Functional limitations associated with mental disorders

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Chapter 2
Psychometric properties of the World Health Organization Disability Assessment Schedule

Version that was used in the European Study of the Epidemiology of Mental Disorders (ESEMeD)

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2.1 Abstract

Objective- To assess the factor structure, internal consistency, and validity of the WHO Disability Assessment Schedule (WHODAS) version used in the European Study of the Epidemiology of Mental Disorders (ESEMeD).

Method- In total 8796 adults were assessed using the ESEMeD WHODAS (22 severity and 8 frequency items). An Exploratory Factor Analysis (EFA) with promax rotation was done with a random 50%. The other half was used for confirmatory factor analyses (CFA) comparing models (a) suggested by EFA; (b) hypothesized a priori; and (c) reduced with four items. A CFA model with covariates was conducted in the whole sample to assess invariance across Mediterranean (Spain, France and Italy) and non-Mediterranean (Belgium, Germany and the Netherlands) countries. Cronbach's alphas and discriminatory validity were also examined..

Results- EFA identified 7 factors (explained variance: 84.7%). The reduced model (six factors, four frequency items excluded) presented the best fit. The second order factor structure also fitted well. Measurement non-invariance was found for Embarrassment. Cronbach's alphas ranged from 0.84 for Participation to 0.93 for Mobility. Preliminary data suggest acceptable discriminatory validity.

Conclusions- After excluding four frequency items, a two level hierarchical structure with six domains and one global disability factor was confirmed.

2.2 Introduction

Due to improvements in public health, fewer diseases in higher-income countries are fatal nowadays (Mathers and Loncar, 2006). The drawback of this increased survival rate, however, is that an increasing number of individuals experience limitations in their ability to function in everyday life (Mathers and Loncar, 2006). Apart from the difficulties at the individual level (Buist-Bouwman et al., 2004), diseases involving impairments lead to increased societal costs as well due to, for example, work loss (Goering et al., 1996; Kessler and Frank, 1997; Kouzis and Eaton, 1994), and the utilization of health and support services (Kouzis and Eaton, 1997).

To assess the disturbances in social adjustment and behavior in persons with mental and physical disorders, the World Health Organization Disability Assessment Schedule (WHODAS) was published in 1988 (http://www.who.int/icidh/whodas/ generalinfo.html). In 1998, the WHODAS-II was launched which was a completely revised version of the WHODAS to reflect the WHO's current thinking about functioning and disability as described in the

International Classification of Functioning, Disability and Health (ICF). In short, the ICF provides codes to describe the complete range of health states and the consequences of ill-health for both physical and mental disorders (World Health Organization, 2001). Psychometric testing of the WHODAS-II suggests a two level hierarchical structure in which individual items load onto one of six domains which in turn load on a global disability latent variable. There is a growing number of studies evaluating the psychometric properties of the WHODAS-II (Annicchiarico et al., 2004; Chisolm et al., 2005; Chopra et al., 2004; Chwastiak and Von Korff, 2003; Gallagher and Mulvany, 2004; Kim et al., 2005; McKibbin et al., 2004; van Tubergen et al., 2003), suggesting acceptable internal consistency, test-retest reliability, convergent validity and responsiveness to change.

Due to time pressures, a shortened version of the WHODAS-II was used in the European Study of the Epidemiology of Mental Disorders (ESEMeD) which sought to estimate the prevalence and associated disability using nationally representative, general population surveys in Europe. Compared to the original WHODAS-II, the ESEMeD WHODAS (1) is more time efficient, because less questions were asked and a filter question was employed for each multi item domain; (2) assesses overall role functioning (your normal daily activities) in stead of housework and employment separately; and (3) employs one frequency item in each scale while the WHODAS-II employs one frequency question per item.

This study examines the psychometric properties of the ESEMeD WHODAS. More specifically: (1) its factor structure, (2) internal consistency of the disability factors identified; (3) the robustness of the factor structure across countries, and (4) its validity. The assessment of the psychometric properties of the ESEMeD WHODAS is important, because its strengths and weaknesses are essential in interpreting data in the studies it is and will be used in.

