



## World health organization disability assessment schedule 2.0 as an objective assessment tool for predicting return to work after a stroke

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### ABSTRACT

**Purpose:** To analyze whether World Health Organization Disability Assessment Schedule 2.0 can be used as an objective assessment tool for predicting the return-to-work status of working-age patients with stroke.

**Method:** We obtained the data on 2963 patients disabled by stroke (age <60 years) from the Taiwan Data Bank of Persons with Disability for the July 2012–January 2014 period. Of these patients, 119 could return to work, whereas 2844 could not. Demographic data and World Health Organization Disability Assessment Schedule 2.0 standardized scores of patients with stroke who could return to work and those who could not (return to work and nonreturn-to-work groups, respectively) were analyzed and compared using the chi-squared and independent Student's *t*-tests. Receiver operating characteristic curve analysis was performed to investigate the prediction accuracy for the return-to-work status, and the optimal cutoff point was determined using the Youden index. Binary logistic regression was employed to determine the predictors of the return-to-work status of patients with stroke.

**Results:** The World Health Organization Disability Assessment Schedule 2.0 scores in all domains were lower in the return-to-work group than in the nonreturn-to-work group. The receiver operating characteristic curve showed moderate accuracy for all domain-specific scores [area under the curve, 0.6–0.8] and good accuracy for the summary scores of World Health Organization Disability Assessment Schedule 2.0 (area under the curve, >0.8). Binary logistic regression revealed that younger age, less severe stroke and standardized World Health Organization Disability Assessment Schedule 2.0 summary scores below the cutoff points were predictors of the return to work status of working-age patients disabled by stroke.

**Conclusions:** World Health Organization Disability Assessment Schedule 2.0 can be used as an objective assessment tool for predicting the return-to-work status of working-age patients disabled by stroke. This tool can aid in establishing rehabilitation strategies and goal-setting processes for the return-to-work of patients with stroke.

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### ► IMPLICATIONS FOR REHABILITATION

- World Health Organization Disability Assessment Schedule 2.0 summary scores can predict the return-to-work status of working-age patients with stroke.
- Younger age and less severe stroke are associated with the return-to-work status of patients with stroke.
- Lower disability scores of the World Health Organization Disability Assessment Schedule 2.0 items result in a favorable return-to-work status and help in establishing effective rehabilitation strategies for facilitating the return-to-work of young patients with stroke.

### Introduction

Stroke has been found to be the main cause of morbidity and mortality in younger adults and is particularly relevant to working individuals [1]. Neurological injury after stroke can lead to strength, cognitive and speech dysfunction and loss of

employment, which generally leads to a substantial or complete loss of income. Consequently, patients with stroke and their families have to endure a substantial economic burden [2,3]. In working-age adults (age, 20–64 years), the incidence of stroke has been increasing over the last three decades, and the economic

burden caused by stroke has received considerable attention [4,5]. Although stroke is most prevalent in elderly individuals, its prevalence among working-age adults was shown to be 45% in those younger than 65 years and 27% in those younger than 55 years [6]. In contrast to patients with stroke who are older than 65 years and retired from work, the early return-to-work (RTW) of stroke patients younger than 65 years is essential to minimize the social economic burden [7]. Many working-age patients with stroke must confront employment challenges while also being responsible for caring for their children and elderly parents. Therefore, the opportunity to RTW is crucial for stroke patients younger than 65 years to maintain their quality of life and subjective well-being while minimizing the economic burden on their families.

Studies have reported that self-rated health levels at 3 months after stroke, positive attitudes and high levels of preserved motor performance are associated with RTW status and work stability after stroke [8,9]. However, a comprehensive multidimensional measurement tool for the accurate prediction of the RTW status after stroke in working-age patients is yet to be well-established. In 2001, the World Health Organization (WHO) developed the International Classification of Functioning, Disability and Health (ICF), which is an integrative biopsychosocial model for comprehensively evaluating the functioning and disability of patients. The ICF provides information on health conditions, the impairment of body functions or structures (such as muscle strength and cognitive functions), activity limitations, participation restrictions and relevant environmental effects [10]. To quantify the multidimensional aspects of patients' disability status, WHO Disability Assessment Schedule 2.0 (WHODAS 2.0) was developed in accordance with the ICF framework for evaluating six domains of functioning, including social participation and cognition-related daily activities. WHODAS 2.0 can evaluate patients' disability and functional status with adequate reliability and validity and can be applied across cultures and is available in more than 30 languages [11]. Therefore, WHODAS 2.0 could be a useful measurement tool for assessing disability status after stroke. Furthermore, it could be a predictive tool for the RTW status of young patients with stroke.

