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# FACTORS INFLUENCING VOCATIONAL OUTCOMES FOLLOWING STROKE IN TAIWAN: A MEDICAL CENTRE-BASED STUDY

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**ABSTRACT. This study was aimed at identifying the factors relating to return to work for stroke patients of working age in Taiwan, adjusting for confounding factors. A retrospective cohort study was used to test the association between patients' characteristics, such as medical condition at admission and sociodemographic factors, and the degree of return to work after stroke. Two hundred and forty-eight consecutive stroke survivors discharged from the National Taiwan University Hospital participated in the follow-up survey. Variables considered likely to influence return to work were collected from the patients' hospital records. Vocational outcomes were collected via questionnaire. Return to work was classified into four levels: (I) no return to work; (II) limited return to work; (III) partial return to work; and (IV) complete return to work. Of the 248 subjects surveyed, 105 (42.7%) subjects had not returned to work, 32 (12.9%) subjects had returned to work on a limited basis, 43 (17.3%) subjects had partially returned, and 68 (27.4%) subjects had returned to work completely. Cramer's *V* test and stepwise logistic regression were employed to examine factors influencing return to employment. Maximum weakness and employment institution were identified as the strongest predictors of return to work. In brief, nearly three-quarters of the patients did not resume their usual work roles after stroke. Maximum weakness and employment institution were the strongest predictors of return to work following a stroke in Taiwan.**

*Key words:* cerebrovascular disorders, employment, retrospective study.

The age-specific incidence rates of stroke are higher in Taiwan than those reported from the United Kingdom and the United States (11). The steady ageing of the population has increased the estimated prevalence of stroke survivors in Taiwan. Return to work following stroke has become more important as a stroke-related outcome in recent years.

Employment usually results in a sense of achievement, independence, freedom, and security (17). The ability to work is important for individuals. This is most likely also true for stroke patients. Identifying predictive factors of the early stage after stroke associated with return to work is important for improving vocational outcomes.

Several studies have investigated the vocational outcome of stroke patients (1, 2, 6–8, 10, 13–16, 18, 21, 22, 24, 25). However, results vary in the percentage of stroke patients returning to work. While a few studies have tried to identify the factors that predict the success or failure of vocational outcome (3, 9, 12, 19), the results have not been conclusive. These studies have usually treated vocational results as a dichotomous variable (i.e. returning to work or not). However, some stroke patients may return to work partially (e.g. a reduction in working hours or complexity of tasks). Dichotomizing vocational outcomes to success or failure appears to be too crude an approach.

Vocational outcome of stroke patients has not been systematically investigated in Taiwan. This study aimed at revealing the vocational outcome of working-age stroke patients in Taiwan and identifying prognostic predictors of vocational results. The vocational outcomes after stroke were treated as a polychotomous scale in this study. A retrospective cohort study was conducted on the association between patients' medical condition and demographic details, and return to work.

## MATERIALS AND METHODS

### *Subjects*

The National Taiwan University Hospital, one of the largest academic hospitals in Taiwan, has 20 medical departments and 2,000 beds, and serves as a teaching hospital and medical centre in the city of Taipei (population, approximately 4.5 million). It is also a referral hospital for patients throughout Taiwan. Most stroke patients are admitted through the emergency department

and are transferred to the departments of internal medicine, neurology, neurosurgery, or rehabilitation for further treatment and care.

Of the 2,398 consecutive stroke patients admitted to the National Taiwan University Hospital between September 1989 and March 1994, 310 were found to meet the following criteria by reviewing medical records and by telephone interview: (1) aged 25–64 years; (2) diagnosis [International Classification of Diseases, Ninth Revision Clinical Modification (ICD-9-CM) codes] of subarachnoid haemorrhage (430), cerebral haemorrhage (431), cerebral infarction (434), or other (432, 433, 436, 437); (3) admitted to the hospital within 1 day after stroke; (4) employed at time of latest stroke; (5) discharged from the hospital at least 6 months before follow-up; and (6) available for the follow-up questionnaire, which was conducted by telephone between September and November 1994. Patients who were diagnosed with transient ischaemic attack (ICD-9-CM code 435) or with late effects of cerebrovascular disease (ICD-9-CM code 438) were excluded.