2.3 Methods

A complete description of the methods is presented elsewhere (Alonso et al., 2002; The ESEMeD/MHEDEA 2000 investigators, 2004c). Briefly, ESEMeD is a cross-sectional survey representative of the adult population of Belgium, France, Germany, Italy, the Netherlands, and Spain. In total 21,425 individuals aged 18 years and older, residing in private households, were interviewed between January 2001 and July 2003. The overall response rate of the study was 61.2%, ranging from 45.9% in France to 78.6% in Spain. The ethics committees in each participating country approved these procedures and informed consent was obtained from all respondents.

2.3.1 The survey interview

2.3.1.1 Screening section

The screening section, located at the beginning of the interview, was administered to all 21,425 respondents. Depending on the responses provided in the mood and anxiety sections, two interview paths were chosen. Individuals who exceeded a number of anxiety or depresion symptoms ('high risk individuals') and a random subsample (25%) of the rest ('low risk individuals') followed the long path of the interview. The remaining 75% 'low risk' respondents followed the short path of the interview. In this study, only those who followed the long path of the interview (n=8796) were included in the analyses (figure 2.1).
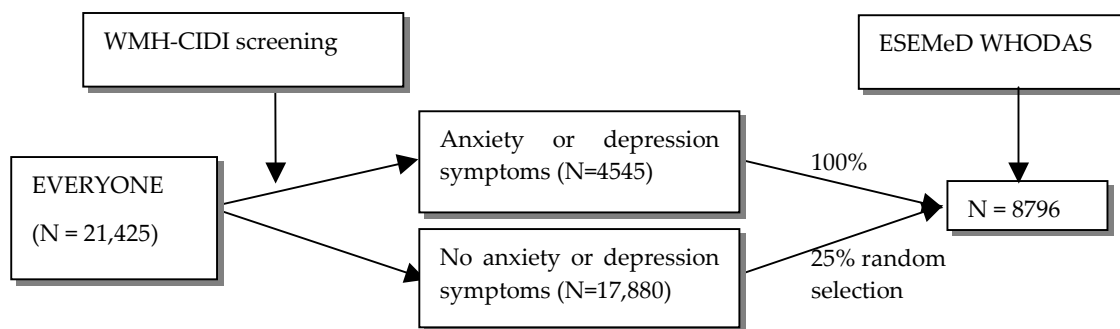
Figure 2.1. Flowchart indicating to whom the ESEMeD WHODAS was administered.

2.3.1.2 World Health Organization Disability Assessment Schedule (WHO-DAS)

The ESEMeD WHODAS (see appendix A) includes six scales: (a) Role Functioning, (b) Cognition, (c) Mobility, (d) Self-care, and (e) Social Interaction, (f) Participation. The first disability scale (Role Functioning) in the ESEMeD WHODAS is a radical departure from the WHODAS-II scale as global questions about overall role functioning rather than separate questions about housework and employment were used. The four questions that assessed Role Functioning were explicitly designed to define 'normal activities' in such a way as to encompass whatever it is that the respondent might normally do whether they are a homemaker or an employed person. Also, these questions were all frequency questions while other domains consist mostly of severity items. The total score on the scale 'Role Functioning' was calculated in such a way that each day out of role is assigned a score of 1, each day of cutback in quantity or quality is assigned a score of 0.5, and each day of extreme effort is assigned a score of 0.25. The sum is then transformed to a 0-100 scale, which indicates the percent of days a respondent was completely out of role.

In the multi item domains Cognition, Mobility, Self-care, and Social Interaction, respondents were initially asked a single general question about whether they had had any difficulty in the broad area of functioning in the past 30 days and, if so, they are asked about frequency and severity of the problems. These domains are scored in a 0 to 100 scale, where 0 represents no disability and 100 represents maximum impairment.

The last three questions in the Participation scale, i.e. Embarrassment, Discrimination, and Family burden, were only assessed in respondents that reported at least some limitations in other domains of functioning. Those that were not asked the question were assigned '0'. It was reasoned that since they did not report any disability in the previous questions, they were unlikely to experience embarrassment, discrimination, or family burden because of their health problems.

