Structural and Construct Validity of the WHO Disability Assessment Schedule (WHO-DAS 2.0) on the Population of Slovenian Patients with Depression and Normative Controls

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ABSTRACT

The study investigates the structural and construct validity of the World Health Organization Disability Assessment Schedule (WHO-DAS 2.0) within a Slovenian population comprising patients with depression and normative controls. WHO-DAS 2.0, a widely used instrument for assessing functional disability across seven domains, was translated into Slovene and validated using a range of statistical analyses, including exploratory and confirmatory factor analysis, internal consistency measures, and construct validity tests. Results indicated significant differences in functional disability between patient and normative groups, with patients reporting higher levels of impairment. Factor analysis revealed that the Slovene translation deviates from the nominal seven-domain structure, suggesting a one-factor model after excluding cognitive dysfunction items due to low construct validity. The study also demonstrated strong internal consistency (Cronbach's alpha = 0.940) and significant correlations with related construct (depression, anxiety, and depression-related functional disability). These findings support the use of WHO-DAS 2.0 as a reliable tool for assessing functional disability in Slovenian clinical and normative populations.

Keywords: functional disability, depression, WHO-DAS 2.0, ICHOM

1. Introduction

According to the World Health Organization's *International Classification of Functioning, Disability and Health* [1]; ICF), functioning refers to positive or neutral interactions between a person's physical or mental health and their environmental and personal context. Pathologies are often defined in two ways: as states that cause harm (*normativism*) or as a result of dysfunctional biological processes (*naturalism*) [2]. Broadly speaking, in psychiatry, functional impairment is defined as an extension of the naturalist view of disorders. That is, it refers to impairment in psychological, social, or professional functioning due to the psychiatric disorder both as a proximal (e.g., reduced ability to work due to primary cognitive deficit related to a disorder) or a distal cause (e.g., reduced ability to socialize due to the financial burden of the disease) [3].

Dysfunctionality is a multifaceted concept. It may be that individuals experience subjective distress in absence of objectively present external dysfunction thereby complicating evaluation of treatment response [4]. On the other hand, there may be overlap between dysfunction as part of normal psychological development and psychiatric disorders, leading to overdiagnosis [5] (e.g., reduced cognitive abilities constituting part of normal aging, leading to misdiagnosis of psychiatric disorders) [6]. Finally, from an evolutionary perspective, it may be that certain symptoms of psychiatric disorders have been adaptive in the hunter-gatherer context in which they evolved, but became maladaptive due to the evolution of human society or personal history (e.g., how in the context of relative scarcity, pleasure seeking behavior may be adaptive, whereas in the modern era of abundance, leads to addiction [7].

Psychiatric disorders are associated with considerable global disability [8,9]. Globally, half of the burden of premature mortality can be linked to functional disability [10]. A related issue is presenteeism. The term refers to people attending work or school while experiencing health problems [11]. While for some patients, attending work can be related with reduced symptom severity, it has been shown to increase symptoms of psychiatric disorders, in particular depression [12]. In Slovenia, psychiatric disorders are associated with 24.7% to 27.7% of cases of disability status or early retirement [13]. In Slovenia, the economic burden of psychiatric disease amounted to 1.6 billion € or 4.14% of the country's gross domestic product [14].

Given the significant impact of psychiatric disorders on daily functioning in Slovenian society, it is therefore imperative to validate psychological instruments for assessment of disease-related impairment.

International Consortium for Health Outcomes Measurement (ICHOM) is a value-based non-governmental organization founded in 2012 that aims to standardize health outcome measurements. It is focused on developing, spreading, and validating instruments and assessment procedures that are centered around the patients. They emphasize the importance of relying on health outcomes that are consistent with patients' needs. ICHOM's goal is to establish health outcomes as a standard measure in healthcare. [15]

ICHOM has put forward so-called *standard sets*, batteries of tests that they recommend to be used in clinical practice broadly to evaluate treatment outcomes. According to ICHOM standard set for treatment of adults, all patients should provide information on age, sex, level of education, marital status, employment status, housing status, comorbidities, body mass index, blood pressure, an assessment of cardiovascular risk, smoking habits, alcohol intake, and their level of physical activity. These measurements should be used to assess the patients' health status at baseline and the at 6-month intervals. In terms of outcome, two instruments are predominantly used to evaluate both patients' physical and mental health: World Health Organization's Disability Assessment Schedule (WHO-DAS 2.0; [16] and Patient-Reported Outcomes Measurement Information System (PROMIS;[17].

WHO-DAS 2.0 was developed due to a general lack of conceptual clarity in defining and measuring functional disability and instruments to measure it. WHO-DAS 2.0 is an openly available instrument developed by the World Health Organization. It supersedes the earlier version, WHO-DAS II. The revision presents a generic assessment of functionality across all types of diseases. It can be used on clinical and general populations. It has

cross-cultural validity, and it is easy and quick to use. WHO-DAS 2.0 was developed on the basis of ICF in order to create an instrument that was not too burdensome for the patients to fill out. WHO-DAS 2.0 is sufficiently sensitive to be used as an outcome measure following a therapeutic intervention. Seven different versions of WHO-DAS 2.0 are available differing in scope and mode of administration. Cross-cultural population norms for WHO-DAS 2.0 are openly available.

