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ORIGINAL ARTICLE

Developing a disability determination model using a decision support system in Taiwan: A pilot study

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Background/Purpose: The aims of our study were to: (1) develop the Disability Grading Decision Support System (DGDSS) and to (2) compare the new International Classification of Functioning, Disability, and Health (ICF)-based disability determination tool (ICF-DDT) with the diagnosis-based disability determination tool (D-DDT).
Methods: A total of 9357 patients recruited from 236 accredited institutions were evaluated using the ICF-DDT and the D-DDT, and the presence, severity, and category of the disability identified using the two determination tools were compared. In the DGDSS, the ICF-DDT consisted of four models comprising nine modules to determine the presence and the severity of the disability. The differences between models (modules) are the different combinations of World Health Organization Disability Assessment Schedule 2.0 (WHODAS 2.0) and Scale of Body Functions and Structures.
Results: Compared with the D-DDT, more patients were determined to be disability-free when using the ICF-DDT. Module 1-1 had the highest profoundly severe rate, and module 2-2 had the highest mild and moderate disability rates. Module 2-1 had the highest severe disability rate. Module 1-1 resulted in the smallest difference, and module 3-1 resulted in the largest

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difference, compared with the D-DDT. Feedback from users suggested that the DGDSS is a robust system if the original data are accurate.
Conclusion: The presence, severity, and category of the disability determined using the ICF-DDT and the D-DDT were significantly different. The results of the DGDSS provide information for policymakers to determine the optimal allocation of social welfare and medical resources for people with disabilities.

Introduction

Disability is defined as the consequence of an interaction between an impaired body structure and its function, limitations of activities of participation, and barriers in the environment.[1] People with disabilities encounter problems during daily activities, and require resources to overcome these difficulties.[2] The determination of disability assists the government in selecting the people who are in need of social welfare and medical resources, and determines the types and extent of resources that are to be delivered. However, the determination of disability is confounded by the lack of specific standards, and multiple disability measures are needed to meet the various purposes of measurement.[3]

Two important issues must be considered when developing criteria for disability screening. First, an eligibility threshold is needed to determine the presence of disability. Second, the degree or severity of the disability must be objectively evaluated. In the past, the determination of disability in Taiwan was based on a medical model that used the diagnoses of diseases and various impairments of physical functions to determine the presence and severity (mild, moderate, severe, or profoundly severe) of the disability.[4] Beginning in 2012, a new disability determination tool based on the International Classification of Functioning, Disability, and Health (ICF) framework was applied in Taiwan.[5] Disability determinations made using the ICF-based tool were thought to provide more information than determinations based on diagnoses alone, because it was developed based on the biopsychosocial model framework,[3,6,7] and it followed the recommendations of the World Health Organization (WHO) by addressing the problems encountered by people with disabilities.[7,8] However, studies that have investigated the presence and level of disability determined by the tools based on alternative criteria are scant.

The ICF-based disability determination tool (ICF-DDT) developed by the Taiwan Department of Health consists of two measures derived from the ICF framework: (1) the Scale of Body Functions and Structures, which determines the presence, type, and severity of the disability based on physical functioning and structural impairment, and (2) the Functioning Scale of Disability Evaluation System, which determines the presence and severity of the disability based on activity limitations, participation restrictions, and environmental barriers.[9] The ICF-DDT, like other ICF-based disability discrimination tools, uses the ICF framework to describe disability. The ICF-DDT combines the results of the two measures into a single disability level to allow comprehensive descriptions of disabilities and enhance communication between healthcare professionals and disability policymakers. However, other ICF-DDTs, such as the ICF Check List, describe the disability separately according to four chapters of the ICF.[10,11] To our knowledge, no relevant study has evaluated the use of combinations of the available standards.

We developed the Disability Grading Decision Support System (DGDSS) with decision models (combinations of the Scale of Body Functions and Structures and the Functioning Scale of Disability Evaluation System) based on different concepts of disability to assist healthcare policymakers in the determination of the presence and severity of disability, and we compared the ICF-DDT with the previous diagnosis-based disability determination tool (D-DDT). Disability policymakers can use the system to choose the most appropriate disability determination tool, and researchers may use it to investigate the impact of the different ICF-DDT models on disability determinations.

