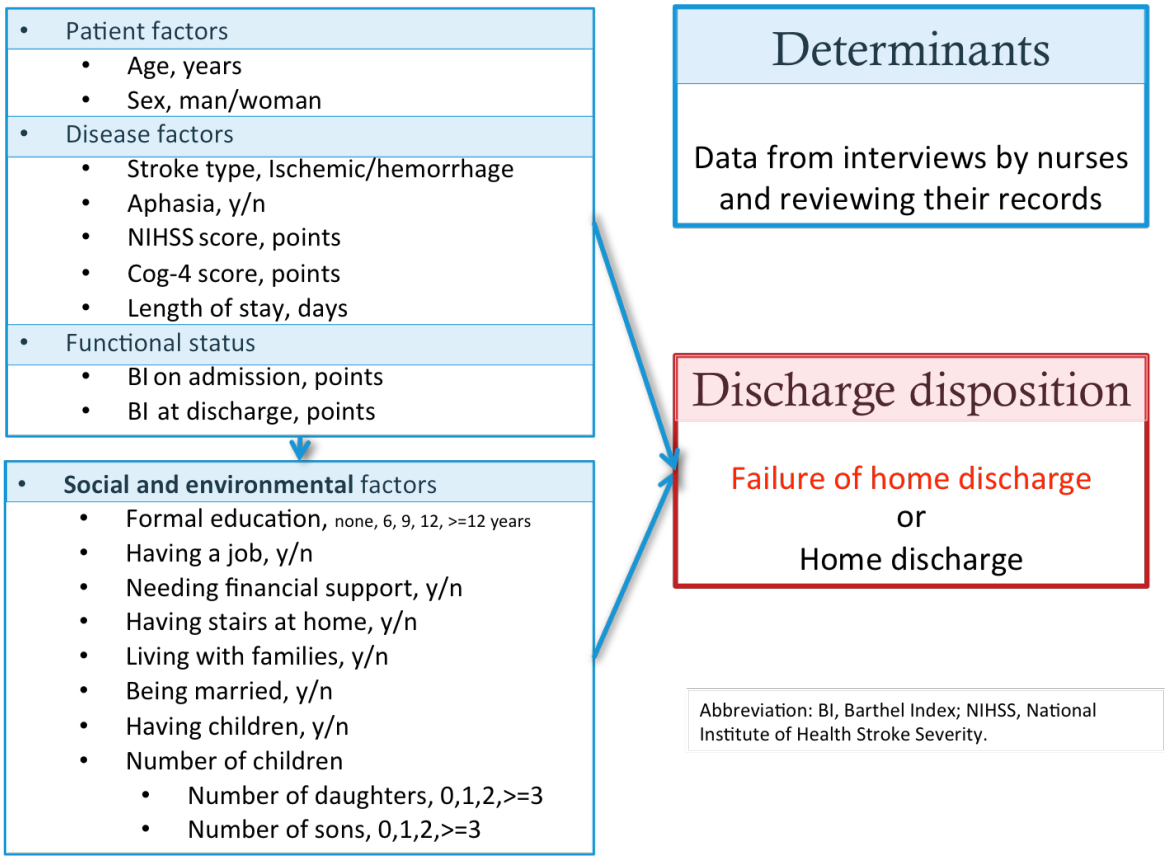


Figure 5. Diagram of data collection



Abbreviation: BI, Barthel Index; NIHSS, National Institute of Health Stroke Severity.