Our previous studies have used WHODAS 2.0 to investigate the functional and disability status of patients with dementia in order to predict their likelihood of institutionalization [12,13]. Our results have shown that WHODAS 2.0 can objectively evaluate social participation as well as the physical and cognitive aspects of daily living. However, data regarding the prediction accuracy of WHODAS 2.0 for the RTW status of stroke survivors of working age are lacking. Therefore, we hypothesized that WHODAS 2.0 could be an objective assessment tool for predicting the RTW status of working-age patients with stroke. Accordingly, in the present study, we investigated the functional and disability status of young patients with stroke who could or could not RTW and determined the prediction accuracy of WHODAS 2.0 for the RTW status by using a nationwide database in Taiwan.

## Methods

### Database settings and patients

In Taiwan, patients with diseases leading to functional impairment and disability can apply for disability assessment and certification to receive social welfare support from the government. In July 2012, a new edition of the disability assessment process system, referred to as the Disability Eligibility Determination Scale 2012

(DES-2012), was developed in accordance with the ICF framework [14]. The present study analyzed the data on patients with stroke from the Taiwan Data Bank of Persons with Disability (TDPD) for the July 2012–January 2015 period. To separately evaluate the disability status, the DES-2012 assessment process was performed in two parts by two specialists with specific qualifications for the DES-2012. The first part was performed by clinical physicians (depending on the type of disease and the related experts' fields; for example, stroke was evaluated by physiatrists, neurologists and neurosurgeons) to verify the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) code(s) for diagnosis and classify the impairment aspects in accordance with the ICF categories of body structures (s codes) and functions (b codes). The second part contains the environmental categories (e codes) of the ICF, and WHODAS 2.0 measurements that were performed by trained specialists (e.g., physiotherapists, occupational therapists, speech pathologists, psychologists and social workers) from paramedical fields. The data on stroke patients younger than 60 years (ICD-9-CM codes 430–438) were obtained from the TDPD. The following variables were obtained from the following TDPD data: sex, age, educational levels (above college level, senior high school, junior high school, primary education or without formal education), residence (community dwelling or institutionalized), urbanization levels (rural, suburban, or urban), severity of impairment, and WHODAS 2.0 scores. In the TDPD data, the severity of impairment due to stroke was determined by clinical physicians in accordance with the ICF categories of body functions (b codes classified from 1 to 4; 1 = mild severity with 5–24% impairment; 2 = moderate severity with 25–49% impairment; 3 = severe severity with 50–95% impairment; and 4 = extreme severity with 96–100% impairment). In the analysis of the TDPD data, individuals were de-identified to protect their privacy. This study was approved by the Joint Institutional Review Board of Taipei Medical University and informed consent was waived because of the retrospective nature of the secondary data analysis in this study. The TDPD includes records of the 36-item version of WHODAS 2.0, which comprises six domains representing the fields of cognition (Domain 1, six items), mobility (Domain 2, five items), self-care (Domain 3, four items), getting along with people (Domain 4, five items), life activities (Domain 5, four items for household activities and four items for work and school activities) and participation in society (Domain 6, eight items). The performance experience of these items in the last 30 days was rated using a 5-point Likert scale (1 = no difficulty, 2 = mild difficulty, 3 = moderate difficulty, 4 = severe difficulty and 5 = extreme difficulty). The scores of each domain and summary (summed) scores of the six domains were standardized from 0 (least difficulty) to 100 (most difficulty). Higher scores indicated higher disability in patients. Regarding the missing data, the WHODAS 2.0 manual indicates that the formula for score computation allows for up to 30% of items to be unrated in each domain, and the scores of these unrated items can be substituted with the domain mean for the imputation of missing data [11]. Because our study investigated the predictors of the RTW status after stroke and four items of Domain 5 were related to work performance, these four items were excluded. Finally, we calculated the scores for the remaining 32 items of WHODAS 2.0. In the TDPD, the data were obtained from the traditional Chinese version of the WHODAS 2.0 questionnaire. This questionnaire has been previously reported to have a reliability of 0.73–0.99 and intraclass correlation coefficient values of 0.8–0.89 [15,16]. The RTW and non-RTW statuses were obtained from the TDPD.