WHO-DAS 2.0 is used to assess functional disability in seven domains: i) cognition: ii) mobility; iii) self-care; iv) getting along (i.e., interacting with other people); v) life activities (e.g., household responsibilities); vi) participation (e.g., in community activities) and vii) work/school. WHO-DAS 2.0 can be used to measure functional disability in any disease. The WHO-DAS 2.0 instrument exists in several versions. The complete version consist of 36 items. The short form version consists of 12 items. The patients report on their functional disability in the 30 days prior to the administration of WHO-DAS 2.0. WHO-DAS 2.0 can be administered by a health care practitioner who does not need to be formally trained in the procedure, it can be administered by a proxy (e.g., family member), or the patients can respond on their own.

2. Method

2.1. Participants

In total, 183 responders were included in the present study. The responders were included from ongoing patient monitoring at the University Psychiatric Clinic Ljubljana while normative participants were drawn from existing studies. Table 1 summarizes participants' demographic information. Since WHO-DAS 2.0 aims to measure functional disability, regardless of diagnosis, a transdiagnostic sample of patients was collected. Forty-five patients were diagnosed with major depressive disorder, thirteen with generalized anxiety disorder, three patients were diagnosed with adjustment disorder, two with addiction disorders, and one with obsessive compulsive disorder. Ten participants had comorbid personality disorder, all of them borderline personality disorder.

Variable	Normative	Patient	p-value
Gender			0.177
Men	47	28	
Women	54	53	
Age	29.1 (9.3)	36.5 (12.7)	0.000
Years of completed education	17.2 (2.7)	16.4 (4.2)	0.134

Table 1. *Demographic information*

2.2. Instruments

2.2.1. World Health Organization Disability Assessment Schedule (WHODAS 2.0)

For his validation study, we used the longform self-reported version of WHO-DAS 2.0. The questionnaire was translated into Slovene by a clinician. A reverse translation was performed by a researcher with an undergraduate degree in English language. The questionnaire was implemented as an online survey on the Pavlovia website.

2.2.2. Patient Health Questionnaire (PHQ-9)

To further validate WHO-DAS 2.0, we included additional instruments assessing related constructs. The Patient Health Questionnaire (PHQ-9) was used as it is the only clinical scale that is validated in Slovene [18] and includes an item inquiring into patients' functionality. PHQ-9 primarily consists of nine items inquiring into the severity of the symptoms of depression. These nine items are added together to yield one-factor score of the severity of depressive symptoms. The tenth item ($PHQ\text{-}9_{10}$) inquiries into whether any of the first symptoms inquired about in the first nine items caused the patient impairment in everyday functioning. The raw score on PHQ-910 was used to ascertain the convergent validity of WHO-DAS 2.0.

2.2.3. Symptom Checklist (SCL-90)

As will be shown below, one of the underlying dimensions of WHO-DAS 2.0 suggested by the exploratory principal component analysis is social functioning. In order to establish the construct validity of this dimension, we employed two subscales of the Symptom Checklist (SCL-90; [19]. SCL-

90 is a 90-item questionnaire used to investigate a variety of psychiatric symptoms. Participants respond on a 5-point Likert scale (min = 0, max = 4). SCL-90 includes ten subscales: somatization, obsessive-compulsive symptoms, interpersonal sensitivity, depression, anxiety, anger-hostility, phobic anxiety, paranoid ideation, psychoticism, and additional items. To establish the construct validity of the Slovenian version of WHO-DAS 2.0, we used the anger-hostility and interpersonal sensitivity subscales.

2.2.4. Change Detection Task

The first domain of WHO-DAS 2.0 inquiries into cognitive dysfunction related to disease. A subsection of the responders also performed the Change Detection Task (CDT), a cognitive task aimed at measuring working memory capacity [20]. CDT consists of two subsequent stimuli, the memory and the probe stimuli. Both stimuli consist of an array of colored squares. Participants are instructed to try to remember the target stimuli. When the probe stimuli appear on the screen, they are instructed to indicate, by button press, whether it is equal to (right button) or different from (left button key) the memory stimulus. The stimuli may differ only in terms of color of the squares, but not position. Color differences can be subtle, thereby facilitating explicit encoding strategies. The number of squares in each array varied between 3 and 16. The memory stimulus, the delay, the target stimulus, and the intertrial interval all lasted for 2.0 seconds. A hundred trials of the CDT were performed. Two performance measures were extracted: performance accuracy (percentage of correct trials) and reaction times, however only the former was used in the analysis.