For all domains, respondents who refused to answer the question or indicated they did not know the answer were assigned a score of 0 in order to give conservative estimates about problems in functioning. The exact wording of the questions are presented in appendix A, located at the end of this thesis.

2.3.2 Statistical analyses

Structural equation models for categorical and continuous variables were used to assess the psychometric properties of the ESEMeD WHODAS. First, an exploratory factor analysis (EFA) with promax rotation was performed on a random 50% of the sample. Second, the remaining 50% of the sample was used to perform confirmatory factor analyses to compare three different models: (a) the model suggested from the results of the EFA, (b) the theoretical WHO model that assumed six disability factors, and (c) a reduced model, in which the same six domains as in model b were tested, but without the frequency items FD10a (Cognition), FD12a (Mobility), FD14a (Self-care), and FD16a (Social Interaction). Third, a CFA with covariates (MIMIC model) was estimated to test for invariance and population heterogeneity across countries, that were grouped into Mediterranean (Spain, France and Italy) and non-Mediterranean (Belgium, Germany and the Netherlands). Fourth, a single second order factor, including the first-order factors, was specified and tested using CFA. Fifth, internal consistency of the ESEMeD WHODAS was determined by calculating Cronbach's alpha for each domain. Cronbach's alpha indicated good internal consistency for group comparisons if it is higher than 0.70 and good internal consistency for individual comparisons if it is 0.90 or above. Finally, the discriminating validity of the ESEMeD WHODAS was examined by comparing individuals (a) without any lifetime mental disorder; (b) any lifetime disorder,

but not active in the past 12 months; (c) any non-severe mental disorder in the past 12 months; and (d) any severe mental disorder in the past 12 months.

The data were weighted to account for the different probabilities of selection as well as to restore age and gender distribution of the population within each country and the relative dimension of the population across countries.

EFA and CFA for categorical and continuous variables were performed with MPLUS, version 4.2 (Muthén and Muthén, 2006). Factors were selected in the EFA taking into account the residuals and the percent of variance explained and also based on the interpretability of the results. In CFA, robust weighted least squares estimator was applied (WLSMV in M-PLUS), that uses a diagonal weight matrix with robust standard errors and mean- and variance-adjusted χ^2 test statistic. Goodness of fit (GOF) was assessed with the following fit indices: (a) Confirmatory Fit Index (CFI), and (b) Tucker-Lewis Index (TLI) which both indicate good fit if their values exceed 0.95 (Hu and Bentler, 1999), (c) Root Mean Square Error of Approximation (RMSEA) which indicates adequate fit if it is less than 0.08, and good fit if the value is less than 0.05 (Browne and Cudeck, 1993), (d) Weighted Root Mean Square Residual (WMRM) indicates good fit if it is less than 1.0. A decisive argument for electing TLI and WMRM was that they are relatively independent of the sample size compared with other common indices. Other issues that were taken into account to assess model fit were: the degree of significance of the factor loadings and the fact that the residual variances did not take negative values for any of the items. Estimation methods implemented in M-PLUS for the analysis of complex survey data were used.

The internal consistency and validity analyses were performed with SAS™ software version 9.01 (SAS institute Inc, 2006) and SUDAAN software version 9, a statistical package used to estimate standard errors of data obtained from surveys with a complex sampling design (Research Triangle Institute, 2005).

2.4 Results

2.4.1 Descriptive

Table 2.1 presents the activity limitations and participation restrictions in the ESEMeD sample. The activities in which relatively many individuals experienced limitations in the past 30 days include reduced quantity of work (FD7; 13,9%) and being emotionally affected (FD18b; 14.3%), while activities in which few individuals experienced limitations are: controlling their emotions when being around people (FD17e; 1.5%) and experiencing discrimination or unfair treatment: (FD21; 1.5%)..

Table 2.1. Activity limitations and participation restrictions in the ESEMeD sample.