## Statistical analyses

Patients with stroke were classified into two groups, RTW and non-RTW, according to the TDPD data and their work status when undergoing the DES-2012 assessment process. The demographic data on age, sex, educational level (above college level, senior high school, junior high school, primary education or without formal education), urbanization level (urban, suburban or rural) and stroke severity leading to functional impairment (mild, moderate, severe or extreme) are presented in numbers and percentages. The chi-squared test was used to compare the categorical variables of RTW and non-RTW groups. The independent Student's *t*-test was used to compare the continuous variables of standardized WHODAS 2.0 domain-specific and summary scores of RTW and non-RTW groups. To estimate the prediction accuracy for the RTW status of patients disabled by stroke, we performed receiver operating characteristic (ROC) curve analyses for the standardized WHODAS 2.0 scores of each domain and the summary scores of six domains. We determined the cutoff points on the ROC curve with optimal sensitivity and specificity according to the Youden Index. Adjusted binary logistic regression was performed to analyze the demographic variables and WHODAS 2.0 summary scores at the cutoff points to identify the predictors and odds ratios for the RTW status of patients with stroke. Clinical variables, such as the severity of impairment and demographic variables, were adjusted in the binary logistic regression model, and effect sizes were calculated using the Hosmer and Lemeshow goodness-of-fit test. All analyses were performed using SAS software (SAS Institute, Inc., Cary, NC), and  $p < 0.01$  was considered statistically significant.

## Results

In this study, the data on 2963 patients disabled by stroke (men = 2146; women = 817) were obtained from the TDPD. Of these patients, 119 (men = 100, 84.03%) could RTW after stroke, whereas 2844 (men = 2046, 71.94%) could not. Regarding the RTW status of the patients, the chi-squared test revealed significant differences for sex, age, education level, residence status and severity of impairments (Table 1). The domain-specific and summary scores of WHODAS 2.0 were higher in the non-RTW group than in the RTW group, indicating that the non-RTW group had a higher disability status (Table 2). The ROC curve analysis (Figure 1) for predicting the RTW status of study patients revealed significant results for all domains, and the highest area under the curve (AUC) was obtained for WHODAS 2.0 summary scores (AUC, 0.803; sensitivity, 65.6%; specificity, 82.4%) with a cutoff value of 42.5, which was calculated using the Youden Index (Table 3). Binary logistic regression demonstrated that patients with WHODAS 2.0 summary scores of less than 42.5 had a 4.697 times higher opportunity to RTW than those with WHODAS 2.0 scores more than 42.5 (adjusted odds ratio, 4.697; 95% confidence interval, 2.416–9.135;  $p < 0.001$ ). Age and the severity of impairment were the other independent predictors of the RTW status of study patients (Table 4).

## Discussion

Disability along with loss of employment due to stroke have a negative effect on patients' quality of life and subsequently incurs an economic burden on working-age patients with stroke, their families, and society [17–19]. Identifying the predictors of the RTW status after stroke is essential to establishing intervention strategies and goal-setting processes for working-age patients

**Table 1.** Relation between the RTW status and sociodemographic characteristics of patients with stroke in Taiwan ( $n = 2963$ ).