Materials and methods

Participants

From June 2011 to May 2012, we reviewed 11,716 volunteers, aged 18 years and over, from 236 accredited institutions for our study. The patients were recruited as they presented for the renewal of their certificate of disability. Patients with multiple disabilities, as determined by a previous D-DDT, were excluded. The evaluations using the ICF-DDT and the D-DDT were completed for 9357 patients. A total of 221,963 patients underwent disability determination using the D-DDT in Taiwan during the study period.[12] Therefore, the sampling rate was 4.21%.

Model design

Based on the Scale of Body Functions and Structures and the Functioning Scale of Disability Evaluation System, four models were developed for the ICF-DDT to determine the presence, the type, and the severity of the disability. The Scale of Body Functions and Structures describes the patient's level of physical functioning and his or her structural impairment, and the Functioning Scale of Disability Evaluation System describes the patient's activity limitations, participation restrictions, and environmental barriers.

We divided 199 experts into eight groups to discuss and generate the components included in the Scale of Body

Functions and Structures. A total of 32 ICF b codes and 11 ICF s codes in the following eight categories were selected as the evaluation criteria for the presence and the category of the disability: (1) the structures of nervous systems and spiritual and mental functions; (2) the eyes, the ears, the relevant structures and sensory functions, and pain; (3) the structures related to voice and speech and their functions; (4) the structures related to the circulatory, hematopoietic, immune, and respiratory systems and their functions; (5) the structures related to the digestive, metabolic, and endocrine systems and their functions; (6) the structures related to the urinary and reproductive systems and their functions; (7) the mobile structures, including nerves, muscles, and bones and their functions; and (8) the skin and relevant structures and functions. Four levels of severity were established to grade the degree of the disability in body functions and structures.

A panel of 10 experts was invited to discuss and generate the components included in the Functioning Scale of Disability Evaluation System. Thirty-six items of the WHO Disability Assessment Schedule 2.0 (WHODAS 2.0) were selected as evaluation criteria for activity limitations and participation restrictions, and the severity was graded on a scale from 0 to 100.[7] Seven ICF d4 codes were evaluated to validate the WHODAS 2.0, and eight types of environmental factors were evaluated and used as ancillary information, neither of which were used to determine the presence and the severity of the disability.[6]

To provide a comprehensive description of disability, the Scale of Body Functions and Structures and the Functioning Scale of Disability Evaluation System were combined to form the ICF-DDT. However, the severity scales used in the Scale of Body Functions and Structures (mild, moderate, severe, and profoundly severe) and the Functioning Scale of Disability Evaluation System (0—100) were different. Therefore, two strategies were used to standardize the severity scales. Using the first strategy, the WHODAS 2.0 scores were converted into four severity levels using the ICF qualifiers.[13] The levels were defined based on the proportion of patients among the total number of people in the general population with the particular disability, and were graded as follows: 5—24%, mild severity; 25—49%, moderate severity; 50—94%, severe; and $\geq$95%, profoundly severe. This strategy allows the application of the model to other countries, and meets the WHO recommendations for disability determination. Using the second strategy, the WHODAS 2.0 scores were converted into four severity levels using the disability distribution obtained from the D-DDT (1.56—40.86%, mild; 40.87—77.55%, moderate; 77.56—92.93%, severe; and $\geq$ 92.94%, profoundly severe), thus maintaining a stable severity rate. The DGDSS also allows the adjustment of the percentages of the four disability levels in Models 2 and 3.

Four models consisting of nine modules were generated by the focus group. The model rules are shown in Table 1. Model 1 is an impairment-based combination, and the

Table 1 Decision models of Disability Grading Decision Support System.