*Predictors*

Variables considered likely to influence return to work were collected retrospectively from the patients' medical charts recorded by physicians (Table I). Physical and neurological examinations for potential stroke patients were evaluated by physicians of the departments of internal medicine, neurology, neurosurgery, radiology, or rehabilitation. The clinical diagnosis of stroke was confirmed by neuroimaging examination (computed tomography or magnetic resonance imaging). Higher cortical functions (mentality and aphasia) were examined when the patient was conscious at admission. Level of consciousness was assessed using the Glasgow Coma Scale (23). Because of the possible presence of aphasia, the verbal component of this scale was deleted. When a patient had a maximum score on the eye and motor components, he or she was considered to be alert. Activities of daily living (ADL) were evaluated using a 3-point scale (independent, partially dependent, totally dependent) at the time of admission. The muscle strength of each of the four extremities was rated separately using a 0–5 scale (5). A score of 5 points was categorized as normal, 4 as mildly weak, 2–3 as moderately weak and 0–1 as severely weak. The maximum weakness factor in this study means the rating for the most severely involved extremity of each patient. All factors of medical condition were evaluated by physicians within 3 days after admission.

*Outcome*

Vocational outcomes were collected via questionnaire. The questionnaire included two main parts. The first part addressed employment status (occupation category, average number of working hours per day, duration of work) before and after stroke, and self-perception toward difference of work complexity after stroke. The second part collected sociodemographic information. The patients were invited to participate in the survey primarily by telephone. If no telephone number or a wrong number was found in the hospital records, a written invitation letter was mailed. Two hundred and forty-eight subjects (80%) participated in the follow-up survey. Fifty-one (20.6%) of the participants could not answer the telephone because of speech impairment or other problems (e.g. severe physical disability).

Table I. *Associations between prospective factors and vocational outcomes after smoke*

| Factor | No. of patients[1] | Degree of return to work[2] (%) | | | | $p^3$ |
|---|---|---|---|---|---|---|
| | | I | II | III | IV | |
| Gender | | | | | | |
| Male | 163 | 41.7 | 12.9 | 17.2 | 28.2 | 0.9835 |
| Female | 85 | 43.5 | 12.9 | 17.6 | 25.9 | |
| Age (years) | | | | | | |
| ≤ =45 | 58 | 37.9 | 6.9 | 19.0 | 36.2 | 0.6553 |
| 46–55 | 100 | 43.0 | 15.0 | 15.0 | 27.0 | |
| 56–64 | 90 | 44.4 | 14.4 | 18.9 | 22.2 | |
| Education | | | | | | |
| Less than high school | 126 | 49.2 | 15.1 | 16.7 | 19.0 | 0.0137 |
| High school graduate | 74 | 37.8 | 12.2 | 21.6 | 28.4 | |
| College graduate | 46 | 30.4 | 8.7 | 13.0 | 47.8 | |
| Occupation | | | | | | |
| White collar | 71 | 35.2 | 14.1 | 18.3 | 32.4 | 0.0799 |
| Blue collar | 137 | 51.1 | 10.9 | 16.1 | 21.9 | |
| Housewife | 40 | 25.0 | 17.5 | 20.0 | 37.5 | |
| Marriage | | | | | | |
| Married | 229 | 41.9 | 13.5 | 16.6 | 27.9 | 0.6625 |
| Single/divorced/widowed | 18 | 50.0 | 5.6 | 22.2 | 22.2 | |
| Prior smoking | | | | | | |
| Yes | 107 | 48.6 | 9.3 | 19.6 | 22.4 | 0.1184 |
| No | 141 | 37.6 | 15.6 | 15.6 | 31.2 | |
| Prior alcohol use | | | | | | |
| Yes | 69 | 52.2 | 10.1 | 15.9 | 21.7 | 0.2881 |
| No | 177 | 39.0 | 14.1 | 17.5 | 29.4 | |