Figure 6. Flowchart of patients

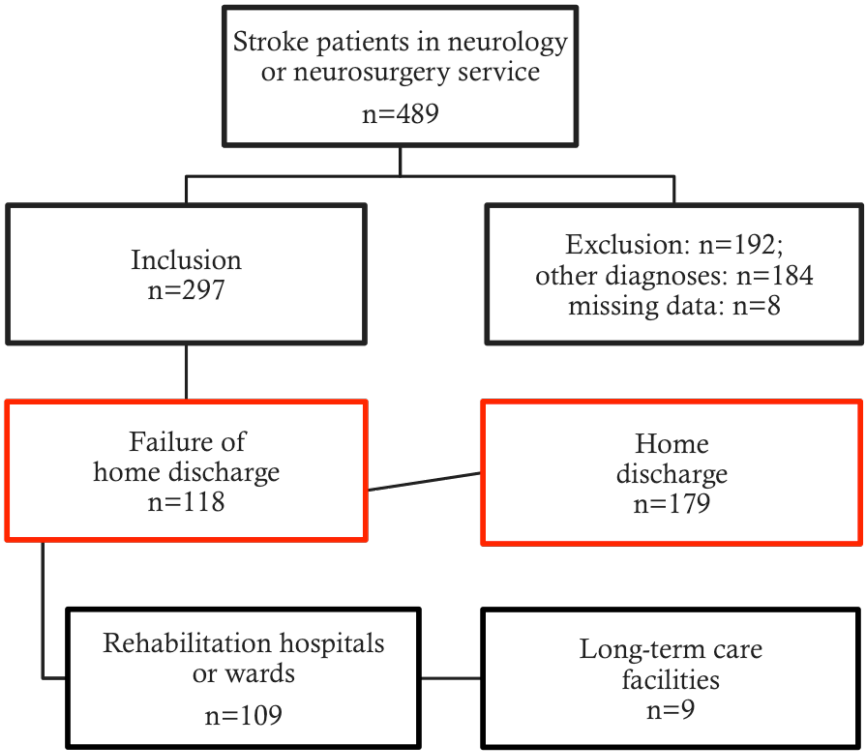
