ORIGINAL ARTICLE

Accuracy of the World Health Organization Disability Assessment Schedule 2.0 (WHODAS 2.0) score as an objective assessment tool for predicting return-to-work status after head and neck cancer in male survivors

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Abstract

Purpose The objective of this nationwide study in Taiwan was to predict work participation by using the World Health Organization Disability Assessment Schedule 2.0 (WHODAS 2.0) score as an objective assessment tool.
Method Data from between July 2012 and July 2017 regarding 1206 male head and neck cancer (HNC) survivors with disability aged < 50 years were obtained from the Taiwan Data Bank of Persons with Disability (TDPD). Demographic data and the WHODAS 2.0 scores were analyzed to compare employment statuses among HNC survivors.
Results The WHODAS 2.0 scores in all the domains were lower in unemployed than in employed HNC survivors ($p < 0.001$). The receiver operating characteristic (ROC) curve revealed that the summary WHODAS 2.0 score (area under curve > 0.8) was an extremely accurate predictive tool. Binary logistic regression revealed that the severity levels of impairment and standardized WHODAS 2.0 summary scores less than the cutoff value (27.81) were predictors for the return-to-work (RTW) status of HNC survivors with disability in the working age group.
Conclusions The WHODAS 2.0 score is an objective quantitative assessment tool for evaluating the RTW possibility among these patient groups.

Keywords Head and neck cancer · Return-to-work · Employment · WHODAS 2.0 score · ICF

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Introduction

Head and neck cancers (HNCs) are predominantly cancers of squamous cell origin arising in the larynx, throat, lips, mouth, nose, and salivary glands. According to a population-based cancer registry in Taiwan [1, 2] founded in 1979 and supported by a grant-in-aid for the National Department of Health from Executive Yuan, the HNC age-standardized incidence increased significantly between 1979 and 2014. The incidence was considerably higher in men (5.09/100,000 in 1979 to 42.85/100,000 in 2014) than in women (1.32/100,000 in 1979 to 3.92/100,000 in 2014). By contrast, a trend of improved survival after diagnosis of HNCs has been observed over the past three decades (the 5-year disease-specific relative survival rate increased from 39.89% in 1987 to 55.1% in 2014). Similar trends have also been observed in the USA [3], Canada, Denmark, and the UK [4].

The current treatment strategy for HNC is a combination of surgical resection and radiotherapy and/or systemic chemotherapy after appropriate cancer staging. Although the aforementioned treatments prolong survival, they can also cause long-term organ damage and functional disabilities [5]. Because patients mostly receive diagnoses of HNCs in middle age [6], HNC survivors potentially face serious economic effects and adverse effects of their illness, treatment, and sequelae on their employment roles and functionality. More than 60% of survivors have unmet needs [7]. A study [8] revealed that 75% of patients with HNC took time off from work after the cancer diagnosis, and 52% of them reduced their working hours. Only 33–53% of the patients have been reported to return to work after treatment in other studies [9, 10]. The productivity losses associated with HNC are substantial [11], and a previous study demonstrated that the quality of life of unemployed HNC survivors was significantly lower than that of employed HNC survivors at a 24-month follow-up [9]. Return-to-work (RTW) status is undoubtedly a crucial issue in the rehabilitation of HNC survivors. Previous studies have discussed some factors that affect the work participation of HNC survivors [8, 10, 12, 13]; these included cancer sites, aggressive treatment, comorbidity, occupation type, having private health insurance, depression, drinking habit, and low socioeconomic status. To date, no large-scale study on an objective, quantified prediction tool for the RTW status of HNC survivors has been conducted.