Table I. *Cont.*

| Factor | No. of patients[1] | Degree of return to work[2] (%) I | II | III | IV | $p$[3] |
|---|---|---|---|---|---|---|
| Prior hypertension | | | | | | |
| Yes | 139 | 42.4 | 12.9 | 18.0 | 26.6 | 0.9785 |
| No | 107 | 41.1 | 13.1 | 16.8 | 29.0 | |
| Diagnosis | | | | | | |
| Cerebral haemorrage | 27 | 22.2 | 7.4 | 33.3 | 37.0 | 0.0021 |
| Cerebral infarction | 113 | 54.9 | 9.7 | 17.7 | 17.7 | |
| Subarachnoid haemorrhage | 53 | 35.8 | 20.8 | 13.2 | 30.2 | |
| Other | 55 | 32.7 | 14.5 | 12.7 | 40.0 | |
| Side of hemiplegia | | | | | | |
| None | 32 | 6.3 | 12.5 | 21.9 | 59.4 | 0.0001 |
| Left | 86 | 44.2 | 18.6 | 17.4 | 19.8 | |
| Right | 116 | 50.0 | 10.3 | 16.4 | 23.3 | |
| Bilateral | 10 | 70.0 | – | 10.0 | 20.0 | |
| Length of stay (day) | | | | | | |
| $\leq = 15$ | 90 | 30.0 | 16.7 | 14.4 | 38.9 | <0.0001 |
| 16–30 | 78 | 26.9 | 15.4 | 21.8 | 35.9 | |
| $\geq = 31$ | 90 | 71.3 | 6.3 | 16.3 | 6.3 | |
| Employment institution | | | | | | |
| Government | 53 | 22.6 | 13.2 | 24.5 | 39.6 | 0.0010 |
| Private | 83 | 51.8 | 7.2 | 13.3 | 27.7 | |
| Self-employment | 72 | 55.6 | 16.7 | 15.3 | 12.5 | |
| Housewife | 38 | 26.3 | 15.8 | 21.1 | 36.8 | |
| Urinary incontinence | | | | | | |
| Yes | 48 | 64.6 | 10.4 | 18.8 | 6.3 | 0.0005 |
| No | 198 | 36.4 | 13.6 | 17.2 | 32.8 | |
| Bowel incontinence | | | | | | |
| Yes | 17 | 94.1 | – | 5.9 | – | 0.0001 |
| No | 229 | 38.0 | 14.0 | 18.3 | 29.7 | |
| Rehabilitation therapy | | | | | | |
| Yes | 108 | 63.9 | 9.3 | 19.4 | 7.4 | <0.0001 |
| No | 130 | 24.6 | 16.9 | 14.6 | 43.8 | |
| Mentality | | | | | | |
| Normal | 171 | 33.3 | 15.2 | 21.1 | 30.4 | 0.0110 |
| Impaired | 44 | 59.1 | 4.5 | 11.4 | 25.0 | |
| Activities of daily living | | | | | | |
| Independent | 50 | 12.0 | 12.0 | 20.0 | 56.0 | <0.0001 |
| Partially dependent | 138 | 40.6 | 14.5 | 19.6 | 25.4 | |
| Totally dependent | 56 | 71.4 | 10.7 | 10.7 | 7.1 | |
| Speech ability | | | | | | |
| Normal | 133 | 24.1 | 15.8 | 21.8 | 38.3 | <0.0001 |
| Slur/Bulbar/Aphasic | 108 | 62.0 | 10.2 | 12.0 | 15.7 | |
| Sensation | | | | | | |
| Normal | 96 | 30.2 | 11.5 | 17.7 | 40.6 | 0.0028 |
| Impaired/Absent | 142 | 49.3 | 13.4 | 17.6 | 19.7 | |
| Consciousness level | | | | | | |
| Conscious | 175 | 35.4 | 15.4 | 17.1 | 32.0 | 0.0026 |
| Unconscious | 73 | 58.9 | 6.8 | 17.8 | 16.4 | |
| Maximum weakness | | | | | | |
| Normal | 45 | 8.9 | 8.9 | 20.0 | 62.2 | <0.0001 |
| Mild | 84 | 29.8 | 19.0 | 19.0 | 32.1 | |
| Moderate | 61 | 57.4 | 6.6 | 18.0 | 18.0 | |
| Severe | 58 | 70.7 | 13.8 | 12.1 | 3.4 | |