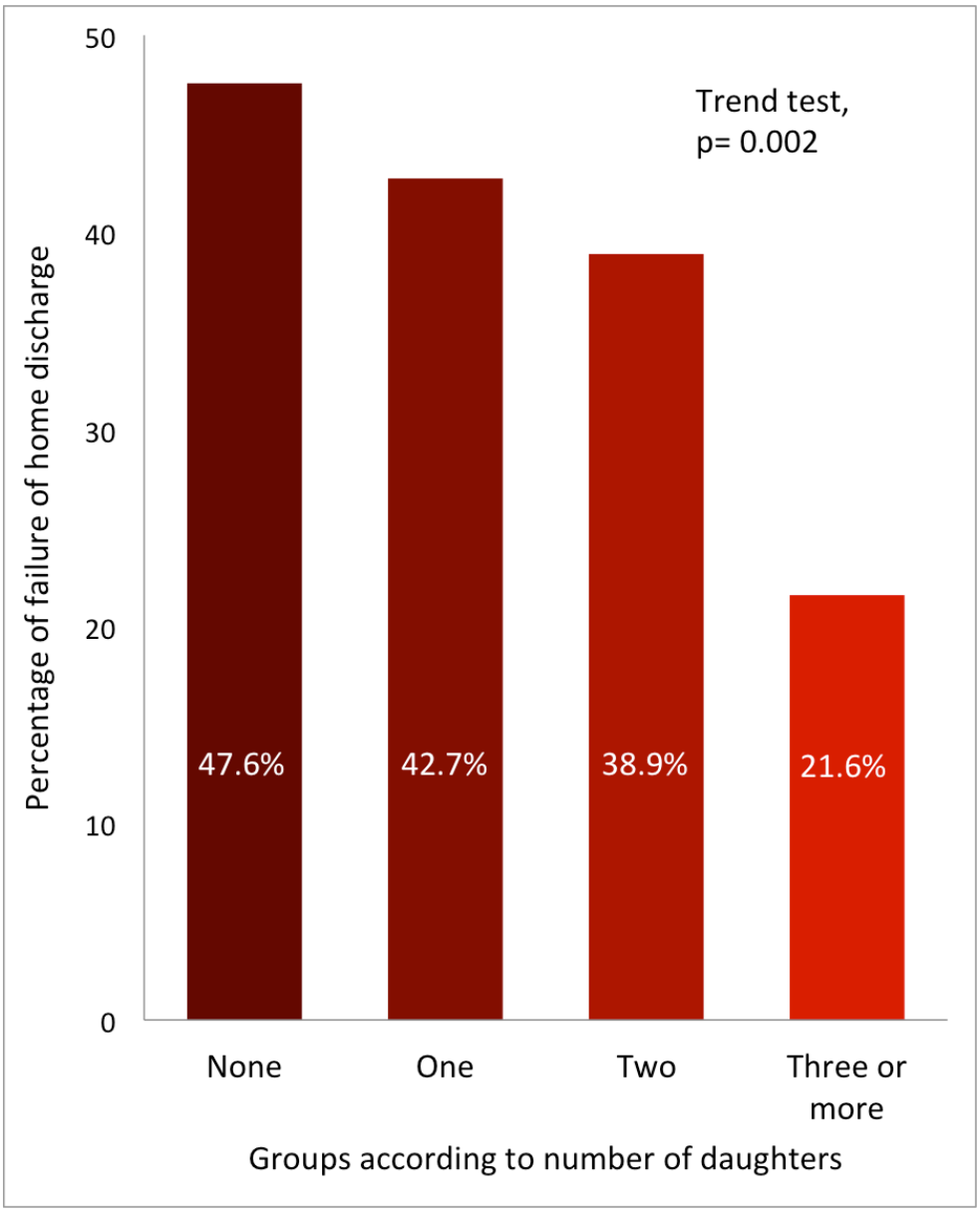
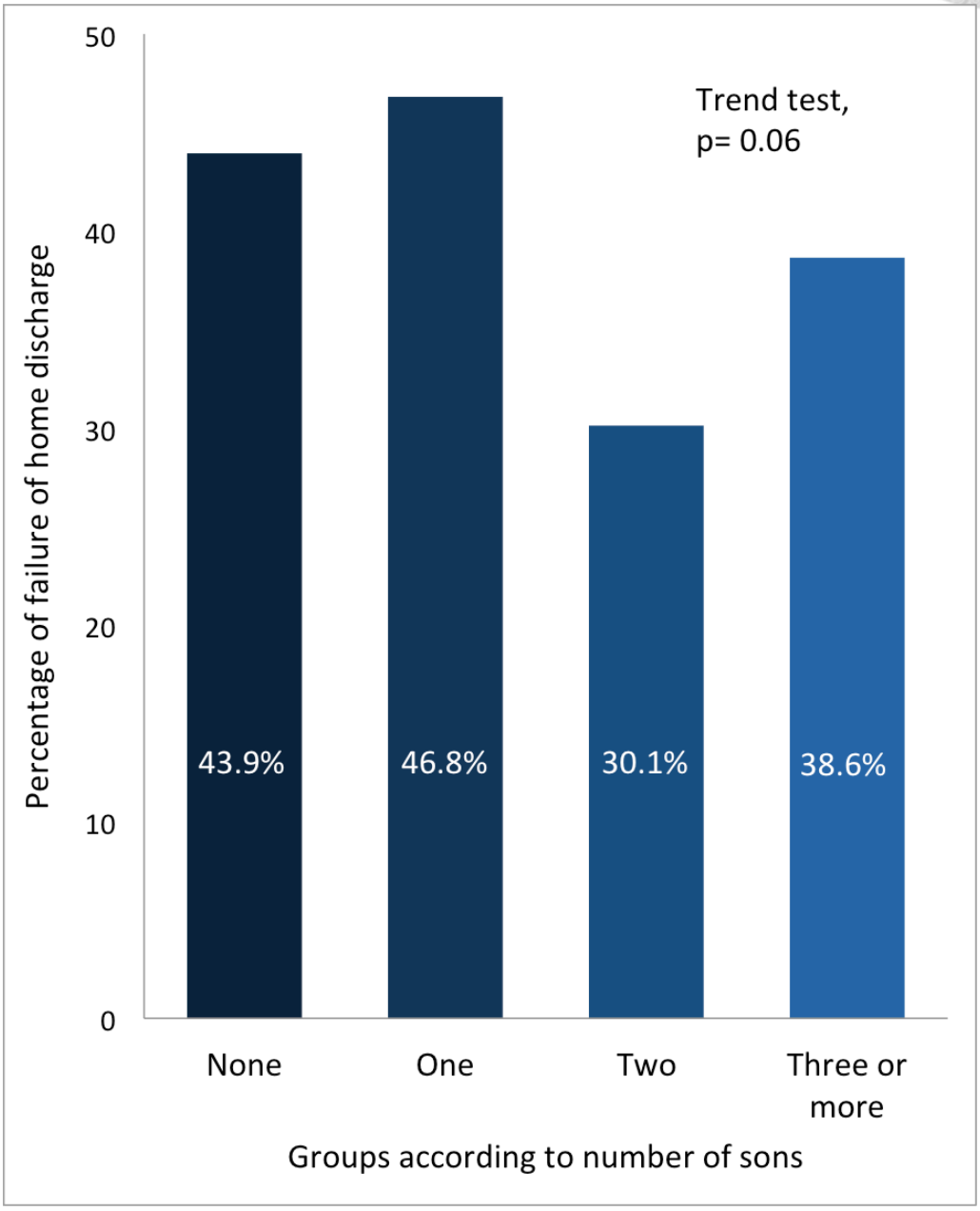