In 2001, the International Classification of Functioning, Disability, and Health (ICF) model was officially endorsed by World Health Organization (WHO). The ICF model comprehensively defines functioning and disability with regard to impairments, activity limitations, participation restrictions, and personal or environmental factors. It is an integrative biopsychosocial model and can be used as a framework and classification system for measuring the effects of health conditions on the functionality and disability of a patient. World Health Organization Disability Assessment Schedule 2.0 (WHODAS 2.0) was developed within the conceptual framework of the ICF model and its latest version was published in 2010. Unlike other assessment tools, it records an individual's level of functioning in six major life domains [14], namely cognition, mobility, self-care, getting along with people, daily life activities, and participation in society. It provides a summary of functioning and disability that is reliable and applicable across cultures in adult populations. WHODAS 2.0 has been translated into 47 languages and dialects and is used in 27 areas of research; hundreds of studies have been conducted using WHODAS 2.0 in the past 15 years [15].

To our knowledge, no study has used WHODAS 2.0 scores for predicting the work participation of HNC survivors. The objectives of this nationwide study in Taiwan was to predict work participation by using the WHODAS 2.0 score as an objective assessment tool, to provide implications for clinicians to formulate an effective rehabilitation plan, and to promote efficient public health policies to facilitate a successful return to work of HNC survivors.

Methods

Patients and data collection

We collected the data of male HNC survivors with disability aged < 50 from the Taiwan Data Bank of Persons with Disability (TDPD); we selected records from between July 2012 and July 2017. In Taiwan, patients with stable disability after a disease event can apply for social welfare support by obtaining disability certification through a specialized disability evaluation system known as the Disability Eligibility Determination Scale 2012 (DES-2012). DES-2012 was developed according to ICF concepts and has been used in Taiwan to assess disability since July 2012 [16]. The DES-2012 evaluation process consists of two stages, which are completed by two independent and well-trained specialists. In stage 1, values for the body function and body structure categories of the ICF are assigned using the standardized coding criteria of DES-2012 by a clinical physician with a specialization in the patient's disease. The physician assigns a diagnostic code to the disease; the codes are taken from the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) and the International Classification of Diseases, 10th Revision, Clinical Modification (ICD-10-CM). In stage 2, another specialist, such as a physical therapist, occupational therapist, psychologist, or social worker, assigns the environmental categories of the ICF and WHODAS 2.0 to determine daily activity limitations and social participation restrictions of the patients. Two stages of the evaluation process are

completed in 1 week. After the process is completed, the results of DES-2012 for each patient are registered in the TDPD.

Data related to malignant neoplasms of the lip, oral cavity, larynx, nasal cavity, ear, salivary gland, and pharynx (ICD-9-CM Diagnosis Codes 140–149, 160–161; ICD-10-CM Diagnosis Codes C00–C14, C30–32) were collected. Codes for the ICF categories of body functions and body structures, demographic data including age, education level (above college, senior high school, junior high school, and under junior high school), residence status (community-dwelling and institution), urbanization level (urban, suburban, and rural), socioeconomic status (average, middle low, and low), status in employment, severity of impairment, and WHODAS 2.0 scores (traditional Chinese version) were obtained from the TDPD. The severity of impairment was determined using the concept of the highest qualifier of the b (b310, voice functions; b320, articulation functions; b330, fluency and rhythm of speech functions; and b510, ingestion functions) codes and s (s320, structure of the mouth; s330, structure of the pharynx; and s340, structure of the larynx) codes of ICF (1 = mild, 5–24% impairment; 2 = moderate, 25–49% impairment; 3 = severe, 50–95% impairment; and 4 = complete, 96–100% impairment). In DES-2012, considering s340-structure of the larynx as an example, s340.1 indicates partial (25–49%) laryngectomy, s340.2 indicates extended partial laryngectomy (50–96%), and s340.3 indicates total laryngectomy. Patients with the s340.3 code are classified as having the severe impairment. All data were analyzed anonymously to protect patient privacy. Because this was a retrospective secondary data analysis study, patient informed consent was waived. This study was approved by the Joint Institutional Review Board at Taipei Medical University (Approval No. 201004001 and No. 201205042).