[1] Sum of patients for each factor varies slightly because of missing values.
[2] Degree of return to work: (I) no return to work, (II) limited return to work, (III) partial return to work, and (IV) complete return to work.
[3] Significance test by Cramer's $V$ test.

Their spouses or other family members were interviewed instead. Only two subjects who were contacted by telephone refused to participate in the survey. A change of telephone number or address constituted the main reason for omission of follow-up questionnaire.

Work was defined as full-time and part-time competitive employment, and housekeeping in this study. The definition of return to work was 1 month or more duration of work in competitive employment or continuing housework after stroke. Return to work was classified into four levels: (I) no return to work, (II) limited return to work (reductions in both working hours and complexity of tasks), (III) partial return to work (reduction in working hours or complexity of tasks), and (IV) complete return to work.

*Data analysis*

The associations between the prospective factors and the degree of return to work in the univariate analysis were examined using Cramer's $V$ test. Logistic regression, incorporating these factors as predictors, was then used to predict the probability of subjects returning to work and to examine the statistical significance of these factors after adjusting for confounding factors. To predict different degrees of return to work, the dependent variables used in the logistic regression models were (1) complete return to work, (2) partial return to work and complete return to work, and (3) limited return to work, partial return to work and complete return to work. If we can predict those who have at least a limited return to work, we also know who will not return to work at all. Therefore, the model to predict failure to return to work is not presented. SPSS software was used for all data management and analysis.

## RESULTS

Of the 248 subjects in the study, 57.7% reported returning to work before follow-up. Although the follow-up survey was conducted 6–58 months (median = 26 months) after discharge, those who returned to work did so a median of 3.8 months after discharge. Thirty-two of these (12.9%) had limited return to work, 43 subjects (17.3%) had partially returned, and 68 subjects (27.4%) had completely returned.

Cramer's $V$ test showed that the following factors were significantly associated with the degree of return to work ($p < 0.02$): (1) medical condition at admission and others, including diagnosis, side of hemiplegia, ADL, maximum weakness, speech disturbance, sensation, consciousness, urinary incontinence, bowel incontinence, whether patient received rehabilitation therapy at hospital, length of hospital stay; and (2) sociodemographic factors, including education and employment institution (Table I).

These significant factors, identified by univariate analysis, were then incorporated into prospective predictors (medical condition at admission, rehabilitation therapy received at hospital, length of stay at hospital and sociodemographic factors), to construct models predicting extent of return to work.

Stepwise logistic regression was employed to construct predictive models. Colinearity among potential predictors was evaluated using the Spearman rank correlation. Variables with moderate to high intercorrelations (Spearman rank correlation coefficient, $r_s \geq 0.60$ or $\leq -0.60$) were regarded as colinear and consequently not entered together in the same regression analysis. All possible combinations of variables were entered in order to find the best model. The final models were selected based on goodness-of-fit of the models. Using logistic regression, the same final models were achieved from both the forward and backward stepping algorithms. Tables II–IV give significant predictors of each model.

The outcome of the logistic regression equation was a prediction of the probability of return to work. Predicted probabilities of 50% or more were classified as a prediction that the subject would return to work, whereas probabilities of less than 50% as a prediction that the subject would not return to work. The correct classification percentage of the models varied slightly, ranging from 75.6% to 80.3%. Since two factors, maximum weakness and employment institution, were selected as significant factors by all of the models, we simply employed both of these factors as predictors in the logistic regression analysis. It was found that the correct classification percentage of all models decreased slightly, ranging from 75.6% to 77.6%. This reflects that maximum weakness and employment institution were the strongest predictors of the degree of return to work.