Figure 7. Trend test for number of daughters and rate of failure of home discharge



Number of daughters									Number of sons								
None (n=82)		One (n=110)		Two (n=54)		More than three (n=51)		p, test for trend	None (n=66)		One (n=94)		Two (n=93)		More than three (n=44)		p, test for trend
N	%	N	%	N	%	N	%		N	%	N	%	N	%	N	%	
39	47.6	47	42.7	21	38.9	11	21.6	0.002	29	43.9	44	46.8	28	30.1	17	38.6	0.06

Figure 8. Trend test for number of sons and rate of failure of home discharge



Number of daughters									Number of sons								
None (n=82)		One (n=110)		Two (n=54)		More than three (n=51)		p, test for trend	None (n=66)		One (n=94)		Two (n=93)		More than three (n=44)		p, test for trend
N	%	N	%	N	%	N	%		N	%	N	%	N	%	N	%	
39	47.6	47	42.7	21	38.9	11	21.6	0.002	29	43.9	44	46.8	28	30.1	17	38.6	0.06

Appendix

Appendix 1. The National Institute of Health Stroke Severity (NIHSS) Scale

The National Institute of Health Stroke Severity (NIHSS) Scale

- Assessing consciousness, motor, sensory, coordination, cognitive, speech, visuospatial functions
- Measuring during the first visit of neurologists
- Good validity, reliability and prognostic value
- With 11 items
- Item scored 0 (no symptoms) - 4 (severe); total score 0 – 42
- 0: No symptoms, 1-4: minor stroke;
  5-15: moderate; 16-20: moderate to severe; 21-42: severe

Reference:

Meijer R, Ihnenfeldt D, Vermeulen M, De Haan R and Van Limbeek J. The use of a modified Delphi procedure for the determination of 26 prognostic factors in the sub-acute stage of stroke. International journal of rehabilitation research Internationale Zeitschrift fur Rehabilitationsforschung Revue internationale de recherches de readaptation. 2003;26:265-70. [27]

http://www.ninds.nih.gov/doctors/NIH_Stroke_Scale.pdf

NIH STROKE SCALE

Patient Identification. ___ ___-___ ___ ___-___ ___ ___

Pt. Date of Birth ___ ___/___ ___/___ ___

Hospital _____(___ ___-___ ___)

Date of Exam ___ ___/___ ___/___ ___

Interval: [ ] Baseline [ ] 2 hours post treatment [ ] 24 hours post onset of symptoms ±20 minutes [ ] 7-10 days
[ ] 3 months [ ] Other _____(___ ___)

Time: ___ ___:___ ___ [ ]am [ ]pm

Person Administering Scale _____

Administer stroke scale items in the order listed. Record performance in each category after each subscale exam. Do not go back and change scores. Follow directions provided for each exam technique. Scores should reflect what the patient does, not what the clinician thinks the patient can do. The clinician should record answers while administering the exam and work quickly. Except where indicated, the patient should not be coached (i.e., repeated requests to patient to make a special effort).