Outcome measurements

The WHODAS 2.0 scores were derived from the questionnaires administered to either the patients or to their health care agents if the patients could not answer the questions themselves. The questionnaire had the following six domains: 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 5-1: four items for household activities), and participation in society (domain 6: eight items). A 5-point scale (1 = no difficulty, 2 = mild difficulty, 3 = moderate difficulty, 4 = severe difficulty, and 5 = extreme difficulty) was used to assess the level of difficulty experienced while performing the activities. A well-trained interviewer recorded the results. The scores ranged from 0 (the lowest level of difficulty) to 100 (the highest level of difficulty) for each domain, and high scores indicated more severe disability than low scores did. Items that were not

experienced by the patient in the past 30 days were left unrated. The missing data (i.e., the unrated items) were substituted by the mean score of the domain. For score computation, according to the WHODAS 2.0 manual, a maximum of 30% of unrated items was allowed in each domain [14]. The standardized scores of all six domains were calculated for each patient. For the traditional Chinese version of WHODAS 2.0, the value of Cronbach's α for internal consistency and reliability was between 0.73 and 0.99, and the intraclass correlation coefficient values were between 0.8 and 0.89 [17, 18].

Statistical analysis

In this report, demographic data are presented in numbers and percentages. Patients were classified into two groups, namely employed (including self-employed patients) and unemployed, depending on their employment status. The chi-square or Fisher exact test analysis was used for comparing the categorical variables between the employed and unemployed groups. Independent Student's t tests were used for comparing the standardized WHODAS 2.0 scores in the six domains between the employed and unemployed groups. Receiver operating characteristic (ROC) curves for predicting the unemployment of the HNC survivors were generated using the standardized WHODAS 2.0 scores in each domain and the sum of the scores of the six domains. The optimal cutoff point on the ROC curve was determined using the Youden index for the highest sensitivity and specificity in predicting the employment status of HNC survivors. Standardized WHODAS 2.0 scores and variables were analyzed using binary logistic regression analysis to determine risk factors for unemployment. All analyses were performed using SAS 9.4 software (SAS Institute, Inc., Cary, NC). A value of $p < 0.05$ was considered statistically significant.

Results

In total, 1206 HNC survivors with disability in TDPD were examined. Among them, 185 and 1021 survivors were employed and unemployed, respectively.

The survivors with a community-dwelling residence status ($p < 0.001$), high socioeconomic status ($p = 0.048$), and low impairment severity status ($p < 0.001$) tended to have jobs (Table 1). High WHODAS 2.0 scores in all the domains and the summary score indicated higher levels of disability in the unemployed compared to the employed group ($p < 0.001$) (Table 2). The ROC curves for predicting the unemployment of the HNC survivors revealed that all domains were statistically significant ($p < 0.001$). Hence, by using the Youden index, we defined the optimal cutoff point and accuracy of the WHODAS 2.0 scores for predicting the risk of unemployment in the HNC survivors and disability. The statistics of cutoff

Table 1 Social demographic characteristics of male HNC survivors in Taiwan (*n* = 1206)

Variables	Employment[b] N = 185		Unemployment[c] N = 1021		*p* value
	No.	%	No.	%	
Age (mean/SD)					0.120
Year	44.06	4.68	44.64	4.68	
Education					0.188
Above college	9	4.86%	27	2.64%	
Senior high school	96	51.89%	467	45.74%	
Junior high school	71	38.38%	464	45.45%	
Under junior high school[a]	9	4.86%	63	6.17%	
Residence					< 0.001[d,e]
Community dwelling	184	99.5%	937	91.8%	
Institution	1	0.5%	84	8.2%	
Urbanization level					0.078
Urban	57	30.8%	359	35.2%	
Suburban	95	51.4%	434	42.5%	
Rural	33	17.8%	228	22.3%	
Socioeconomic status					0.048[d,e]
Average	184	99.5%	989	96.9%	
Middle low and low	1	0.5%	32	3.1%	
Severity status					< 0.001[d]
Mild	121	65.4%	459	45.0%	
Moderate	50	27.0%	252	24.7%	
Severe	14	7.6%	310	30.4%	

[a] Under junior high school includes primary and no formal education

[b] Employment includes employment and owning business

[c] Unemployment includes volunteering, student, housekeeper, retired, no work because of health issues and other issues