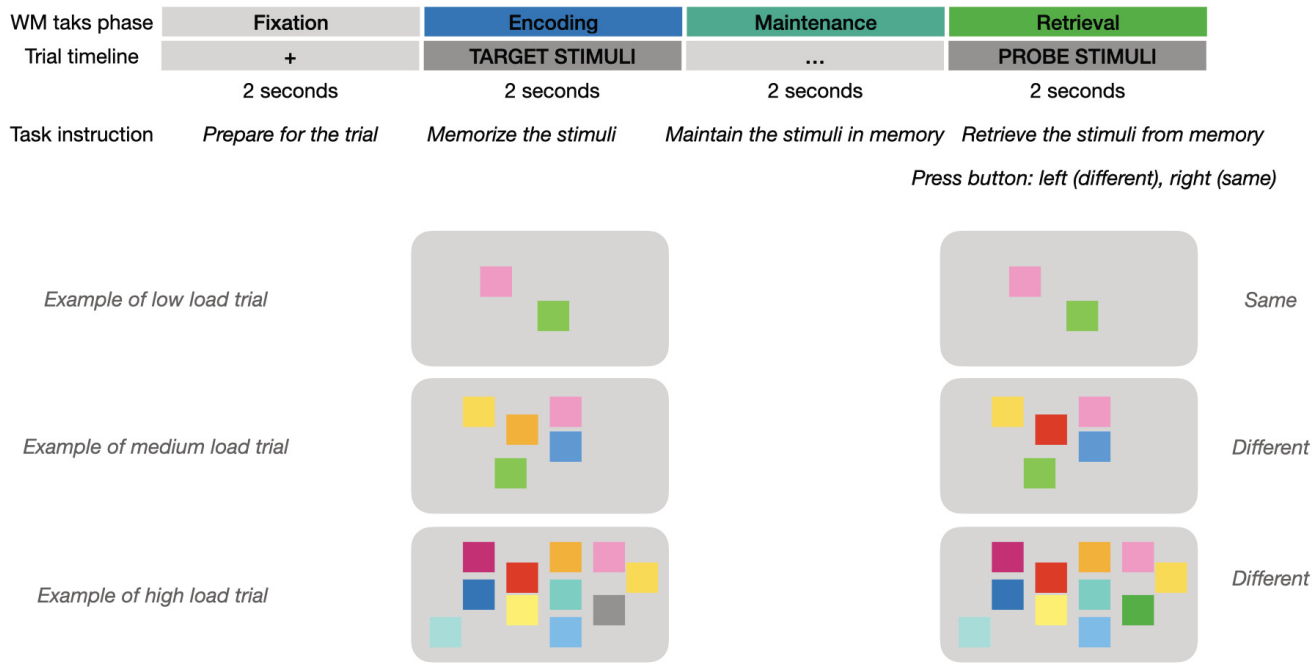

Figure 1. Temporal structure of the change detection working memory task.

2.3. Analysis

Data analysis was performed in R and RStudio [21]. Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was used to assess the degree of interrelatedness of items in the questionnaire. KMO of 0.6 or above indicates that items can be clustered together into meaningful factors. This property of the data was double checked by calculating the determinant of the correlation matrix.

We tested three factor models. The first model that we tested was the seven-factor model that followed the nominal division of WHO-DAS 2.0 into seven domains of functional disability. The second model was empirically determined from

the bottom-up. The bottom-up model was calculated in two steps. First, the appropriate number of factors was determined using Horn's parallel analysis using the R library paran, which suggested that the Slovene translation of the model had a two-factor structure. A two-factor model was extracted using principal component analysis. Orthogonal varimax rotation was used, assuming independence between principal components. Qualitative examination of the two components was performed and we determined that they correspond to social functioning and general functioning. The nominal WHO-DAS 2.0 domain of cognitive dysfunction was split between the two components. Construct validity was performed. Due to low construct validity, the cognitive dysfunction domain was excluded. After the exclusion, Horn's parallel analysis was repeated, which now suggested a one-factor structure to the Slovene translation of WHO-DAS 2.0. The one-factor solution with the cognition domain removed was the third and final model that was tested.

Confirmatory factor analysis of the three models (seven-factor nominal model, two-factor exploratory model, and one-factor model without the cognition domain) was performed using the Lavaan library in R [22]. Multiple criteria were used to assess the goodness of fit for confirmatory factor analysis. The Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) measure how well the proposed model compares with the baseline model, which assumes that all items are uncorrelated. CFI and TLI range from 0.0 to 1.0 Values above 0.90 suggest an acceptable fit. The Akaike Information Criterion is a measure of balance between model fit and complexity. The Akaike Criterion has no straightforward interpretation, only that lower values indicate a better model. Finally, we used Root Mean Square Error of Approximation (RMSEA), which estimates how well a proposed model fits the true population covariance matrix. RMSEA ranges from 0 to 1.0. Values below 0.05 suggest a good fit, values between 0.05 and 0.08 suggest an acceptable fit, and values above 0.10 suggest a poor fit.

Construct validity was determined by calculating correlation between WHO-DAS 2.0 scores and other measurements. Self-reported cognitive dysfunction was evaluated by correlating the WHO-DAS 2.0 items from the cognition domain and performance accuracy during CDT. General dysfunction was determined by correlating the summed score of WHO-DAS 2.0 with PHQ-9_{10}. Social dysfunction was determined by correlating the relevant items with the interpersonal sensitivity and hostility/hostility subscales of the SCL-90. The critical value was set at $\alpha = 0.05$.