## DISCUSSION

Results showed that 57.7% of the subjects returned to work before the follow-up interview. This proportion was almost the same as that of the study of Saeki et al. (19) in Japan, but higher than that of most other reports (1–4, 7–9, 12, 14, 15, 21, 22, 24, 25). This difference may be due to different sample characteristics (e.g. age distribution, disease severity), definition of return to work (whether housewives or students are included), cultural factors and other possible sociodemographic factors (3, 19).

We also found that 42.3% of the subjects had not returned to work. Of those who had returned to work 12.9% returned with a reduction in working hours *and* complexity of tasks and 17.3% returned with a reduction in working hours *or* complexity of tasks. In other words, nearly three-quarters of the patients did not resume their

Table II. *Selected factors influencing complete return to work after stroke*

| Factor | $B$[1] | SE | Wald | $p$ | Odds ratio |
|---|---|---|---|---|---|
| Maximum weakness | | | | | |
| Normal | 3.12 | 0.89 | 12.27 | 0.0005 | 22.69 |
| Mild | 1.90 | 0.83 | 5.25 | 0.0219 | 6.70 |
| Moderate | 1.73 | 0.85 | 4.12 | 0.0424 | 5.66 |
| Severe[2] | – | – | – | – | 1.00 |
| Rehabilitation therapy | | | | | |
| Yes[2] | – | – | – | – | 1.00 |
| No | 1.59 | 0.49 | 10.38 | 0.0013 | 4.89 |
| Education | | | | | |
| Less than high school[2] | – | – | – | – | 1.00 |
| High school graduate | −0.23 | 0.46 | 0.25 | 0.6161 | 0.79 |
| College graduate | 1.24 | 0.54 | 5.25 | 0.0219 | 3.46 |
| Employment institution | | | | | |
| Government | 1.23 | 0.57 | 4.68 | 0.0305 | 3.41 |
| Housewife | 1.57 | 0.58 | 7.25 | 0.0071 | 4.82 |
| Private | 0.91 | 0.50 | 3.28 | 0.0702 | 2.49 |
| Self-employment[2] | – | – | – | – | 1.00 |
| Constant | −1.31 | 0.27 | 23.77 | <0.0001 | – |

[1] The $B$ coefficient and odds ratio for each factor is adjusted for possible confounding by all the other factors in the table.
[2] Reference category.

Table III. *Selected factors influencing partial return to work after stroke*[1]

| Factor | $B$[2] | SE | Wald | $p$ | Odds ratio |
|---|---|---|---|---|---|
| Maximum weakness | | | | | |
| Normal | 3.49 | 0.57 | 37.12 | <0.0001 | 32.70 |
| Mild | 1.74 | 0.44 | 15.51 | 0.0001 | 5.68 |
| Moderate | 1.22 | 0.47 | 6.61 | 0.0101 | 3.38 |
| Severe[3] | – | – | – | – | 1.00 |
| Employment institution | | | | | |
| Government | 1.49 | 0.44 | 11.67 | 0.0006 | 4.42 |
| Housewife | 1.53 | 0.48 | 10.12 | 0.0015 | 4.61 |
| Private | 0.54 | 0.39 | 1.88 | 0.1699 | 1.71 |
| Self-employment[2] | – | – | – | – | 1.00 |
| Constant | −2.51 | 0.47 | 28.41 | <0.0001 | – |

[1] Including partial return to work and complete return to work.
[2] The $B$ coefficient and odds ratio for each factor is adjusted for possible confounding by all the other factors in the table.
[3] Reference category.

usual work roles after stroke. Loss of work role may cause psychosocial dysfunction and thereby further isolate patients after a stroke (20). Vocational intervention is, therefore, important for most younger survivors of stroke.

Univariate analysis showed that there was not significant association between age and return to work (3, 19). This result is similar to those of studies in which subjects were aged younger than 65. According to Howard et al. (12), age had little effect on the probability of return to work until the patient approached 65. When a patient approaches 65, advancing age and socioeconomic factors (including retirement) might jointly affect the probability of return to work.