Variables	RTW <sup>a</sup> $n = 119$		Non-RTW <sup>b</sup> $n = 2844$		<i>p</i> value
	No.	%	No.	%	
Sex					0.003*
Male	100	84.03%	2046	71.94%	
Female	19	15.97%	798	28.06%	
Age (years)					<0.001*
Mean, SD	47.28	8.284	50.58	7.719	
Education					<0.001*
Above College Level	26	21.85%	229	8.05%	
Senior high	55	46.22%	915	32.17%	
Junior high	17	14.29%	871	30.63%	
Primary	15	12.61%	699	24.58%	
Without formal education	6	5.04%	130	4.57%	
Residence					<0.001*
Community dwelling	115	96.64%	2106	74.05%	
Institution	4	3.36%	738	25.95%	
Urbanization level					.125
Rural	14	11.76%	510	17.93%	
Suburban	51	42.86%	1255	44.13%	
Urban	54	45.38%	1079	37.94%	
Severity of impairment					<0.001*
Mild	68	57.14%	664	23.35%	
Moderate	40	33.61%	1044	36.71%	
Severe	5	4.20%	573	20.15%	
Extreme	6	5.04%	563	19.80%	

<sup>a</sup>RTW (return to work) includes employed and self-employed individuals.

<sup>b</sup>Non-RTW includes volunteers, students, housekeepers, retired persons and individuals not working because of health-related or other concerns.

\* $p < 0.01$ .

**Table 2.** Comparison between overall disability and domain-specific WHODAS 2.0 scores of RTW and non-RTW groups in Taiwan ( $n = 2963$ ).

Variables	RTW		Non-RTW		<i>p</i> value
	Mean	SD	Mean	SD	
Domain 1	19.83	20.221	47.62	33.978	<0.001
Domain 2	27.61	24.072	58.64	31.886	<0.001
Domain 3	16.81	22.244	42.32	35.100	<0.001
Domain 4	25.80	27.456	56.43	34.788	<0.001
Domain 5.1	40.67	34.315	72.97	35.461	<0.001
Domain 6	37.66	22.927	59.86	26.584	<0.001
Summary	28.53	17.782	56.03	25.975	<0.001

non-RTW: nonreturn-to-work; RTW: return-to-work.

Domain 1, cognition; Domain 2, mobility; Domain 3, self-care; Domain 4, getting along with people; Domain 5.1, life activities; Domain 6, participation in society.

with stroke. Our study results demonstrate that WHODAS 2.0 can be used as a quantitative measurement tool for predicting the RTW status of patients disabled by stroke. In the present study, the patients with summary scores below the cutoff standardized total scores of WHODAS 2.0 had a 4.697 times higher opportunity to RTW than those whose scores were above the cutoff point. In addition, our results demonstrate that age and the severity of impairment are predictors of the RTW status of working-age patients with stroke.

In each of the WHODAS 2.0 domains, the non-RTW group exhibited a higher number of functional disabilities than the RTW group. Therefore, cognitive function, physical ability, self-care ability, ability to get along with people, life activities and social participation were associated with the RTW status of working-age patients with stroke. Previous studies have revealed that impairments limiting the activities of daily living that patients can engage in are a key determinant for predicting their RTW status, and walking ability in particular has been associated with the RTW status after stroke [18,20,21]. In addition, among mental aspects, fatigue and depression are negative contributors to the RTW