Model	Module	Description
1	1-1	1. Use qualifier 1 in b code or s code of Scale of Body Functions and Structures as the criteria for disability. 2. Use qualifier of Scale of Body Functions and Structures. Choose the highest one as the Disability Grading if there are more than two gradings.
2	2-1	1. Use qualifier 1 in b code or s code of Scale of Body Functions and Structures as the criteria for disability. 2. Convert WHODAS 2.0 scores into four severity levels by using ICF qualifiers percentage to fit the distribution of WHODAS 2.0 scores.
	2-2	1. Use qualifier 1 in b code or s code of Scale of Body Functions and Structures as the criteria for disability. 2. Convert WHODAS 2.0 scores into four severity levels by using the percentage of each grading of D-DDT to fit the distribution of WHODAS 2.0 scores.
	2-3	1. Use qualifier 1 in b code or s code of Scale of Body Functions and Structures as the criteria for disability. 2. Convert WHODAS 2.0 scores into four severity levels by user definition.
3	3-1	1. Use the WHODAS2.0 as the criteria for disability. 2. Convert WHODAS 2.0 scores into four severity levels by using ICF qualifiers percentage to fit the distribution of WHODAS 2.0 scores.
	3-2	1. Use the WHODAS2.0 as the criteria for disability. 2. Convert WHODAS 2.0 scores into four severity levels by using the percentage of each grading of D-DDT to fit the distribution of WHODAS 2.0 scores.
	3-3	1. Use the WHODAS2.0 as the criteria for disability. 2. Convert WHODAS 2.0 scores into four severity levels by user definition.
4	4-1	1. Use both Body Functions and Structures and WHODAS2.0 as the criteria for disability. 2. The grading of WHODAS2.0 is based on module 2-1. 3. Grading of disability is the sum of 50% of Body Functions and Structures grade and 50% of WHODAS2.0.
	4-2	1. Use both Body Functions and Structures and WHODAS2.0 as the criteria for disability. 2. The grading of WHODAS2.0 is based on module 2-1. 3. Self-define the weighting of Body Functions and Structures and WHODAS Grade 2.0.

D-DDT = diagnosis-based disability determination tool; ICF = Internal classification of Functioning, disability and Health; WHODAS = World Health Organization Disability Assessment Schedule.

presence, the grading, and the category of the disability are determined using the Scale of Body Functions and Structures. Model 2 uses the Scale of Body Functions and Structures as the threshold of disability, and grades the severity of the disability according to the scores of the WHODAS 2.0 in the Functioning Scale of Disability Evaluation System. According to Model 2, the disability determined must be based on the impairment of body function and structure. The differences among modules 2-1, 2-2, and 2-3 resulted from the different strategies used to standardize the WHODAS 2.0. Model 3 uses the WHODAS 2.0 as the criteria and grading tool for the disability determination, whereas the Scale of Body Functions and Structures determines the category of disability only. According to Model 3, patients with no impairment in body function and structure can nonetheless be determined to be disabled if 1 or more points are scored in the WHODAS 2.0 assessment. The differences among modules 3-1, 3-2, and 3-3 resulted from the different strategies used to standardize the WHODAS 2.0. Model 4 used both the Scale of Body Functions and Structures and the WHODAS 2.0 as the criteria for the disability determination. The grading of the disability was generated as the sum of the two scales that were adjusted according to specific weighting or to weighting chosen by the end user. Model 4 thus maintained the characteristics of both scales. The WHODAS 2.0 scores were converted into four severity levels using the ICF qualifiers percentage to fit the distribution of the WHODAS 2.0 scores in Model 4. In module 4-1, the Body Functions and Structures and the WHODAS 2.0 each accounted for 50% of the weighting. In module 4-2, the weighting was determined by the end user.

System design and evaluation

We used semistructured decision making in our study, which involved various combinations and comparisons. Because of the large amount of data and the complex calculations, the decision support system (DSS) was developed to assist decision makers in analyzing the results under different initial conditions based on the overall data set.[14,15] The DSS has been widely applied to a range of decision-making processes to enhance quality and performance,[16] such as the Clinical DSS, which provides evidence-based clinical decision-making support to healthcare professionals by determining the best therapy for a patient based on the findings of clinical trials.[17] A DSS was also shown to provide an effective basis for policymaking for resource allocation for sustainable land management,[18] and another DSS was developed to evaluate various situations associated with water restrictions in Spain to assess the economic impact of water conservation policies.[19] The DGDSS is a general DSS that focuses on providing experimental data from different computing models applied to disabilities, to enable a better understanding of the differences between the distributions of physical and mental disabilities based on different perspectives and portfolio judgments of disabilities.

The DGDSS is based on a web-based module. The system architecture (Fig. 1) uses the components and the data sources of the Disability Determination System Database. The DSS web service module and the database server module transfer the data from the Disability Determination System Database. Users submit requests to and receive results from the DSS server through the web interface.