Internal consistency was calculated using Cronbach's Alpha. Differences between the groups were estimated using the Brunner-Munzel test.

3. Results

First, we tested the difference in functional disability as measured by simple summation of all items on WHO-DAS 2.0. Since normality was violated in both the normative and patient groups, we used the Brunner-Munzel test, which was statistically significant ($W = 5.55$, $p < 0.001$). As expected, the patient group experienced considerably larger functional disability than the normative controls. The difference is displayed in Figure 1.

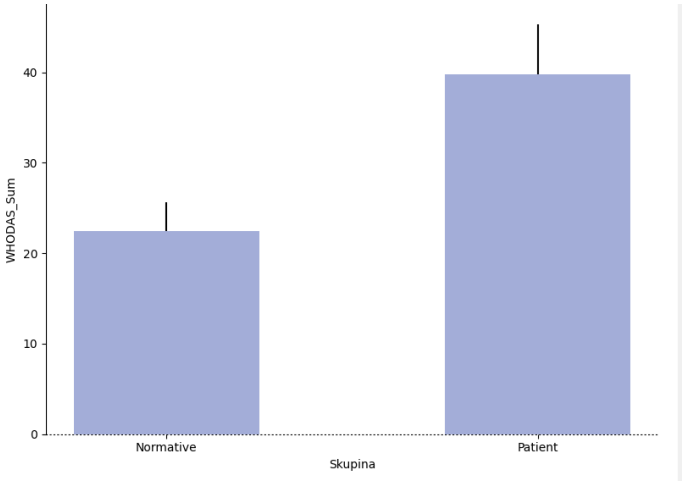

Figure 2. Difference in functional disability between the normative and patient groups

Second, we performed a factor analysis of WHO-DAS 2.0. Table 2 represents the item-level statistics of WHO-DAS 2.0. Overall, Cronbach's alpha was 0.940, suggesting excellent internal consistency.

Number	Item	Nominal domain	Normative	Patient	*a*
	In the past 30 days, how much difficulty did you have in:				
WHODAS1	… concentrating on doing something for ten minutes? … *z osredotočanjem na nekaj za 10 minut?*	Cognition	1.0 (1.1)	1.2 (1.1)	0.939
WHODAS2	Remembering to do important things? … *da ste se spomnili opraviti pomembna opravila?*	Cognition	0.7 (0.9)	1.1 (1.1)	0.939
WHODAS3	Analysing and finding solutions to problems in day-to-day life? … *pri analiziranju in iskanju rešitev za vsakodnevne probleme?*	Cognition	0.9 (1.1)	1.0 (0.9)	0.939
WHODAS4	Learning a new task, for example, learning how to get to a new place?... *pri učenju nove naloge, na primer, da ste si zapomnili pot do novega kraja?*	Cognition	0.9 (1.1)	0.9 (1.0)	0.939
WHODAS5	Generally understanding what people say?... *da ste v splošnem razumeli, kaj vam ljudje govorijo?*	Cognition	0.7 (1.0)	0.7 (0.8)	0.939
WHODAS6	Starting and maintaining a conversation? … *da ste začeli in ohranjali pogovor?*	Cognition	0.5 (0.8)	0.6 (0.9)	0.892
WHODAS7	Standing for long periods such as 30 minutes? … *pri tem, da ste stali za dlje časa, npr. 30 minut?*	Mobility	0.8 (1.0)	0.9 (1.0)	0.939
WHODAS8	Standing up from sitting down? … *pri vstajanju po tem, ko ste sedeli?*	Mobility	0.7 (1.0)	0.6 (1.0)	0.941
WHODAS9	Moving around inside your home? … *pri premikanju skozi vaš dom?*	Mobility	0.5 (0.9)	0.6 (0.8)	0.939
WHODAS10	Getting out of your home? … *pri zapuščanju vašega doma?*	Mobility	0.4 (0.8)	0.4 (0.7)	0.939
WHODAS11	Walking a long distance such as a kilometre? … *pri hoji na daljše razdalje, kakršen je en kilometer?*	Mobility	0.6 (1.0)	0.6 (0.9)	0.939
WHODAS12	Washing your whole body? … *pri umivanju? celega telesa?*	Self-care	0.5 (0.9)	0.2 (0.6)	0.94
WHODAS13	Getting dressed? … *pri oblačenju?*	Self-care	0.3 (0.8)	0.3 (0.7)	0.939
WHODAS14	Eating? … *pri hranjenju?*	Self-care	0.3 (0.7)	0.2 (0.5)	0.94
WHODAS15	Staying by yourself for a few days? … *pri tem, da za nekaj dni ostanete sami?*	Self-care	0.5 (0.9)	0.5 (0.8)	0.939
WHODAS16	Dealing with people you do not know? … *pri ukvarjanju z ljudmi, ki jih ne poznate?*	Getting along	0.8 (1.1)	0.7 (1.2)	0.941
WHODAS17	Maintaining a friendship? … *pri ohranjanju prijateljstev?*	Getting along	0.9 (1.1)	0.7 (1.1)	0.94
WHODAS18	Getting along with people who are close to you? … *pri razumevanju z ljudmi, ki so vam blizu?*	Getting along	0.5 (0.7)	1.2 (1.3)	0.937