Our study indicates that prior alcohol use does not have a significant effect on the probability of return to work. This finding appears to contradict that of Black-Schaffer & Osberg (3) who reported that alcohol use had a negative effect on vocational outcome. According to Black-Schaffer & Osberg (3), alcohol consumption may have no direct causal relationship to vocational outcome. It may be caused by job dissatisfaction, poor self-esteem or excessive stress, which may lead to alcohol abuse as

Table IV. *Selected factors influencing limited return to work after stroke*[1]

| Factor | $B$[2] | SE | Wald | $p$ | Odds ratio |
|---|---|---|---|---|---|
| Maximum weakness | | | | | |
| Normal | 2.66 | 0.64 | 17.13 | <0.0001 | 14.34 |
| Mild | 1.23 | 0.43 | 8.37 | 0.0038 | 3.43 |
| Moderate | 0.40 | 0.43 | 0.83 | 0.3619 | 1.49 |
| Severe[3] | – | – | – | – | 1.00 |
| Speech ability | | | | | |
| Normal | 1.09 | 0.33 | 11.05 | 0.0009 | 2.97 |
| Slur/Bulbar/Aphasic[3] | – | – | – | – | 1.00 |
| Employment institution | | | | | |
| Government | 1.39 | 0.48 | 8.50 | 0.0035 | 4.00 |
| Housewife | 1.17 | 0.50 | 5.60 | 0.0180 | 3.25 |
| Private | −0.14 | 0.38 | 0.13 | 0.7142 | 0.87 |
| Self-employment[3] | – | – | – | – | 1.00 |
| Constant | −1.51 | 0.41 | 13.85 | 0.0002 | – |

[1] Including limited return to work, partial return to work and complete return to work.
[2] The $B$ coefficient and odds ratio for each factor is adjusted for possible confounding by all the other factors in the table.
[3] Reference category.

well as poor vocational outcome. However, its mechanism needs to be clarified.

Contrary to the findings of other studies (12, 19), occupational category was not found to have significant association with degree of return to employment in this study. If we simply dichotomized vocational outcome as return to work or not, as with previous studies (1–3, 6–10, 12–16, 18, 19, 21, 22, 24, 25), the association between prior category of occupation and return to employment did indeed exist ($p = 0.0047$). However, occupation category was not selected as a significant predictor if we forced the occupation category into the logistic regression analysis in which the dependent variable was return to work or not. We also found that there was fair correlation between occupation category and employment institution ($r_s = 0.5027$, $p < 0.001$). The effect of occupation may have been subsumed by the employment institution. This result further indicates that the occupation category was not a significant predictor of return to employment.

Employing logistic regression, several factors (maximum weakness, rehabilitation therapy, education, employment institution and speech ability) were selected as significant predictors of extent of return to work. Overall, maximum weakness and employment institution appear to be the strongest predictors of return to work.

The effect of employment institution on influencing the probability of returning to work has not previously been examined. This is the first study to find that employment institution is a significant predictor of vocational outcome. Government employees were least likely not to return to work (Table I). About eight of ten government employees who survived a stroke returned to work. This may be because the Taiwanese government provides greater job stability than other employers. Therefore, we must be cautious in generalizing this result to other countries.

Rehabilitation therapy and speech ability were selected by one of the models as significant predictors (Tables II and IV, respectively), but their effects, though significant, were small and not consistent in the other models. This result may be explained by the fact that there was fair correlation between these two factors and maximum weakness ($r_s = 0.5617$ and 0.4149 respectively, $p < 0.001$). This may reflect the effects of rehabilitation therapy, and speech ability may have been partially explained by maximum weakness as well as the incomplete descriptions of speech ability in the data.

Likewise, education was selected by one of the models as a significant predictor (Table II). It was found that there was significant association between education and employment institution ($r_s = 0.3802$, $p < 0.001$). The effect of education may have been explained by employment institution, to some extent.