[d] *p* < 0.05

[e] Fisher's exact test

point, sensitivity, specificity, and area under curve (AUC) of WHODAS 2.0 domains are shown in Table 3. The total standardized WHODAS 2.0 score exhibited higher accuracy in predicting the risk of unemployment in the HNC survivors than did other statistics. The sensitivity and specificity were 86.2 and 61.6%, respectively. The AUC of the ROC curve was > 0.8 and the lower confidence limit was > 0.7, which suggested that the WHODAS 2.0 summary score provided excellent discrimination between the male HNC survivors who were employed and those who were unemployed. By contrast, binary logistic regression analysis revealed that WHODAS 2.0 standardized scores 27.81 or higher (adjusted

odds ratio [aOR] = 8.54, 95% confidence interval [CI], 5.95–12.27, *p* < 0.001) and severe impairment (aOR = 3.95, 95% CI, 2.14–7.18, *p* < 0.001) were independent factors for predicting unemployment in the male HNC survivors with disability (Table 4).

Discussion

The main findings of our study are that significant statistical differences were observed in residency status, socioeconomic status, and impairment severity status between the employed

Table 2 Comparison of disability among male HNC survivors based on WHODAS 2.0 scores in Taiwan (*N* = 1206)

Variables	Employment		Unemployment		*p* value
	Mean	SD	Mean	SD	
Domain 1: cognition	16.35	15.73	25.13	22.81	< 0.001
Domain 2: mobility	15.24	18.41	28.34	24.91	< 0.001
Domain 3: self-care	17.89	15.62	25.24	21.01	< 0.001
Domain 4: getting along with people	37.66	27.95	55.69	28.08	< 0.001
Domain 5-1: daily life activities	22.11	27.37	39.40	37.36	< 0.001
Domain 6: participation in society	36.55	21.14	52.51	22.26	< 0.001
Summary score	25.45	15.86	46.27	16.99	< 0.001

Table 3 Prediction accuracy of the WHODAS 2.0 scores for RTW of male HNC survivors

Variable	Cutoff point	Sensitivity	Specificity	AUC[a]	95% CI		p value
Domain 1: cognition	27.50	0.394	0.784	0.607	0.566	0.648	< 0.001
Domain 2: mobility	21.88	0.531	0.730	0.666	0.626	0.706	< 0.001
Domain 3: self-care	15.00	0.655	0.503	0.596	0.555	0.637	< 0.001
Domain 4: getting along with people	45.83	0.648	0.611	0.676	0.635	0.718	< 0.001
Domain 5-1: daily life activities	55.00	0.297	0.919	0.624	0.585	0.663	< 0.001
Domain 6: participation in society	39.58	0.688	0.595	0.695	0.655	0.736	< 0.001
Summary score	27.81	0.862	0.616	0.818	0.782	0.854	< 0.001

[a] *AUC* area under the curve

and unemployed groups. High WHODAS 2.0 scores in all the domains indicated that the unemployed group exhibited more severe disability than the employed group; more importantly, a WHODAS 2.0 standardized summary score ≥ 27.81 and severe impairment are independent predictive factors for the work participation of the male HNC survivors with disability.

HNC survivors experience various disease- or treatment-related disabilities, which may profoundly affect their social participation after the disease event. Disease severity, aggressive treatment, depressive mood, and poor socioeconomic status are thought to negatively affect work participation of HNC survivors according to currently available studies [5, 8–10, 12,

13, 19]. However, the assessment tools used in previous studies varied widely, thus complicating computation or comparison of all the factors. The WHODAS 2.0 score is a suitable candidate as an assessment tool because of its comprehensiveness, reliability, and cross-cultural applicability [14]; these attributes of the score are demonstrated by the fact that by the end of 2015, it had been administered in almost 100 countries and had been translated into almost 50 languages and dialects [15].