WHODAS19	**Making new friends? … *pri sklepanju novih prijateljstev?***	**Getting along**	**0.6 (0.8)**	**1.1 (1.2)**	**0.938**
WHODAS20	Sexual activities? … *pri spolni aktivnosti?*	Getting along	0.5 (0.9)	1.6 (1.6)	0.937
WHODAS21	Taking care of your household responsibilities? … *pri opravljanju obveznosti v gospodinjstvu?*	Life activities	0.5 (1.0)	1.1 (1.4)	0.938
WHODAS22	Doing most important household tasks well? … *pri tem, da ste pomembna gospodinjska opravila opravili dobro?*	Life activities	0.4 (0.7)	1.3 (1.2)	0.937
WHODAS23	Getting all the household work done that you needed to do? … *pri tem, da ste opravili vsa vaša gospodinjska opravila?*	Life activities	0.4 (0.7)	1.2 (1.2)	0.937
WHODAS24	Getting your household work done as quickly as needed? … *pri tem, da ste gospodinjska opravila opravili tako hitro, kakor jih je bilo treba?*	Life activities	0.7 (0.8)	1.5 (1.2)	0.937
WHODAS25	Your day-to-day work/school? … *pri opravljanju vsakdanjih službenih/šolskih obveznosti?*	Life activities	0.6 (0.9)	1.4 (1.3)	0.938
WHODAS26	Doing your most important work/school tasks well? … *pri tem, da ste najpomembnejše službene/šolske obveznosti opravili dobro?*	Life activities	0.9 (0.9)	1.6 (1.4)	0.937
WHODAS27	Getting all the work done that you need to do? … *pri tem, da ste dokončali vse delo, ki ste ga morali?*	Life activities	0.8 (1.0)	1.5 (1.4)	0.937
WHODAS28	Getting your work done as quickly as needed?... *pri tem, da ste svoje delo opravili tako hitro, kakor ga je bilo treba?*	Life activities	1.0 (1.0)	1.8 (1.3)	0.937
WHODAS29	How much of a problem did you have joining in community activities (for example, festivities, religious or other activities) in the same way anyone else can? … *pri vključevanju v skupnostne dejavnosti (npr. festivale, verske, ali druge aktivnosti)*	Participation	0.8 (1.1)	1.7 (1.2)	0.937
WHODAS30	How much of a problem did you have because of barriers or hindrances in the world around you? … *zaradi ovir ali preprek v svetu okoli vas?*	Participation	0.4 (0.7)	1.7 (1.5)	0.936
WHODAS31	How much of a problem did you have living with dignity because of the attitudes and actions of others? . .. *dostojno živeti zaradi odnosov in dejanj drugih?*	Participation	0.4 (0.7)	1.2 (1.3)	0.938
WHODAS32	How much time did you spend on your health condition, or its consequences? *Koliko časa ste porabili pri tem, da ste se ukvarjali s svojim zdravjem ali posledicami bolezni?*	Participation	0.5 (0.8)	1.0 (1.1)	0.938
WHODAS33	How much have you been emotionally affected by your health condition? *Do katere mere je vaše zdravstveno stanje čustveno vplivalo na vas?*	Participation	0.9 (1.0)	1.8 (1.2)	0.938
WHODAS34	How much has your health been a drain on the financial resources of you or your family? *Do katere mere je vaše zdravstveno stanje izčrpalo vaše osebne ali družinske finance?*	Participation	0.8 (1.0)	2.1 (1.4)	0.937
WHODAS35	How much of a problem did your family have because of your health problems? *Kako velike težave ima vaša družina zaradi vašega zdravstvenega stanja?*	Participation	0.1 (0.4)	1.1 (1.2)	0.937
WHODAS36	How much of a problem did you have in doing things by yourself for relaxation or pleasure? *Kako velike težave ste imeli pri tem, da ste se sami udejstvovali v prijetnih ali sproščujočih dejavnostih?*	Participation	0.2 (0.6)	1.2 (1.3)	0.937

Table 2. Item-level statistics.

We tested the results of WHO-DAS 2.0 for sampling adequacy. The KMO test yielded an overall MSA of 0.94, suggesting a marvelous suitability for factor analysis, as the underlying variables have a considerable degree of common variance. This was confirmed by calculating the determinant of the correlation matrix, which was 9.552348e-16. The determinant of the correlation matrix this small suggests near singularity of the data (i.e., some of the variables are very highly correlated with each other).