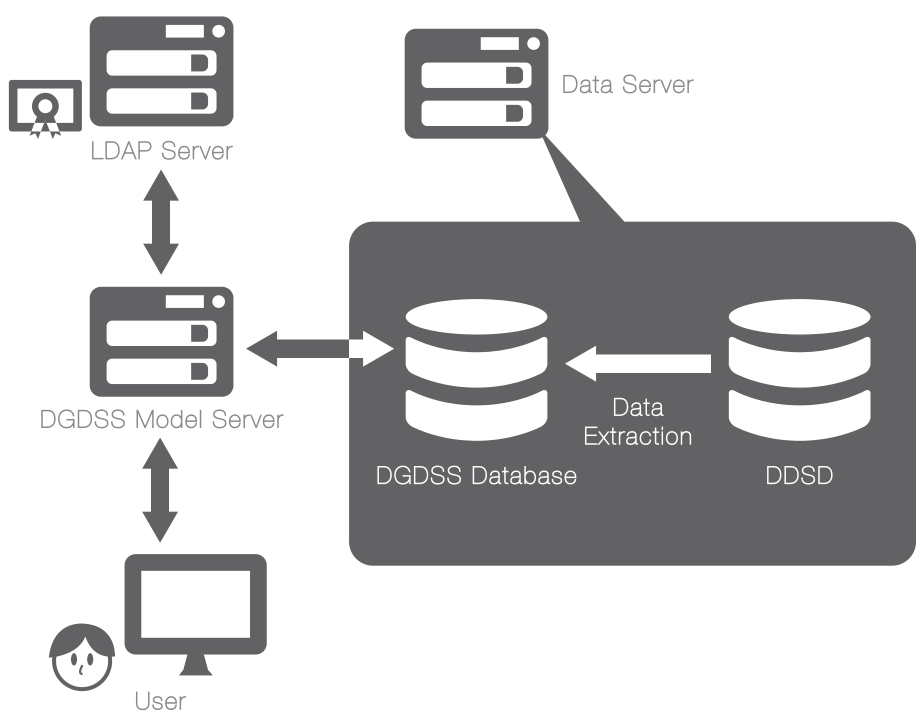

Figure 1 System structure of Disability Grading Decision Support System (DGDSS). There are three main components of the structure: (1) the DGDSS model server provides the models; (2) the Lightweight Directory Access Protocol (LDAP) server is used for account management; and (3) the data server contains the data extracted from Disability Determination System Database (DDSD). The users use the local computers to access the system.

When a model is chosen on the DSS server, the data from the DGDSS database are applied to the model, and the results are shown on the screen. Users must log into the DGDSS on the DSS server by matching the information obtained from the Lightweight Directory Access Protocol server. The DGDSS was developed using JAVA programming language on a Linux-based platform. The DGDSS consists of four models comprising nine modules that can be selected by users based on the requested calculation.

To understand the experts' evaluations of the DGDSS, a brief interview was conducted with one researcher with many years of experience in the area of disability-related research and two policymakers, one middle-level and one high-level manager in the Department of Health. The interview contents were developed using terminology that had been previously used in measuring end-user computing satisfaction.[20]

Data analysis

The data were loaded into the DGDSS, and the end users selected one of the nine modules. The system automatically generated the number of patients, the type of disability, and the distribution of the level of disability severity. The comparisons with the D-DDT results were also automatically generated.

Results

Data description

Among the 9355 participants, 3.54% were determined to be disability-free using modules 1-1, 2-1, 2-2, and 4-1 of the DGDSS, and 6.96% were determined to be disability-free using modules 3-1 and 3-2. Module 1-1 identified the highest rate of profoundly severe cases (n = 1639; 17.52%). Modules 2-1 and 3-1 identified the highest rate of severe cases, as graded by the WHODAS2.0-based assessment and the ICF qualifiers. Modules 2-2 and 3-2 identified relatively high rates of moderate cases, as graded on the basis of the previous rates and levels of physical and mental disabilities (Table 2).

Regarding the severity of the disability, modules 3-1, 2-1, and 3-2 resulted in 69.93%, 68.35%, and 61.10% differences, respectively, relative to the D-DDT. The differences between the severity of the disability determined using the D-DDT and that of the other models were as follows: module 1-1, 44.15%; module 4-1, 52.86%; and module 2-2, 58.31% (Table 3).