In the present study, we noticed that disability in all domains in WHODAS 2.0 is profoundly affected by a preceding history of HNC. Bolt et al. found that a higher level of

Table 4 Logistic regression of WHODAS 2.0 scores for job status[a], degree of disability and basic characteristics ($n = 1206$)

Variables	Effect	OR (adjusted)	β	95% CI		p value
Age						
	Mean, SD	0.99	− 0.001	0.96	1.08	0.976
Education						
	College and above (reference)					
	Senior high	1.32	0.28	0.52	3.37	0.564
	Junior high	1.76	0.57	0.68	4.54	0.242
	Under junior high	1.37	0.31	0.42	4.47	0.605
Urbanization level						
	Urban (reference)					
	Suburban	0.73	− 0.32	0.48	1.09	0.120
	Rural	1.17	0.15	0.70	1.96	0.561
Social economic status						
	Average (reference)					
	Middle low and low	5.14	1.64	0.65	40.62	0.121
Severity of impairment						
	Mild (reference)					
	Moderate	1.08	0.08	0.72	1.63	0.703
	Severe	3.92	1.37	2.14	7.18	< 0.001*
Residence						
	Community dwelling (reference)					
	Institution	6.25	1.83	0.84	46.36	0.073
WHODAS cut point						
	Summary score < 27.81 (reference)					
	Summary score >= 27.81	8.54	2.15	5.95	12.27	< 0.001*

*$p < 0.05$

[a] Job states: employment = 0, unemployment = 1

communicative participation was associated with less severe cognitive problems [20], which may be possible side effects of chemotherapy or radiotherapy [21, 22]. Williams et al. [23] indicated that cognitive impairment was also associated with current alcohol use; past tobacco use; adherence to treatment; and other social, emotional, and functional quality of life scales. Our result is consistent with those of a previous study, which demonstrated that cognitive function deteriorates in HNC survivors and poor cognitive function interferes with the RTW process.

The WHODAS 2.0 score in domain 2 focuses on patient mobility. According to our results, mobility was significantly lower in the unemployed HNC survivors than in the employed survivors. HNC survivors experience either cancer or treatment-related side effects including weight loss, muscle wasting, and fatigue [24, 25]. These conditions are thought to be associated with impairments in physical performance and function [26]. In addition, HNC reconstruction surgery sometimes involves the use of anterolateral thigh flaps [27, 28]; hence, some functional loss of the lower limb can be expected. Poor mobility reduces the chances of employment.

HNC survivors experience self-care problems, for example difficulty in performing tasks such as eating, dressing, and bathing. Swallowing impairment is a common problem after HNC [29]; it may cause malnutrition and loss of social participation. Thus, swallowing impairment can hinder the RTW process. Shoulder or upper limb dysfunction [30] is another well-known, major treatment-related problem of HNC survivors, even after nerve-preserving neck dissection [31]. Upper limb dysfunction causes not only self-care problems but also decreases the capability for working and participating leisure or social activities [13]. Aforementioned reasons provide a possible explanation for low WHODAS 2.0 scores in domains 3, 4, 5-1, and 6 among the male HNC survivors in our study.

We also noticed that getting along with people (domain 4) and participation in society (domain 6) are the two highest scores among the six domains. Participation in social life and the maintenance of cordial relations with people usually require sufficient ability to speak, hear, and write, in addition to self-confidence. These abilities and self-confidence are partially deteriorated by cancer or treatment-related side effects [20, 32, 33]. A recent nationwide cohort study [34] also revealed that the incidence of depressive disorder HNC survivors was three times higher than in other patients, which may hinder the establishment of normal relationships. Furthermore, environmental factors, such as the state of a country's economy, social welfare policy, barrier-free environment arrangement, retirement benefits, and medical system support, also have roles to play in social participation. High domain 6 scores may indicate flaws in the existing care system for cancer survivors.

This study revealed that the standardized WHODAS 2.0 summary score had the highest accuracy in predicting the risk of unemployment in HNC survivors. As expected, RTW possibility cannot be well predicted by a single domain score because the successful return to work has been identified as a multifactorial and multiphase process in cancer survivors in previous studies [19, 35] and should be assessed [36] comprehensively. Under the ICF concept, the environmental factor was first involved in the assessment of HNC-related impairment by the WHODAS 2.0 score in this study, thus increasing the comprehensiveness and reliability of the score.