Item[1]	% (sd) with limitations	Mean (SD)	
		Overall	With limitations
Role Functioning			
FD4 (unable to work)[2]	8.3 (11.9)	1.1 (6.6)	11.7 (15.7)
FD7 (reduced quantity)[2]	13.9 (18.8)	2.8 (10.6)	16.3 (17.7)
FD8 (reduced quality)[2]	9.4 (12.8)	1.3 (7.3)	13.4 (16.4)
FD9 (effort) [2]	10.3 (13.6)	1.5 (8.1)	14.2 (15.8)
Cognition			
FD10a (frequency)[2]	5.3 (6.9)	0.5 (4.0)	10.0 (12.3)
FD11a (concentrating)[3]	3.8 (4.7)	1.1 (0.5)	2.9 (0.9)
FD11b (understanding)[3]	2.1 (2.6)	1.0 (0.3)	2.6 (0.7)
FD11c (remembering)[3]	3.4 (4.6)	1.1 (0.4)	2.7 (0.9)
FD11d (learning)[3]	2.3 (2.7)	1.0 (0.4)	3.0 (1.0)
Mobility			
FD12a (frequency)[2]	12.7 (18.6)	2.2 (12.0)	17.6 (18.1)
FD13a (standing)[3]	11.1 (16.4)	1.3 (1.4)	3.4 (1.5)
FD13b (moving in home)[3]	8.5 (12.1)	1.2 (0.9)	2.9 (1.2)
FD13c (walking)[3]	11.0 (16.4)	1.3 (1.5)	3.8 (1.5)
Self-care			
FD14a (frequency)[2]	3.2 (4.9)	0.6 (6.3)	18.4 (18.0)
FD15a (washing)[3]	2.6 (4.0)	1.1 (0.7)	3.4 (1.4)
FD15b (dressing)[3]	2.6 (4.0)	1.1 (0.6)	3.2 (1.3)
FD15c (being alone)[3]	1.6 (2.4)	1.0 (0.5)	3.5 (1.8)
Social Interaction			
FD16a (frequency)[2]	3.6 (5.0)	0.5 (5.1)	14.3 (15.4)
FD17a (conversing)[3]	1.8 (2.3)	1.0 (0.3)	2.8 (0.9)
FD17b (unknown people)[3]	1.7 (2.2)	1.0 (0.4)	3.1 (1.5)
FD17c (friendship)[3]	1.6 (2.0)	1.0 (0.3)	2.8 (0.9)
FD17d (new friends)[3]	2.1 (2.9)	1.1 (0.6)	3.6 (1.6)
FD17e (control emotions)[3]	1.5 (1.9)	1.0 (0.3)	2.7 (0.8)
Participation			
FD18b (emotionally affected) [3]	14.3 (19.2)	1.2 (0.9)	2.5 (1.0)
FD18c (family financial burden) [3]	6.6 (9.1)	1.1 (0.7)	2.7 (1.2)
FD18d (joining activities) [3]	10.1 (13.8)	1.2 (1.0)	3.0 (1.6)
FD18e (barriers in world around)[3]	7.7 (11.1)	1.1 (0.9)	2.9 (1.7)

Table 2.1 (continued)..

FD20 (embarrassment) [3]	5.5 (7.8)	1.1 (0.6)	2.7 (1.4)
FD21 (discrimination) [3]	1.5 (1.8)	1.0 (0.4)	2.8 (1.5)
FD22 (family burden) [3]	6.3 (8.6)	1.1 (0.6)	2.6 (1.2)

1: see appendix A for exact wording of items; 2: mean is based on the number of days (0-30) a person reported having difficulties; 3: mean is based on the following values: (1) no difficulties, (2) mild difficulty, (3) moderate difficulty, (4) severe difficulty, and (5) spontaneous ´could not do´.

2.4.2 Factor structure of the ESEMeD WHODAS

Table 2.2 shows the results of the exploratory factor analysis on a random 50% of the total sample. Seven factors were found which explained 84.7% of the variance. Frequency and severity items tended to load on different factors. Two frequency items, FD10a (Cognition) and FD16a (Social Interaction), loaded on a separate factor altogether. FD14a (Self-care) presented small loading in all factors (<0.3). In the subsequent confirmatory factor analyses, FD14a was kept with the fifth factor, because factor loading was highest for that factor and it was consistent with the a priori theory.