Some factors (diagnosis, side of hemiplegia or hemiparesis, sphincter control, ADL, mentality, sensation, and consciousness at admission and length of stay) were associated significantly with the extent of return to work in the univariate analysis. However, after controlling for other factors, including maximum weakness, speech and rehabilitation therapy, these factors were found to be insignificant. This is probably a reflection

of the more powerful effect of other factors such as maximum weakness as well as the inter-relatedness between these factors. Therefore, this is not to say that these factors (e.g. ADL), when considered individually, do not influence the chance of return to work; rather, they do not provide additional information to the models containing the aforementioned significant predictors.

The application of the results of this study may be important for improving vocational result after stroke. Using logistic regression, models can be constructed to predict the probability of the extent of return to work after stroke. The coefficients were used to estimate the probability of different degrees of return to work for each level of these factors (Tables II–IV). For example, for a patient with mild muscle weakness, not having received rehabilitation therapy following stroke, having high school education, and employed by the government prior to his/her stroke, the probability of his/her complete return to work may be estimated as follows:

$$\begin{aligned}\text{Probability} &= 1/[1 + exp\ -(-5.05 + MW \\ &\quad + RT + EDU + EI)] \\ &= 1/[1 + exp - (-5.05 + 0.31 + 1.9 \\ &\quad + 1.59 - 0.23 + 1.23)] \\ &= 0.36\end{aligned}$$

where *exp* is the exponential function, *MW* is the maximum weakness coefficient, *RT* is the rehabilitation therapy, *EDU* is the education, and *EI* is the employment institution prior to the stroke (Table II). The patient's estimated chance of complete return to employment is 36%. Although it is still too early to apply these results to individual patients, they may be helpful in identifying prospective stroke patients who need vocational rehabilitation. Early vocational rehabilitation intervention will then be possible. Prospective studies to evaluate the usefulness of the model are required. Furthermore, this study identified several factors of the early stage after stroke in relation to return to employment that may be helpful in focusing the vocational rehabilitation programs on these factors. These items of information would be important for improving vocational outcome following stroke.

Some caution should be mentioned in generalizing these results to all patients who had strokes. First, mortality after a stroke could be a primary factor influencing vocational outcomes (12). This study included only patients who had survived for more than 6 months after a stroke. If all stroke patients were selected, the factors influencing mortality would mask any of the factors that we found in this study. Therefore, it is important to understand that the factors selected as the significant predictors of vocational outcomes in this study are confined to the patients who are of working age, have worked before the stroke and have survived for more than 6 months after discharge.

Second, the representation of the sample of the present study was not examined because no nationwide stroke patient registry exists. Our sample was selected from a medical centre in the city of Taipei. About half of the sample had received no more than 6 years of education, and more than half were blue-collar workers. As the National Taiwan University Hospital is a referral hospital and patients can be transferred within a few hours from suburban, industrial and rural areas, the sociodemographic characteristics of patients are not necessarily reflective of Taipei alone. This indicates that the study sample was not limited to middle- and upper-class patients. These limitations not withstanding, our results may be helpful in prevocational management after stroke.

In brief, maximum weakness and employment institution were identified as the strongest predictors of return to work in stroke survivors of working age in Taiwan. Three-quarters of the subjects were correctly classified into the extent of return to work using both of the factors as predictors with logistic regression models. Further studies to refine and expand the predictive models to include other prospective factors are needed.

## REFERENCES

1. Angeleri, F., Angeleri, V. A., Foschi, N., Giaquinto, S. & Nolfe, G.: The influence of depression, social activity, and family stress on functional outcome after stroke. Stroke *24:* 1478–1483, 1993.
2. Becker, C., Howard, G., McLeroy, K. R., Yatsu, F. M., Toole, J. F., Coull, B., Feibel, J. & Walker, M. D.: Community hospital-based stroke programs: North Carolina, Oregon, and New York, II: description of study population. Stroke *17:* 285–293, 1986.
3. Black-Schaffer, R. M. & Osberg, J. S.: Return to work after stroke: development of a predictive model. Arch Phys Med Rehab *71:* 285–290, 1990.
4. Coughlan, A. K. & Humphrey, M.: Presenile stroke: Long-term outcome for patients and their families. Rheumatol Rehab *21:* 115–122, 1982.
5. Daniels, L. & Worthingham, C.: *Muscle testing*. Saunders, Philadelphia, 1995.
6. Espmark, S.: Stroke before 50: a follow-up study of vocational and psychological adjustment. Scand J Rehab Med *5* Suppl 2: 1–107, 1973.
7. Feldman, D. J., Lee, P. R., Unterecker, J., Lloyd, K., Rusk, H. A. & Toole, A.: A comparison of functionally orientated medical care and formal rehabilitation in the management of patients with hemiplegia due to cerebrovascular disease. J Chronic Dis *15:* 297–310, 1962.