The severity of impairment is also a negative predictive factor of the RTW possibility in addition to the WHODAS 2.0 summary score. According to DES-2012, if a patient with HNC is categorized as exhibiting severe impairment, the chances are high that the patient has undergone major surgery, such as total laryngectomy; has a body structural defect, such as severe trismus with mouth open width < 5 mm; or exhibits impairment in > 60% of the area of the head, neck, or face due to a defect. In fact, in our study, most of the patients were categorized as having mild and moderate impairment. For example, if the patients experienced prominent articulation difficulty and could not communicate with others, they were categorized as having moderate impairment. The patients were categorized as having mild impairment if they experienced articulation difficulty and significant obstacles in communication. In the present study, we used mild impairment as the reference in logistic regression, and no significant differences in employment opportunities were noted between the survivors categorized as having mild and moderate impairment. This may be because some functional loss gap in these two groups of patients can be compensated by activities such as gestures and writing.

Contrary to the results from previous studies [10, 12, 37] and our expectation, although a trend was noted, low education level and low socioeconomic status were not significant in predicting unemployment in the binary logistic regression in our study. Several explanations are possible. According to recent general population data in an East Asian population [38–40], the unemployment rate of highly educated people is actually above average. In contrast, people with < 6 years of education have the lowest unemployment rate. This phenomenon is probably related to the supply–demand mismatch of the labor market due to a rapid increase in access to postsecondary education in the late twentieth century. We believed that HNC patients are not exempted from the effects of this special regional condition. However, because half of our patient groups received < 9 years of education and the overall employment rate was low

(185/1206, 15.3%), our result cannot reject findings from previous studies in which HNC survivors with disability and low education status tend to experience difficulty in finding a job. Furthermore, we believe that the national health insurance policy and the low-income subsidy welfare in Taiwan reduce the medical and living expense burden of HNC survivors; hence, these expenses of patients in Taiwan are lower than those of patients in other countries. Therefore, patients can retire relatively early rather than returning to work, resulting in the paradox observed during the analysis of correlation among educational attainment, socioeconomic status, and the RTW status.

This is the first study to use the WHODAS 2.0 score to evaluate HNC survivors' impairment by using a nationwide study cohort obtained from a detailed clinical database over 5 years. We included only curatively treated, young, male patients (aged ≤ 50 years) with disability because common confounding factors, such as multiple comorbidities and degenerative disorders, tend to be observed in old patients (aged > 50 years). Our study has some limitations. First, the present study is a single-time-point cross-sectional study; we were not able to follow-up on patients' RTW processes or detect the ability to maintain a stable employment status. Second, the two major job types are white-collar and blue-collar jobs. White-collar jobs usually require high communicative ability and intact cognitive function, whereas blue-collar jobs are usually physically demanding. A previous study [10] also shows that blue-collar workers are more frequently unemployed after HNC treatment than are white-collar workers. However, our database does not contain data regarding the job types of the patients. The relationships between job types, the WHODAS 2.0 score, and employment should be examined in future studies. Third, there is a huge patient number difference between male and female HNC survivors in our database; thus, the female HNC survivors' data are not included in the present study for preventing misleading result. Studies for female HNC survivors' RTW prediction are needed in the future. Finally, the complicated interactions among unemployment rate, social welfare policy, and insurance in different countries cannot be evaluated according to the results of this study because the data are limited to a single country.

Conclusions

The WHODAS 2.0 standardized summary score and severity of impairment are independent predictive factors for the work status of male HNC survivors with disability. The WHODAS 2.0 score not only provides a reliable and applicable summary of functioning and disability in male HNC survivors but also is an objective quantitative assessment tool for evaluating RTW possibilities among male HNC survivors. The summary scores of WHODAS 2.0 exhibited higher accuracy in predicting RTW than the scores in six separate domains, which indicates that each HNC survivor's disability should be assessed in its totality. Thorough rehabilitation plans and public health policies should be formulated in the future to enable HNC survivors to return to work.

Compliance with ethical standards

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