Table 2.2. Exploratory factor analysis on the items from the ESEMeD WHODAS.

	Component						
	I	II	III	IV	V	VI	VII
Role Functioning							
FD4 (unable to work)	.869	-.023	-.079	-.026	.032	.013	-.014
FD7 (reduced quantity)	.676	.035	-.049	.013	.011	.051	.005
FD8 (reduced quality)	.911	.035	.046	-.042	-.044	.001	.003
FD9 (effort)	.841	-.007	.024	.023	-.052	.001	.043
Cognition							
FD10a (frequency)	.074	.251	.462	-.020	-.054	-.077	-.018
FD11a (concentrating)	.043	.884	-.018	-.048	.085	.072	-.011
FD11b (understanding)	.058	.973	-.133	.031	-.039	-.033	.041
FD11c (remembering)	-.060	.867	.082	.094	-.082	.070	.058
FD11d (learning)	-.040	.806	.035	-.001	.069	.152	-.019
Mobility							
FD12a (frequency)	.175	-.013	.228	.567	-.032	-.150	.024
FD13a (standing)	-.024	.061	-.051	.693	.219	.041	.166
FD13b (moving in home)	.026	.072	-.093	.563	.286	.056	.223
FD13c (walking)	-.043	.021	-.038	.719	.194	.096	.162

Table 2.2 (continued).

Self-care							
FD14a (frequency)	.262	-.081	.268	.023	.294	-.076	-.050
FD15a (washing)	-.007	-.018	.008	.071	.864	.070	.109
FD15b (dressing)	-.003	.091	-.018	.112	.864	.040	-.018
FD15c (being alone)	-.015	-.099	-.006	.058	.675	.099	.368
Social Interaction							
FD16a (frequency)	.061	-.122	.728	-.056	-.029	.136	.015
FD17a (conversing)	.000	.163	.011	-.029	.115	.851	-.053
FD17b (unknown people)	.009	.032	.022	-.024	.179	.789	.084
FD17c (friendship)	.021	.075	.005	.082	-.064	.852	.065
FD17d (new friends)	-.010	-.061	.087	.049	.036	.786	.222
FD17e (control emotions)	.020	.216	.012	-.078	-.063	.760	.117
Participation							
FD18b (emotionally affected)	-.017	.254	.024	.081	-.115	.081	.647
FD18c (family financial burden)	.028	-.040	-.014	-.042	-.002	-.078	.942
FD18d (joining activities)	.047	-.040	-.005	.178	-.075	.228	.700
FD18e (barriers in world around)	.015	-.147	.004	.211	-.122	.136	.796
FD20 (embarrassment)	.004	.223	.015	-.040	.197	-.025	.602
FD21 (discrimination)	-.021	.059	.015	-.145	.162	-.114	.897
FD22 (family social life burden)	.038	.109	.023	-.002	.131	.189	.601
Cumulative percent of variance explained	53.0%	63.6%	70.9%	75.0%	79.0%	82.1%	84.7%

Chi-square: 91.187 (df: 27); RMSEA: 0.024; grey cells indicate best fit for each individual item.

2.4.3 Comparing three competing models

Three confirmatory factor analyses were performed on the remaining 50% of the ESEMeD sample. To indicate fit, we used four fitindices. The results presented in Table 2.3 suggest that the data fitted the EFA-model (developed in the exploratory factor analysis) well according to CFI and TLI, acceptably (RMSEA), and not so good (WRMR) depending on the fitindex used. The a priori model fitted slightly worse, although still good according to the TLI. The CFI and RMSEA were acceptable but the WRMR was not good. The reduced model (6 factors, without four frequency items) outperformed the other two models, as all fit indices indicated good fit.

Table 2.3. Comparison of fit indices of the confirmatory factor analyses for the new model as found in the exploratory factor analysis, the model as it was a priori designed in ESEMeD, and the reduced model in which frequency items were left out.