The goodness of fit of the confirmatory factor analysis was evaluated using multiple criteria. CFI was 0.804, TLI was 0.783, the Akaike criterion was 13701.702 and RMSEA was 0.108. Together, these indices of goodness of fit suggest a poor fit for the 7-factor solution for the Slovenian translation of WHODAS 2.0 scale.

To account for this, we additionally performed an exploratory factor analysis using PCA. We used Horn's parallel analysis to determine the appropriate number of factors. Horn's parallel analysis suggests that there are two underlying factors in the Slovene translation of the WHO-DAS 2.0 scale. Assuming independence between the factors, we used orthogonal varimax rotation to extract the two factors.

item	RC1	RC2	h2	u2	com	
WHODAS01	0.68		0.52	0.48	1.2	cognition
WHODAS02		0.8	0.66	0.34	1.1	cognition
WHODAS03	0.66		0.62	0.38	1.7	cognition
WHODAS04	0.6	0.61	0.73	0.27	2	cognition
WHODAS05	0.61		0.57	0.43	1.8	cognition
WHODAS06			0.49	0.51	2	cognition
WHODAS07	0.6		0.62	0.38	1.9	mobility
WHODAS08			0.21	0.79	1.3	mobility
WHODAS09			0.37	0.63	1.8	mobility
WHODAS10			0.46	0.54	2	mobility
WHODAS11			0.63	0.37	2	selfCare
WHODAS12			0.48	0.52	2	selfCare
WHODAS13	0.63		0.51	0.49	1.5	selfCare
WHODAS14	0.62		0.5	0.5	1.6	selfCare
WHODAS15			0.46	0.54	2	selfCare
WHODAS16			0.34	0.66	1.4	gettingAlong
WHODAS17		0.6	0.62	0.38	1.9	gettingAlong
WHODAS18		0.62	0.55	0.45	1.7	gettingAlong
WHODAS19		0.75	0.62	0.38	1.2	gettingAlong
WHODAS20	0.6		0.69	0.31	2	gettingAlong
WHODAS21			0.4	0.6	2	lifeActivities
WHODAS22	0.77		0.72	0.28	1.4	lifeActivities
WHODAS23	0.79		0.76	0.24	1.4	lifeActivities
WHODAS24	0.77		0.68	0.32	1.3	lifeActivities
WHODAS25	0.76		0.67	0.33	1.3	lifeActivities
WHODAS26	0.8		0.74	0.26	1.3	workSchool
WHODAS27	0.74		0.64	0.36	1.3	workSchool
WHODAS28	0.82		0.72	0.28	1.2	workSchool
WHODAS29	0.83		0.73	0.27	1.1	workSchool
WHODAS30	0.61	0.6	0.73	0.27	2	participation
WHODAS31		0.76	0.65	0.35	1.3	participation
WHODAS32		0.84	0.76	0.24	1.1	participation
WHODAS33			0.31	0.69	1.8	participation
WHODAS34			0.59	0.41	2	participation
WHODAS35		0.66	0.56	0.44	1.5	participation
WHODAS36		0.76	0.71	0.29	1.4	participation

Table 3. Item loadings.

Broadly speaking, items nominally classified as mobility, self-care, and difficulties with school and work load onto the first component (which we could thus conceptualize as *general functioning*), and getting along and participation load onto the second component (which could be conceptualized as *social functioning*). The items nominally related to cognition load variably onto both the first and the second principal component.

3.1. Construct validity: Cognitive difficulties

We tested the construct validity of WHO-DAS 2.0 against three measures: cognition, social dysfunction, and general dysfunction. Descriptive statistics for all relevant measures are presented in Table 4.

Variable	*M*	*SD*	*Range*	*Kurt*	*Skew*
Performance accuracy on CDT	*79.2*	*13.6*	*[26.0, 100.0]*	*2.7*	*-1.2*
SCL-90 - Interpersonal sensitivity	*6.5*	*6.4*	*[0.0, 33.0]*	*2.4*	*1.4*
SCL-90 - Hostility	*2.6*	*3.3*	*[0.0, 20.0]*	*9.2*	*2.6*
PHQ-9 - Item 10	*0.8*	*1.0*	*[0.0, 3.0]*	*-0.4*	*0.9*

Table 4. Descriptive statistics for measures used for validation.

We sought to assess whether our participants were able to self-report on their cognitive dysfunction. For 63 participants, scores on a working memory task were available. To ascertain convergent validity, we hypothesized that subjectively reported cognitive dysfunction on WHO-DAS 2.0 would be negatively correlated with performance accuracy on CDT. However, the Pearson correlation between self-reported cognitive difficulties, defined as the summation of scores on the items nominally falling under the cognition domain, and objectively measured performance on a cognitive task (i.e., the visual CDT) was not statistically significant with strong evidence supporting the null hypothesis: ($r(61) = -0.002$, $p = 0.939$, $BF_{10} = 0.157$, $BF_{01} = 6.357$).