Instructions	Scale Definition	Score
1a. Level of Consciousness: The investigator must choose a response if a full evaluation is prevented by such obstacles as an endotracheal tube, language barrier, orotracheal trauma/bandages. A 3 is scored only if the patient makes no movement (other than reflexive posturing) in response to noxious stimulation.	0 = **Alert;** keenly responsive. 1 = **Not alert**; but arousable by minor stimulation to obey, answer, or respond. 2 = **Not alert**; requires repeated stimulation to attend, or is obtunded and requires strong or painful stimulation to make movements (not stereotyped). 3 = Responds only with reflex motor or autonomic effects or totally unresponsive, flaccid, and areflexic.	_____
1b. LOC Questions: The patient is asked the month and his/her age. The answer must be correct - there is no partial credit for being close. Aphasic and stuporous patients who do not comprehend the questions will score 2. Patients unable to speak because of endotracheal intubation, orotracheal trauma, severe dysarthria from any cause, language barrier, or any other problem not secondary to aphasia are given a 1. It is important that only the initial answer be graded and that the examiner not "help" the patient with verbal or non-verbal cues.	0 = **Answers** both questions correctly. 1 = **Answers** one question correctly. 2 = **Answers** neither question correctly.	_____
1c. LOC Commands: The patient is asked to open and close the eyes and then to grip and release the non-paretic hand. Substitute another one step command if the hands cannot be used. Credit is given if an unequivocal attempt is made but not completed due to weakness. If the patient does not respond to command, the task should be demonstrated to him or her (pantomime), and the result scored (i.e., follows none, one or two commands). Patients with trauma, amputation, or other physical impediments should be given suitable one-step commands. Only the first attempt is scored.	0 = **Performs** both tasks correctly. 1 = **Performs** one task correctly. 2 = **Performs** neither task correctly.	_____
2. Best Gaze: Only horizontal eye movements will be tested. Voluntary or reflexive (oculocephalic) eye movements will be scored, but caloric testing is not done. If the patient has a conjugate deviation of the eyes that can be overcome by voluntary or reflexive activity, the score will be 1. If a patient has an isolated peripheral nerve paresis (CN III, IV or VI), score a 1. Gaze is testable in all aphasic patients. Patients with ocular trauma, bandages, pre-existing blindness, or other disorder of visual acuity or fields should be tested with reflexive movements, and a choice made by the investigator. Establishing eye contact and then moving about the patient from side to side will occasionally clarify the presence of a partial gaze palsy.	0 = **Normal.** 1 = **Partial gaze palsy;** gaze is abnormal in one or both eyes, but forced deviation or total gaze paresis is not present. 2 = **Forced deviation,** or total gaze paresis not overcome by the oculocephalic maneuver.	_____

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N I H STROKE SCALE

Patient Identification. ___ ___-___ ___ ___-___ ___ ___

Pt. Date of Birth ___ ___/___ ___/___ ___

Hospital _____(___ ___-___ ___)

Date of Exam ___ ___/___ ___/___ ___

Interval: [ ] Baseline [ ] 2 hours post treatment [ ] 24 hours post onset of symptoms ±20 minutes [ ] 7-10 days
[ ] 3 months [ ] Other _____(___ ___)