	WHODAS models		
	Exploratory	A priori	Reduced
X^2 (df)	411.609 (31)	787.403 (32)	118.049 (33)
CFI	0.958	0.916	0.992
TLI	0.977	0.956	0.996
RMSEA	0.053	0.073	0.024
WRMR	1.925	2.649	0.969

Internal consistency was determined for the disability scales in the a priori model and the reduced model (Table 2.4) using the full sample of 8796 individuals, because the factor structure in the two subsamples was similar. All disability scales have good internal consistency for group comparisons. The disability scales based on the reduced model perform slightly less compared to the disability scales based a priori model, but are still very good. The slightly lower Cronbach's alpha of the factors without the frequency items might be due to the fact that Cronbachs alpha tend to increases as the number of items increase.

Table 2.4. Internal consistency (Cronbach's alpha) of the domains of functioning identified in the ESEMeD WHODAS.

Domains of functioning	Cronbach's alphas of WHODAS models	
	A priori	Reduced
Global disability	0.94	0.93
Role Functioning	0.90	0.90
Cognition	0.89	0.88
Mobility	0.94	0.93
Self care	0.92	0.89
Social Interaction	0.91	0.91
Participation	0.84	0.84

2.4.4 Global disability latent variable

It is unclear whether one or two global disability latent variables underpin the observed associations between the disability scales. The two-dimensional model would encompass activity limitations (Cognition, Self-care, Mobility, Social Interaction) and participation restrictions (Role Functioning and Participation).

The one- and two-dimensional models were tested on the three sets of factor scales as derived in the three competing models. The solution for the two-dimensional model (activity limitations, participation restrictions) was not positive definite in any of the three sets of factor scales, suggesting a very high correlation between the two dimensions. The one-dimensional fitted rather well in all three sets of factor scales as indicated by the CFI and TLI (Table 2.5). The RMSEA indicated acceptable fit in the exploratory and the a priori model, while it indicated good fit in the reduced model. None of the models (sets of factor scales) had acceptable WRMR as indicated by a score below 1.5, but the reduced model performed best. In every model, Role Functioning presented a low R^2, which indicates that the one-dimensional second order factor of global disability only partly covers the role functioning domain.

Table 2.5. Comparison of fit indices of the global disability factor for the new model as found in the exploratory factor analysis, the model as it was a priori designed in ESEMeD, and the reduced model in which frequency items were left out.

	WHODAS models		
	Exploratory	A priori	Reduced
X^2 (df)	436.830 (23)	544.486 (25)	165.699 (25)
CFI	0.954	0.942	0.987
TLI	0.966	0.961	0.991
RMSEA	0.064	0.069	0.036
WRMR	2.728	2.880	1.556
Latent variable R^2			
Role Functioning	0.204	0.201	0.158
Cognition	0.679	0.669	0.665
Mobility	0.687	0.696	0.715
Self care	0.820	0.823	0.816
Social Interaction	0.667	0.708	0.712
Participation	0.869	0.882	0.908
FD10a/FD16a	0.393	---	---

2.4.5 Validity of the ESEMeD WHODAS

To examine the discriminatory validity of the ESEMeD WHODAS, the following groups known to differ in activity limitations were used: 1) individuals without any lifetime mental disorder; 2) individuals with a lifetime, but not active in the past 12 months; 3) individuals with a mental disorder in the past 12 months that was a) not severely, or b) severely interfering with work, social life, or personal relationships. It was hypothesized that the first group functioned best on all

disability scales measured by the ESEMeD WHODAS and those with severely interfering 12-month mental disorder the worst. The data clearly supported the hypothesis (Table 2.6) .The level of activity limitations and participation restrictions increased with the level of severity as defined by the groups. Individuals without any lifetime mental disorder functioned better than any other group whereas those with a severely interfering 12-month mental disorder did worst.

Table 2.6. Activity and participation limitations in respondents with gradient on severity of mental disorders.