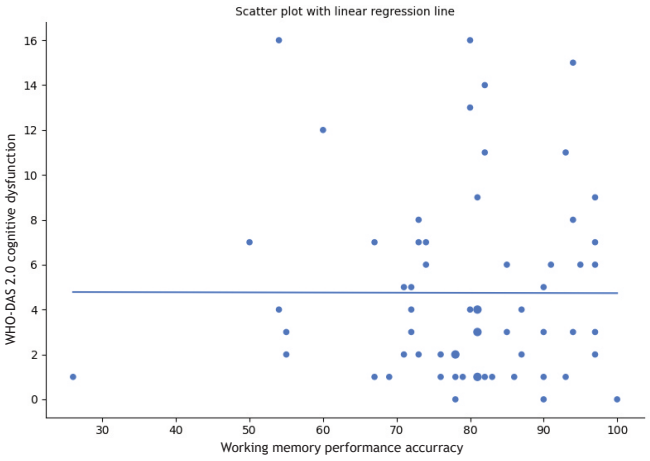

Figure 3. Correlation between objective performance on the change detection task and self-reported cognitive dysfunction.

We see that participants' self-reports on their cognitive difficulties do not correlate with objective performance as measured by the working memory task. Due to the low construct validity of this scale, as well as due to its cross-loading onto both general and social functioning factors, we removed the cognition domain from further analysis.

3.2. Construct validity: Social functioning

We evaluated the construct validity of the supposed social functioning factor that was derived from the Slovenian translation of the WHO-DAS 2.0 questionnaire with data obtained from participants included in the validation of the miniR-DoC battery. The latter included the SCL-90 questionnaire, which examines various domains of psychiatric symptoms. In particular, we were interested in two subscales of SCL-90: interpersonal sensitivity and hostility/hostility.

In the proposed social functioning dimension, we included $WHO\text{-}DAS_{16,\ 17,\ 18,\ 19,\ 21,\ 31,\ 32,\ 35,\ 36}$. We excluded items from the cognition domain due to the reasons reported in the following subsection. Additionally, $WHO\text{-}DAS_{10,\ 12}$ were excluded due to extremely similar factor loadings onto the supposed general functioning factor.

We observed a statistically significant correlation between both SCL-90 dimensions interpersonal sensitivity ($r(120) = 0.57$, $p < .001$) and hostility ($r(120) = 0.42$, $p < .001$), and social functioning.

However, the two-factor model proposed by our analysis yielded poor goodness of fit indices. CFI

was 0.783, TLI was 0.759, Akaike index was 9650.674, and RMSEA was 0.137. In other words, the two-factor model exhibited worse fit than the initial 7-factor model.

Model	CFI	TLI	AIC	RMSEA
Seven-factor	0.804*	0.783*	13701.702	0.108
Two-factor (w/o cognition)	0.783	0.759	9650.674*	0.137
One-factor (w/o) cognition	0.723	0.696	9865.622	0.154

Table 5. Goodness of fit indices

Overall, all three models that were tested exhibit poor structural validity. The nominal seven-factor model exhibits the best goodness of fit on three indices, whereas the two-factor model exhibits the best goodness of fit on the AIC.

3.3.Construct validity: Functional disability

To assess the construct validity of WHO-DAS 2.0 in general, we investigated the relationship between a simple summation of all its items (WHO-DAS_{Sum}) with item 10 of the PHQ-9 questionnaire. The latter inquiries into whether the responders experience the symptoms of depression, as measured by the first nine items of the questionnaire, are causing them difficulties in everyday functioning. We assumed that the responses to PHQ-9_{10} are measured on the interval scale. As such, we investigated the relationship between WHO-DAS_{Sum} with the Spearman rank-order correlation, which was statistically significant with strong evidence supporting the alternative hypothesis ($r_s(181) = 0.75$, $p < .001$, $BF_{10} = 8.562 \times 10^{+35}$, $BF_{01} = 1.168 \times 10^{-36}$). The relationship between WHO-DAS_{Sum} and PHQ-9_{10} is summarized in Figure 4.

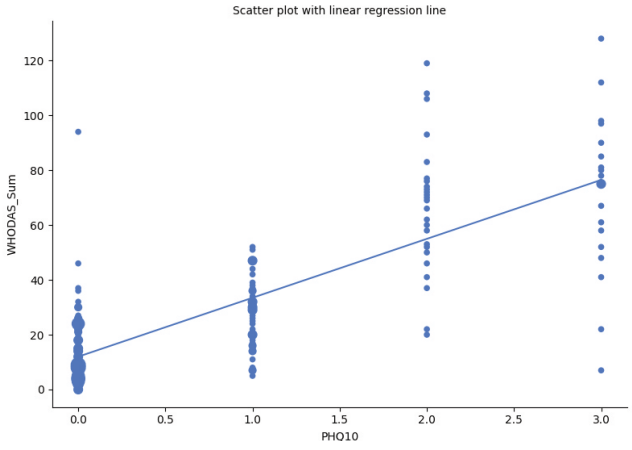

Figure 4. Correlation between WHO-DAS 2.0 and depression-related functional disability.