3. Visual: Visual fields (upper and lower quadrants) are tested by confrontation, using finger counting or visual threat, as appropriate. Patients may be encouraged, but if they look at the side of the moving fingers appropriately, this can be scored as normal. If there is unilateral blindness or enucleation, visual fields in the remaining eye are scored. Score 1 only if a clear-cut asymmetry, including quadrantanopia, is found. If patient is blind from any cause, score 3. Double simultaneous stimulation is performed at this point. If there is extinction, patient receives a 1, and the results are used to respond to item 11.	0 = **No visual loss.** 1 = **Partial hemianopia.** 2 = **Complete hemianopia.** 3 = **Bilateral hemianopia** (blind including cortical blindness).	_____
4. Facial Palsy: Ask – or use pantomime to encourage – the patient to show teeth or raise eyebrows and close eyes. Score symmetry of grimace in response to noxious stimuli in the poorly responsive or non-comprehending patient. If facial trauma/bandages, orotracheal tube, tape or other physical barriers obscure the face, these should be removed to the extent possible.	0 = **Normal** symmetrical movements. 1 = **Minor paralysis** (flattened nasolabial fold, asymmetry on smiling). 2 = **Partial paralysis** (total or near-total paralysis of lower face). 3 = **Complete paralysis** of one or both sides (absence of facial movement in the upper and lower face).	_____
5. Motor Arm: The limb is placed in the appropriate position: extend the arms (palms down) 90 degrees (if sitting) or 45 degrees (if supine). Drift is scored if the arm falls before 10 seconds. The aphasic patient is encouraged using urgency in the voice and pantomime, but not noxious stimulation. Each limb is tested in turn, beginning with the non-paretic arm. Only in the case of amputation or joint fusion at the shoulder, the examiner should record the score as untestable (UN), and clearly write the explanation for this choice.	0 = **No drift;** limb holds 90 (or 45) degrees for full 10 seconds. 1 = **Drift;** limb holds 90 (or 45) degrees, but drifts down before full 10 seconds; does not hit bed or other support. 2 = **Some effort against gravity;** limb cannot get to or maintain (if cued) 90 (or 45) degrees, drifts down to bed, but has some effort against gravity. 3 = **No effort against gravity;** limb falls. 4 = **No movement.** UN = **Amputation** or joint fusion, explain: _____ **5a. Left Arm** **5b. Right Arm**	_____ _____
6. Motor Leg: The limb is placed in the appropriate position: hold the leg at 30 degrees (always tested supine). Drift is scored if the leg falls before 5 seconds. The aphasic patient is encouraged using urgency in the voice and pantomime, but not noxious stimulation. Each limb is tested in turn, beginning with the non-paretic leg. Only in the case of amputation or joint fusion at the hip, the examiner should record the score as untestable (UN), and clearly write the explanation for this choice.	0 = **No drift;** leg holds 30-degree position for full 5 seconds. 1 = **Drift;** leg falls by the end of the 5-second period but does not hit bed. 2 = **Some effort against gravity;** leg falls to bed by 5 seconds, but has some effort against gravity. 3 = **No effort against gravity;** leg falls to bed immediately. 4 = **No movement.** UN = **Amputation** or joint fusion, explain: _____ **6a. Left Leg** **6b. Right Leg**	_____

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NIH STROKE SCALE

Patient Identification. ___ ___-___ ___ ___-___ ___ ___

Pt. Date of Birth ___ ___/___ ___/___ ___

Hospital _____(___ ___-___ ___)

Date of Exam ___ ___/___ ___/___ ___

Interval: [ ] Baseline [ ] 2 hours post treatment [ ] 24 hours post onset of symptoms ±20 minutes [ ] 7-10 days
[ ] 3 months [ ] Other _____(___ ___)