	No life-time mental disorder		Life-time, but not active in past 12 months		Non-severe mental disorder in past 12 months		Any severe mental disorder in past 12 months	
	%	Mean(95% CI)	%	Mean(95% CI)	%	Mean(95% CI)	%	Mean(95% CI)
Role funct.	60.4	7.3(6.6-8.0)	55.3	9.7(8.3-11.1)	64.5	15.4(10.5-19.3)	61.5	23.1(20.2-26.0)
Cognition	2.8	0.3(0.1-0.4)	5.5	0.4(0.3-0.5)	12.1	1.0(0.6- 1.4)	22.7	4.4(3.4-5.5)
Mobility	10.1	3.5(2.9-4.1)	13.5	3.4(2.6-4.2)	18.3	5.8(3.1- 8.5)	26.8	9.4(7.6-11.2)
Self-care	2.2	0.8(0.5-1.1)	3.2	0.6(0.4-0.8)	6.3	2.1(0.5-3.6)	9.1	2.9(1.7- 4.1)
Social	1.6	0.3(0.1-0.4)	4.0	0.5(0.3-0.7)	5.7	1.0(0.1-2.0)	12.8	3.3(2.3-4.3)
Participation	17.1	2.3(2.0-2.6)	23.9	3.3(2.8-3.8)	38.0	6.3(4.4-8.3)	49.6	11.7(10.1-13.4)

NOTE: Severity of the disorder is based on question of interference asked in each of the disorder sections: "You mentioned having XXX problems I just asked you about. How much did your XXX and these other problems interfere with either your work, your social life, or your personal relationships during that episode- not at all, a little, some, a lot, or extremely?"

To further examine the validity of the ESEMeD WHODAS we also compared individuals with physical disorders who reported 1) no, 2) moderate, or 3) severe interference of their physical disorders with work, social life, or their personal relationships (results not presented here). A similar gradient in WHODAS-II activity limitations and participation restrictions was found.

2.5 Discussion

The ESEMeD WHODAS is a modified version of the WHODAS-II, in which filter questions were used and the number of questions reduced to make it less time-consuming. We found one unidimensional global disability latent variable that was an accurate summary of the subscale scores. This does not exclude a possible hierarchy between Cognition, Mobility, Self-care, and Social Interaction on the one hand and Role Functioning and Participation on the other hand as the latter two regard a more general level of functioning. The Global Disability variable consisted of six distinct subscales: Role Functioning, Cognition, Mobility, Self-care, Social Interaction, and Participation which is in accordance

with the WHODAS-II. Role Functioning, however, retained much unique variance not shared with Global Disability. Excluding four frequency items (Cognition, Mobility, Self-care, and Social Interaction) from the questionnaire improved the underlying factor structure. Also, validity and internal consistency of the ESEMeD WHODAS was acceptable and the factor structure was comparable in Mediterranean and non-Mediterranean countries.

The findings reported in this paper should be interpreted in light of the following potential limitations. First, the prevalence of disability in some domains is unexpectedly low. This may be due to the nature of the sample, a general population sample, but it is also possible that the filter questions may have been too stringent. This may have reduced the ability of the ESEMeD-WHODAS to differentiate individuals with relatively mild levels of functional limitations from individuals who are not disabled at all. A second limitation concerns the very skewed data while most statistical procedures assume a normal distribution. Solutions to this problem may be to (a) use statistical procedures that do not rely on a normal distribution, but can handle very skewed and even zero-inflated data, (b) categorize limitations in 'zero' 'some', and 'many', or (c) dichotomize at the 90th percentile of the population scores. The most profitable strategy depends on the purpose of the study. A third potential limitation is that Role Functioning retained much unique variance that was not explained by the unidimensional latent Global Disability factor. This may be related to the fact that the Role Functioning questions are all frequency questions whereas the other domains consisted exclusively of intensity questions. Therefore, it might be better to not include the Role Functioning in the overall disability scale but use it separately as an index of limitations in functioning at home or in paid employment. Finally, , ESEMeD is a cross-sectional study. Some important psychometric properties, such as responsiveness to change and test-retest reliability, could not be measured due to the cross-sectional design and should be addressed in future studies.

2.6 Conclusion

The current study suggests that the ESEMeD WHODAS may well be a valuable shortened version of the WHODAS-II to measure activity limitations and participation restriction, but further longitudinal research needs to be conducted to confirm these conclusions and measure responsiveness to change and test-retest reliability of the ESEMeD WHODAS.