Participants were classified into one of the eight categories of disabilities. Compared with the grading determined by the D-DDT, different types of changes in the disability grading level occurred in each model. Among the Category 1 disabilities identified by module 1-1, 72% of the patients scored higher in their levels of disabilities. Among the Category 6 disabilities identified using module 2-1, 74.5% of the patients scored lower in their levels of disabilities. Modules 1-1 and 2-1 had the largest range of changes. The various disabilities that were identified using module 2-2 were well-matched changes, excluding Category 5, in which there were increases or decreases of up to 30%. Module 3-1 had the greatest influence on Category 6 disabilities, with 74.37% of the patients scoring lower in their levels of disabilities. Among the Category 3 disabilities identified using module 3-2, 40% of the patients scored lower in their levels of disabilities. Among the Category 4 disabilities identified using module 4-1, 62% of the patients scored lower in their levels of disabilities. The details of the increases and decreases in the various levels of the disabilities according to the models used are shown in Table 3.

System establishment and assessment

A threshold was established for each model in accordance with the categories of disabilities, sex, and age, and a threshold description was produced according to the screening results. All of the three users interviewed expressed a positive attitude toward the necessity of the system functions, indicating that the system can satisfy the needs of most users. However, they had different perspectives on the data processing and the accuracy of contents. For example, User A reported that he or she lacked absolute confidence in the accuracy of the data, and suggested that a mechanism of auditing the input data be added to ensure the accuracy of output data.

Discussion

To meet the perspectives of disabilities set forth by the WHO, the government of Taiwan initiated a project to develop a new disability determination tool. Our study

Table 2 Grading distribution of all models.

	Not eligible	Mild	Moderate	Severe	Profoundly severe
D-DDT	145 (1.55)	3679 (39.32)	3433 (36.69)	1439 (15.38)	661 (7.07)
Module[a] 1-1	331 (3.54)	2866 (30.63)	2326 (24.86)	2195 (23.46)	1639 (17.52)
2-1	331 (3.54)	1887 (20.17)	2300 (24.58)	4330 (46.28)	509 (5.44)
2-2	331 (3.54)	3309 (35.36)	3503 (37.44)	1467 (15.68)	747 (7.98)
3-1	651 (6.96)	1947 (20.81)	2095 (22.39)	4195 (44.83)	469 (5.01)
3-2	651 (6.96)	3133 (33.48)	3410 (36.44)	1458 (15.58)	705 (7.53)
4-1	331 (3.54)	1013 (33.48)	4092 (43.73)	3315 (35.43)	606 (7.53)

Data are presented as n (%).

D-DDT = diagnosis-based disability determination tool.

[a] Modules 2-3, 3-3, and 4-2 were not listed because the results vary by the self-defined weighting.

Table 3 Changes rate of disability grading (%).

Modules[a]	Status	Disability catalog								
		Total	1	2	3	4	5	6	7	8
		$n = 9355$	$n = 3900$	$n = 1514$	$n = 162$	$n = 395$	$n = 165$	$n = 488$	$n = 3197$	$n = 57$
1-1	The same	56.85	22.39	60.57	38.89	51.64	58.78	85.03	58.71	45.62
	Decrease	16.45	5.44	6.87	5.55	14.17	8.48	4.28	33.6	1.75
	Increase	26.7	72.19	32.56	55.56	34.17	32.73	10.63	7.7	52.63
2-1	The same	31.65	33.36	25.96	27.77	31.9	33.94	14.13	39.6	24.56
	Decrease	18.4	16.24	12.56	17.28	29.13	31.51	74.58	15.58	10.53
	Increase	49.95	50.43	61.5	54.93	38.99	34.54	11.25	44.83	64.9
2-2	The same	41.32	45.13	46.44	45.68	49.11	36.36	53.88	46.08	54.39
	Decrease	27.61	26.37	27.09	25.31	29.37	30.9	22.73	26.07	22.81
	Increase	31.07	28.51	26.49	29	21.52	32.72	23.36	27.82	22.8
3-1	The same	30.07	29.71	24.9	29.01	36.36	33.34	13.93	37.06	24.56
	Decrease	21.52	26.66	12.29	29.63	22.48	29.69	74.37	14.54	12.27
	Increase	48.41	43.65	62.82	41.36	41.16	36.97	11.65	48.39	63.15
3-2	The same	38.9	38.73	46.62	39.51	51.77	35.76	53.89	43.73	54.39
	Decrease	29.39	35.56	27.02	40.13	24.99	29.09	22.11	25.98	22.8
	Increase	31.71	25.73	26.35	20.36	24.99	35.15	23.97	30.28	22.8
4-1	The same	43.79	46.77	33.94	41.97	46.08	50.92	49.99	50.49	35.09
	Decrease	6.23	2.82	4.56	3.09	14.94	14.54	38.72	4.69	64.92
	Increase	49.49	50.4	61.49	54.94	38.99	34.54	11.25	44.82	0