7. Limb Ataxia: This item is aimed at finding evidence of a unilateral cerebellar lesion. Test with eyes open. In case of visual defect, ensure testing is done in intact visual field. The finger-nose-finger and heel-shin tests are performed on both sides, and ataxia is scored only if present out of proportion to weakness. Ataxia is absent in the patient who cannot understand or is paralyzed. Only in the case of amputation or joint fusion, the examiner should record the score as untestable (UN), and clearly write the explanation for this choice. In case of blindness, test by having the patient touch nose from extended arm position.	0 = **Absent.** 1 = **Present in one limb.** 2 = **Present in two limbs.** UN = **Amputation** or joint fusion, explain: _____	_____
8. Sensory: Sensation or grimace to pinprick when tested, or withdrawal from noxious stimulus in the obtunded or aphasic patient. Only sensory loss attributed to stroke is scored as abnormal and the examiner should test as many body areas (arms [not hands], legs, trunk, face) as needed to accurately check for hemisensory loss. A score of 2, "severe or total sensory loss," should only be given when a severe or total loss of sensation can be clearly demonstrated. Stuporous and aphasic patients will, therefore, probably score 1 or 0. The patient with brainstem stroke who has bilateral loss of sensation is scored 2. If the patient does not respond and is quadriplegic, score 2. Patients in a coma (item 1a=3) are automatically given a 2 on this item.	0 = **Normal;** no sensory loss. 1 = **Mild-to-moderate sensory loss;** patient feels pinprick is less sharp or is dull on the affected side; or there is a loss of superficial pain with pinprick, but patient is aware of being touched. 2 = **Severe to total sensory loss;** patient is not aware of being touched in the face, arm, and leg.	_____
9. Best Language: A great deal of information about comprehension will be obtained during the preceding sections of the examination. For this scale item, the patient is asked to describe what is happening in the attached picture, to name the items on the attached naming sheet and to read from the attached list of sentences. Comprehension is judged from responses here, as well as to all of the commands in the preceding general neurological exam. If visual loss interferes with the tests, ask the patient to identify objects placed in the hand, repeat, and produce speech. The intubated patient should be asked to write. The patient in a coma (item 1a=3) will automatically score 3 on this item. The examiner must choose a score for the patient with stupor or limited cooperation, but a score of 3 should be used only if the patient is mute and follows no one-step commands.	0 = **No aphasia;** normal. 1 = **Mild-to-moderate aphasia;** some obvious loss of fluency or facility of comprehension, without significant limitation on ideas expressed or form of expression. Reduction of speech and/or comprehension, however, makes conversation about provided materials difficult or impossible. For example, in conversation about provided materials, examiner can identify picture or naming card content from patient's response. 2 = **Severe aphasia;** all communication is through fragmentary expression; great need for inference, questioning, and guessing by the listener. Range of information that can be exchanged is limited; listener carries burden of communication. Examiner cannot identify materials provided from patient response. 3 = **Mute, global aphasia;** no usable speech or auditory comprehension.	_____
10. Dysarthria: If patient is thought to be normal, an adequate sample of speech must be obtained by asking patient to read or repeat words from the attached list. If the patient has severe aphasia, the clarity of articulation of spontaneous speech can be rated. Only if the patient is intubated or has other physical barriers to producing speech, the examiner should record the score as untestable (UN), and clearly write an explanation for this choice. Do not tell the patient why he or she is being tested.	0 = **Normal.** 1 = **Mild-to-moderate dysarthria;** patient slurs at least some words and, at worst, can be understood with some difficulty. 2 = **Severe dysarthria;** patient's speech is so slurred as to be unintelligible in the absence of or out of proportion to any dysphasia, or is mute/anarthric. UN = **Intubated** or other physical barrier, explain:_____	_____

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NIH STROKE SCALE

Patient Identification. ___ ___-___ ___ ___-___ ___ ___

Pt. Date of Birth ___ ___/___ ___/___ ___

Hospital _____(___ ___-___ ___)

Date of Exam ___ ___/___ ___/___ ___

Interval: [ ] Baseline [ ] 2 hours post treatment [ ] 24 hours post onset of symptoms ±20 minutes [ ] 7-10 days
[ ] 3 months [ ] Other _____(___ ___)