8. Fugl-Meyer, A. R., Jääskö, L. & Norlin, V.: The post-stroke hemiplegic patient. Scand J Rehab Med *7:* 73–83, 1975.
9. Heinemann, A. W., Roth, E. J., Cichowski, K. & Betts, H. B.: Multivariate analysis of improvement and outcome following stroke rehabilitation. Arch Neurol *44:* 1167–1172, 1987.
10. Hindfelt, B. & Nilsson, O.: The prognosis of ischemic stroke in young adults. Acta Neurol Scand *55:* 123–130, 1977.
11. Hu, H. H., Sheng, W. Y., Chu, F. L., Lan, C. H. & Chiang, B. N.: Incidence of stroke in Taiwan. Stroke *23:* 1237–1241, 1992.
12. Howard, G., Till, J. S., Toole, J. F., Matthews, C. & Truscott, B. L.: Factors influencing return to work following cerebral infarction. JAMA *253:* 226–232, 1985.
13. Kotila, M., Waltimo, O., Niemi, M. L., Laaksonen, R. & Lempinen, M.: The profile of recovery from stroke and factors influencing outcome. Stroke *15:* 1039–1044, 1984.
14. Mackay, A. & Nias, B. C.: Stroke in the young and middle-aged: consequences to the family and to society. J R Coll Physicians Lond *13:* 106–112, 1979.
15. Matsumoto, N., Whisnant, J. P., Kurland, L. T. & Okazaki, H.: Natural history of stroke in Rochester, Minnesota, 1955 through 1969: an extension of a previous study, 1945 through 1954. Stroke *4:* 20–29, 1973.
16. Melamed, S., Ring, H. & Najenson, T.: Prediction of functional outcome in hemiplegic patients. Scand J Rehab Med *12:* 129–133, 1985.
17. Mosey, A. C.: Psychosocial components of occupational therapy. Raven Press, New York, 1989.
18. Niemi, M. L., Laaksonen, R., Kotila, M. & Waltimo, O.: Quality of life 4 years after stroke. Stroke *19:* 1101–1107, 1988.
19. Saeki, S., Ogata, H., Okubo, T., Takahashi, K. & Hoshuyama, T.: Factors influencing return to work after stroke in Japan. Stroke *24:* 1182–1185, 1993.
20. Sandin, K. J., Cifu, D. X. & Noll, S. F.: Stroke rehabilitation. 4. Psychologic and social implications. Arch Phys Med Rehabil *75* Suppl: 52–55, 1994.
21. Smolkin, C. & Cohen, B. S.: Socioeconomic factors affecting the vocational success of stroke patients. Arch Phys Med Rehabil *55:* 269–271, 1974.
22. Terént, A.: Medico-social consequences and direct costs of stroke in a Swedish community. Scand J Rehab Med *15:* 165–171, 1983.
23. Tesdale, G. & Jennet, B.: Assessment of coma and impaired consciousness. A practical scale. Lancet *2:* 81–83, 1974.
24. Waltimo, O., Kaste, M., Aho, K. & Kotila, M.: Outcome of stroke in the Espoo-Kauniainen area, Finland. Ann Clin Res *12:* 326–330, 1980.
25. Weisbroth, S., Esibill, N. & Zuger, R. R.: Factors in the vocational success of hemiplegic patients. Arch Phys Med Rehabil *52:* 441–486, 1971.

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