[a] Modules 2-3, 3-3, and 4-2 were not listed because the results vary by the self-defined weighting.

provides evidence of the differences between the newly developed ICF-DDT and the previously used D-DDT based on the DGDSS. The characteristics of the different modules based on the results of the DGDSS evaluation are shown in Table 4.

Presence of disability

Four models of the ICF-DDT were used to determine the presence of disability. Among the four models, the model that used the WHODAS assessment criteria identified fewer patients with disabilities, compared with the model that used the Scale of Body Functions and Structures. The results showed that up to 651 patients were determined to be disability-free according to the WHODAS 2.0, which accounted for 6.9% of the total cohort. In total, 331 were determined to be disability-free (3.54%) according to the Body Functions and Structures. Only 145 patients (1.55%) were determined to be disability-free based on the D-DDT, the previously used determination tool. These results suggest that some impairments in body functions and structures may not result in significant deficits in living functions. In addition, the threshold defined using the D-DDT was relatively low.

Severity of disability

Regarding the severity of disability, the results obtained using the different models of the ICF-DDT were comparable. The model using the Scale of Body Functions and Structures (Model 1) identified the most cases with a profoundly severe grade of disability. Because daily living functions were not considered in the Scales of Body Functions and Structures and certain impairments are not closely associated with daily living functions, Model 1 was more likely to overestimate the levels of the disabilities. For example, an organ transplant is regarded as a major impairment of body functions and structures. However, after patients recover from the transplant procedure, they should experience limited influences on their daily living functions. Thus, the use of the Scale of Body Functions and Structures as the sole basis of determination may overlook the regaining of living functions, leading to an ineffective distribution of resources. Such scenarios highlight the need to place equal consideration on physical functioning and the functions of activity and participation for the assessment of disabilities.[11]

The nearly equivalent grading distributions obtained using modules 2-2 and 3-2 were similar to those provided by the D-DDT, with only the disability rate differing among them. Using these two modules resulted in a more stable disability rate, compared with that of the D-DDT. The grading obtained using modules 2-1 and 3-1 showed that the percentage of patients with the severe degree is the highest of the four grades. There is a high correlation between the severity level of a disability and the amount of the resources used by a patient.[21] Thus, in contrast to modules 2-2 and 3-2, the disability determinations based on modules 2-1 and 3-1 would allow more people to obtain resources.

Comparison with the D-DDT

Regarding the severity of disability, the differences between the D-DDT and the ICF-DDT were significant. The disability severity grades determined using the nine modules based on the ICF-DDT matched 30.07–56.85% of the grades determined using the D-DDT (Table 3). Model 1 had the least influence on the severity levels of the disabilities, compared with the D-DDT. Approximately 56.85% of the

Table 4 Modules characteristics of Grading Decision Support System reports.

Models	Disability grade description	Comparison with D-DDT
Module 1-1	1. High eligible rate. 2. Percentage of profoundly severe cases was higher than that in other models.	1. Profound changes in the number of cases were observed in the profoundly severe (increased) and the moderate cases (decreased). 2. The percentage of grading change was lower than that in other models.
Module 2-1	1. High eligible rate. 2. Percentage of severe cases was higher than that in other models. Percentage of mild level percentage was lower than that in other models.	1. Profound changes in the number of cases were observed in the severe (increased) and the mild cases (decreased). 2. The percentage of grading change was higher than that in other models.
Module 2-2	1. High eligible rate. 2. Percentages of mild and moderate cases were higher than those in other models.	1. The distribution of disability level percentages was closer to the D-DDT's disability level percentages distribution than that found in other models. 2. The percentage of grading change was higher than that in other models
Module 3-1	1. Low eligible rate. 2. Percentage of severe cases was higher than that in other models. Percentage of mild cases was lower than that in other models.	1. Profound changes in the number of cases were observed in the severe (increased) and the mild and moderate cases (decreased). 2. The percentage of grading change was higher than that in other models.
Module 3-2	1. Low eligible rate. 2. Percentages of mild and moderate cases were higher than those in other models.	1. The distribution of disability level percentages as closer to the D-DDT's disability level percentages distribution than that in other models. 2. The percentage of grading change was higher than that in other models.
Module 4-1	1.High eligible rate 2. Percentage of moderate cases was higher than that in other models, but the percentage of mild cases was lower than that in other models.	1. Profound changes in the number of cases were observed in the severe (increased) and the mild cases (decreased). 2. The percentage of grading change was lower than that in other models.