11. Extinction and Inattention (formerly Neglect): Sufficient information to identify neglect may be obtained during the prior testing. If the patient has a severe visual loss preventing visual double simultaneous stimulation, and the cutaneous stimuli are normal, the score is normal. If the patient has aphasia but does appear to attend to both sides, the score is normal. The presence of visual spatial neglect or anosagnosia may also be taken as evidence of abnormality. Since the abnormality is scored only if present, the item is never untestable.	0 = **No abnormality.** 1 = **Visual, tactile, auditory, spatial, or personal inattention** or extinction to bilateral simultaneous stimulation in one of the sensory modalities. 2 = **Profound hemi-inattention or extinction to more than one modality;** does not recognize own hand or orients to only one side of space.	_____

_____

_____

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Appendix 2. The Cog-4 Scale

The Cog-4 Scale

- A composite scale from 4 items of NIHSS: 1b, 1c, 9, 11 (0-2, 0-2, 0-3, 0-2)
- An indicator for cognitive impairment of acute stroke patients
- Total score 0-9

Reference:

Meijer R, Ihnenfeldt D, Vermeulen M, De Haan R and Van Limbeek J. The use of a modified Delphi procedure for the determination of 26 prognostic factors in the sub-acute stage of stroke. *International journal of rehabilitation research Internationale Zeitschrift fur Rehabilitationsforschung Revue internationale de recherches de readaptation*. 2003;26:265-70. [28]

Appendix 3. The Barthel Index

The Barthel Index

- Assessing functional independence for basic activities of life
- Measuring on admission and at discharge by physiatrists
- Good validity and reliability in stroke rehabilitation settings
- With 10 items
- Total score 0 (most dependent) to 100 (basic independence)
- 0-20: total dependence; 21-60: severe dependence; 61-90: moderate dependence and 91-99: slight dependence.
- In this study, we used the BI score at discharge

Reference:

Mahoney FI, Barthel D. "Functional evaluation: the Barthel Index." Maryland State Med Journal 1965;14:56-61. Used with permission. [29]

THE BARTHEL INDEX

Patient Name: _____
Rater Name: _____
Date: _____

Activity	**Score**
FEEDING 0 = unable 5 = needs help cutting, spreading butter, etc., or requires modified diet 10 = independent	_____
BATHING 0 = dependent 5 = independent (or in shower)	_____
GROOMING 0 = needs to help with personal care 5 = independent face/hair/teeth/shaving (implements provided)	_____
DRESSING 0 = dependent 5 = needs help but can do about half unaided 10 = independent (including buttons, zips, laces, etc.)	_____
BOWELS 0 = incontinent (or needs to be given enemas) 5 = occasional accident 10 = continent	_____
BLADDER 0 = incontinent, or catheterized and unable to manage alone 5 = occasional accident 10 = continent	_____
TOILET USE 0 = dependent 5 = needs some help, but can do something alone 10 = independent (on and off, dressing, wiping)	_____
TRANSFERS (BED TO CHAIR AND BACK) 0 = unable, no sitting balance 5 = major help (one or two people, physical), can sit 10 = minor help (verbal or physical) 15 = independent	_____
MOBILITY (ON LEVEL SURFACES) 0 = immobile or < 50 yards 5 = wheelchair independent, including corners, > 50 yards 10 = walks with help of one person (verbal or physical) > 50 yards 15 = independent (but may use any aid; for example, stick) > 50 yards	_____
STAIRS 0 = unable 5 = needs help (verbal, physical, carrying aid) 10 = independent	_____
TOTAL (0–100):	_____

The Barthel ADL Index: Guidelines

1. The index should be used as a record of what a patient does, not as a record of what a patient could do.
2. The main aim is to establish degree of independence from any help, physical or verbal, however minor and for whatever reason.
3. The need for supervision renders the patient not independent.
4. A patient's performance should be established using the best available evidence. Asking the patient, friends/relatives and nurses are the usual sources, but direct observation and common sense are also important. However direct testing is not needed.
5. Usually the patient's performance over the preceding 24-48 hours is important, but occasionally longer periods will be relevant.
6. Middle categories imply that the patient supplies over 50 per cent of the effort.
7. Use of aids to be independent is allowed.

References

Mahoney FI, Barthel D. "Functional evaluation: the Barthel Index."
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