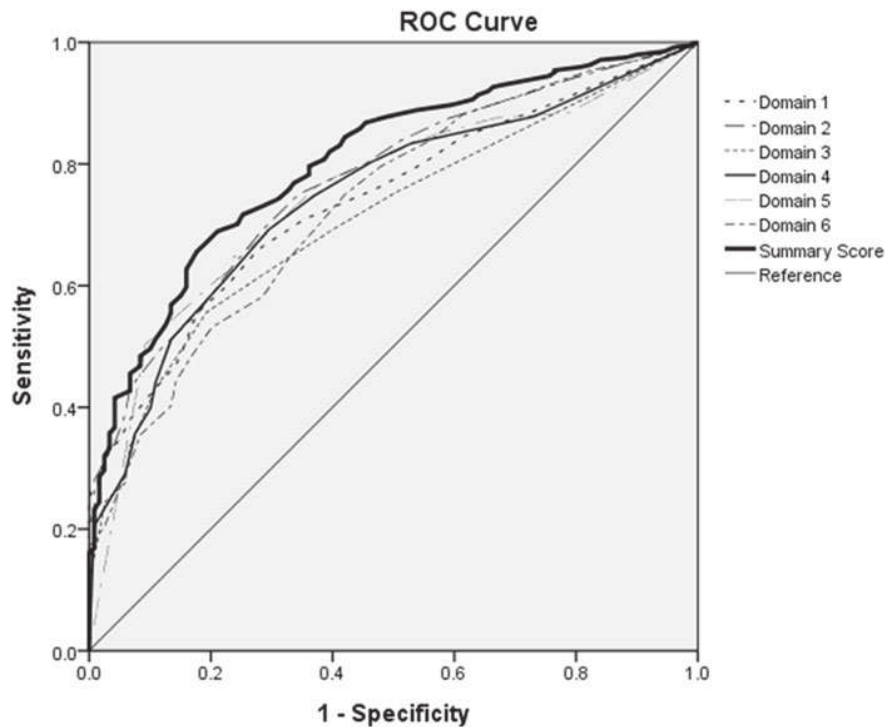


Figure 1. ROC curve analyzes based on WHODAS 2.0 summary and domain-specific scores for predicting the RTW status of patients with stroke.

Table 3. Prediction accuracy of WHODAS 2.0 scores for institutionalization in patients with stroke.

Variables	Cutoff point	Sensitivity	Specificity	AUC	99% CI	<i>p</i> value
Domain 1	27.50	0.659	0.723	0.740	0.692 0.787	<0.001*
Domain 2	41.00	0.693	0.714	0.771	0.723 0.818	<0.001*
Domain 3	35.00	0.557	0.807	0.713	0.662 0.763	<0.001*
Domain 4	37.50	0.691	0.706	0.746	0.695 0.796	<0.001*
Domain 5.1	95.00	0.504	0.908	0.750	0.699 0.800	<0.001*
Domain 6	56.00	0.532	0.798	0.732	0.676 0.788	<0.001*
Total	42.50	0.656	0.824	0.803	0.757 0.849	<0.001*

AUC: area under the curve.

Domain 1, cognition; Domain 2, mobility; Domain 3, self-care; Domain 4, getting along with people; Domain 5.1, life activities; Domain 6, participation in society.

\**p* < 0.01.

status [21,22]. A recent study reported that self-rated physical health levels are strongly associated with the RTW status within the first year after stroke, and that the opportunity to RTW is up to seven times higher in patients with high physical health levels than in those with low physical health levels at 3 months after stroke [8]. Furthermore, the opportunity to RTW is four times higher in stroke patients with high mental health levels than in those with low mental health levels at 1 year after stroke. Health-related factors can yield different RTW outcomes in patients with stroke; therefore, the WHODAS 2.0, which covers the fields of cognitive and physical functions and social participation, can be used to estimate the RTW status of young patients with stroke.

Our study identified severity of impairment as an influencing factor for the RTW status of patients with stroke, which is consistent with the finding of a previous study [23]. Furthermore, our results show that younger age is associated with a higher opportunity for working-age patients with stroke to RTW. This finding is inconsistent with that of a recent study that had similar inclusion criteria for patients with stroke (younger than 60 years) and reported no association between age and RTW status [8]. We hypothesize that different occupation types (demand for physical labor is high in Taiwan), cultures and social welfare systems could

result in different outcomes in other countries. Moreover, on the basis of the inclusion criteria, we included only stroke patients who were younger than 60 years, and the variable influence of age on the RTW status in previous studies may be attributable to the differences in the inclusion criteria [21,23,24].

Our study found no association between education level and the RTW status after stroke. This finding is inconsistent with that of a previous study, which suggested that education levels can be an independent predictor of the RTW status of patients with stroke during the first year after stroke [7]. By contrast, Larsen et al. [8] reported that educational levels are not associated with the RTW status, which agrees with our findings. These inconsistent outcomes may be due to differences in the socioeconomic status, vocational rehabilitation intensity and cultural factors of the patient groups.