4. Discussion

The aim of the present paper was to establish the construct and structural validity of the Slovene translation of WHO-DAS 2.0. The long-form, self-reported version of the questionnaire was used. We used a variety of other measures (scores on PHQ-9 and SCL-90, and performance measures on the CDT) to evaluate the validity of the questionnaire. The Slovene translation of WHO-DAS 2.0 exhibited poor structural validity. We evaluated three models: the model splitting the WHO-DAS 2.0 items into the nominal domains of functional disability related to disease, as well as two exploratory models. The exploratory models were a one-factor model (a general factor of functional disability) and a two-factor model (general dysfunctionality and social dysfunctionality). Although both exploratory models exhibited good construct validity (i.e., were positively correlated with PHQ_{10} and the interpersonal sensitivity and hostility/hostility subscales of the SCL-90), they, on balance, exhibited worse goodness of fit indices than the original model.

We observed a significant difference in functional disability between patients with affective disorders and normative controls, replicating a large body of previous research pointing to this effect [23-27].

The results suggested that the Slovene sample of the model had a two-factor structure. The analysis revealed that the two components align with general and social dysfunctionality which offered a more precise representation of disability in psychiatric disorders. Distinguishing the two is also well-supported by the substantial evidence in literature. For instance, improvements in depressive disorders have been linked to progress in the social domain of functioning, with a lesser impact on the physical domain, highlighting the importance of separating these disfunctioning domains [28]. Besides, since social dysfunction often remains a separate, more persistent challenge in individuals with depression after treatment and often persists even after other symptoms have subsided, it gives the impression that general cognitive recovery does not translate into social recovery [29]. This coincides with previous studies demonstrating that remitted patients continue to experience loneliness, smaller network size, social

support and perceived social disability [30], even 10 years after follow-up of patients with major depressive disorder [31].

Furthermore, the results propose that the individuals from our research struggle to accurately estimate their cognitive impairment as their reports did not correlate with working memory tasks results of CDT. This can be understood as so that defeatist beliefs develop as a result of cognitive errors, unnoticed by the patient, that lead to impaired social functioning (Selwood et al, 2013). [32] also note that patients with depressive disorders may be particularly sensitive to common cognitive deficits, often believing that their brain is "broken", whereas patients experiencing psychosis tend to have lower confidence in their cognitive abilities and greater awareness of their deficits compared to control groups. These factors are key features to depressive disorders in which reduced cognitive confidence contributes to the persistence of difficulties. Moreover, patients with depression are less biased towards self-interest and could be more likely to attribute their problems to internal causes, together with cognitive difficulties [33]. In the same study with patients having first episode schizophrenia-spectrum disorder, those who had more severe depression and anxiety symptoms tended to report greater self-perceived cognitive deficits. Chang et al. [34] additionally state that even when working memory improvements are observed following cognitive remediation, these gains do not translate into self-reported improvements in psychiatric populations probably due to cognitive confidence, metacognitive biases, and mood-related appraisals.

Despite the poor measures of structural validity, we can conclude that the Slovene translation of WHO-DAS 2.0 can be used to collect data on functional disability in patients with depression, as the summed score of all the items is strongly positively correlated with SPQ-9_{10}; an item on a previously validated clinical scale that measures functional disability. It remains to be determined whether using a summation of all the items or specific domains is the most valid approach to be used on samples of Slovenian patients.

One of the ways in which we measured construct validity was to compare the subjectively reported difficulties with cognition and objectively measured performance accuracy on a working memory CDT. The patients' subjective reported cognitive difficulties were not correlated with objective drop in working memory performance.

5. Limitations and future directions

The present paper has several limitations. Firstly, the sample size is small. The limited participant pool may be the reason why we observed such poor measures of structural validity of WHO-DAS 2.0. Further data collection may be needed to provide a more comprehensive validation of the factor structure of WHO-DAS 2.0. Secondly, WHO-DAS 2.0 is intended to be used as a general questionnaire for measuring functional disability regardless of the underlying pathology. Future research should investigate a broader array of diagnoses when evaluating the construct validity of WHO-DAS 2.0.

6. Conclusion

In the present paper, we present the analysis of the structural and construct validity of the Slovenian translation of the WHO-DAS 2.0 questionnaire, which examines illness-related difficulties in everyday functioning. For the validation study, we used the long form, self-reported version of the questionnaire. The structural validity measures were inadequate across all three models tested, although the nominal model which differentiates WHO-DAS 2.0 into several domains of functional disability demonstrated the best goodness of fit. Construct validity was examined in three ways. Firstly, we examined the construct validity of the WHO-DAS 2.0 as a whole. The only questionnaire inquiring into psychiatric symptoms that has previously been validated in the Slovene language is PHQ-9, specifically item 10. We observed a significant relationship between $WHO\text{-}DAS_{Sum}$ and PHQ-9_{10}. This finding suggests that WHO-DAS 2.0 as a whole indeed measures functional disability. Subjectively reported cognitive dysfunction was not correlated with objective performance on the working memory CDT. We conclude that WHO-DAS 2.0 is a valid measure of functional disability in Slovenian patients with depression.

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