D-DDT = diagnosis-based disability determination tool.

severity grades determined using Model 1 matched the grades determined using the D-DDT (Table 3). This likely occurred because the D-DDT is based on both diagnoses and impairments of body functions and structures. Conversely, Model 3 had the greatest influence on the severity levels of disability, which likely occurred because Model 3 considered the involvement of activities and graded the levels of the disabilities according to the WHODAS 2.0 assessment. This method of evaluation is considerably different from that of the D-DDT, which grades the levels of disabilities according to the diagnoses only. A strong relationship between diagnosis and functional disability was not observed in our evaluation. Patients with a medical diagnosis may or may not have functional disability, and vice versa.

According to Msall et al,[22] 53% of functionally disabled school students did not have a medical diagnosis, indicating a considerable gap between medical diagnoses and determinations of functional disability. Describing disabilities based on the medical model with diagnoses may help clinicians accurately diagnose the patients and suggest the appropriate treatment strategies. However, the medical model does not provide comprehensive descriptions related to the functions of people with disabilities.[13] The ICF-DDT is likely to provide a more comprehensive view of the severity of a disability because the functions of an individual are also considered.

Differences between disability categories

Compared to other models, fewer participants classified as Category 1 were kept in Model 1 (22.4%). It is possible that patients with mental disorders were determined to be Category 1 based on diagnosis in D-DDT. The standard of determination for Model 1 includes body functions and structures, and the diagnoses are replaced by various mental functions, such as advance cognitive function and memory functions. In modules 2-1 and 3-1, the level of disability in Category 6, genitourinary and reproductive functions, decreased by 74%. It is possible that impairments in genitourinary and reproductive functions have limited impacts on activity and participation function. Thus, the D-DDT may overestimate Category 6 disability levels, resulting in inappropriate resource allocation. In the future, we will reexamine the appropriateness of various services to ensure expedient care in such cases.

Decision support system and data accuracy

The DGDSS provides integrated information to assist policymakers in disability-related decision-making processes. It also provides information for researchers in the field of disability evaluation. A previous study suggested that the most important variables affecting DSS usage are the accuracy and the relevancy of the output.[23] In the DGDSS, users judged the relevancy of the output as adequate, but expressed concerns regarding the accuracy of output.

In the evaluation of the DSS system, such concerns regarding the accuracy of output were based on issues related to the correctness of the original data. Users suggested that the system lacked proper control mechanisms to ensure the quality of the input data because the data are directly imported from the original database with no proofreading steps. As suggested by Peabody et al,[24] the precision and accuracy of the output data of the system can be improved by correcting inaccurate patterns in the survey data prior to importing the data for analysis. They also classified the sources of the errors as physician errors, input errors, and data defects. These types of errors should be corrected to ensure the accuracy of the system. Our future studies of the DGDSS will add a checking mechanism in the input process to ensure the accuracy of the input data. We will also expand the database for the DGDSS to increase the robustness of the results.

In conclusion, the DGDSS provides necessary information for decision making related to disability grading. The results provided by the DGDSS imply that the presence, severity, and category of the disability determined using the ICF-DDT were significantly different from those obtained using the D-DDT. Thus, a patient is less likely to be identified as having a disability when the ICF-DDT is used. However, patients identified as having a disability using the ICF-DDT are more likely to receive a high grading of severity of disability. Among the modules of ICF-DDT, the modules using the Scale of Body Functions and Structures as the criteria for disability identified more patients with disability than the WHODAS 2.0 assessment.

However, the results of our study show only the macroscopic appearance of the data, which allows a general understanding of the trends and states of the data that are suitable for an in-depth investigation for individual problems in the future. In the follow-up research, the investigators will use dynamic calculations to enable decision makers to freely adjust the proportions of the levels of determination of the DSS.

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