In our study, the RTW rate among working-age patients disabled by stroke was only 4%, which is relatively lower than that reported in a review article, where the RTW rate after stroke varied from 19% to 73% in different countries [21]. These discrepancies may be because our study focused only on patients disabled by chronic stroke (longer than 6 months). In hospital-based population studies on the RTW status, the RTW rate varied from 55% to 75%. This difference between the present and aforementioned findings could be attributed to the differences in the stroke onset period (with a longitudinal follow-up of 18–24 months) and the severity of impairment in the selected participants (our study focused on patients disabled by stroke having limited rehabilitation potential, whereas other studies have investigated all patients with stroke in general) [20,22,25]. Moreover, patients with acute stroke continue to receive intensive rehabilitation intervention with the aim of minimizing any impairments, which could lead delay their RTW. In addition to the influence of medical problems on the RTW rate, the economic and employment status of patients with stroke may influence their RTW status.

Our study results indicate that WHODAS 2.0 can be used as an objective assessment tool for predicting the RTW status of

**Table 4.** Adjusted logistic regression of WHODAS 2.0 scores, severity of impairment and demographic variables for predicting the RTW status of patients with stroke.

Variables	Effect	OR (adjusted)	B	99% CI	<i>p</i> value	GOF
						0.546
Sex	Female					
	Male	1.946	0.666	0.982	3.856	0.012
WHODAS 2.0 Score	Summary Score $\geq 42.5$ (Reference)					
	Summary Score $< 42.5$	4.697	1.547	2.416	9.135	$< 0.001^*$
Age	Age (Years)	0.971	-0.030	0.943	0.999	0.007*
Education	No formal education (Reference)					
	Primary	0.434	-0.836	0.112	1.675	0.111
	Junior high	0.289	-1.243	0.077	1.082	0.015
	Senior high	0.806	-0.216	0.239	2.715	0.647
	Above college level	1.537	0.430	0.422	5.596	0.392
Residence	Institution (Reference)					
	Community dwelling	3.653	1.295	0.927	14.393	0.015
Urbanization level	Rural (Reference)					
	Suburban	1.421	0.351	0.623	3.241	0.273
	Urban	1.728	0.547	0.757	3.944	0.088
Severity of impairment	Extreme (Reference)					
	Severe	0.619	-0.479	0.125	3.060	0.440
	Moderate	1.798	0.587	0.553	5.846	0.200
	Mild	3.393	1.222	1.057	10.892	0.007*

\* $p < 0.01$ .

Work status: employed = 1, unemployed = 0.

 $\beta$ : beta coefficient.

Goodness-of-fit (GOF) measured by the Hosmer and Lemeshow GOF test.

working-age patients with stroke. Nevertheless, our study has several limitations. First, the study population comprised only patients disabled by chronic stroke; those with acute stroke were excluded. Therefore, we must emphasize that the use of WHODAS 2.0 for predicting the RTW status is currently limited to patients disabled by chronic stroke; further research on patients hospitalized for acute stroke is thus warranted. Second, this study only evaluated cross sectional data; a longitudinal prospective data analysis was not performed. Therefore, we could not assess the patients' ability to maintain stable employment. Third, the economic and occupational status of the study patients, which could influence their RTW rate, were not considered. Finally, although WHODAS 2.0 can be used to predict RTW status, it does not account for environmental factors, such as the unemployment rate, social welfare policies and insurance policies. Moreover, because these environmental factors differ between countries, our study results may be limited to Taiwan. Therefore, further investigation aimed at evaluating the effects of these environmental factors is warranted.

## Conclusions

In patients disabled by stroke, we found that age, severity of impairment, and WHODAS 2.0 summary scores are predictors of their RTW status. WHODAS 2.0 summary scores had higher prediction accuracy for the RTW status than did the individual scores of the six domains. To establish effective rehabilitation strategies and goal-setting processes after stroke, the accurate prediction and identification of possible contributors to the RTW status of working-age patients with stroke are essential. WHODAS 2.0 can be used as an objective quantitative assessment tool for evaluating the RTW status of working-age patients disabled by stroke. It can be implemented in clinical practice to assess the RTW status of

patients with stroke. Additional longitudinal cohort studies are warranted to confirm the findings of the present study.

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## Disclosure statement

No potential conflict of interest was reported by the authors.

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