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Research Article

Utility of the World Health Organization Disability Assessment Scale Short Version and the WHO Minimal Generic Data Set Covering Functioning and Health in Assessing Discharge Disposition after Sub-acute Stroke Rehabilitation

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Abstract

In search for the best instruments that are accurate and efficient in distinguishing discharge dispositions after inpatient rehabilitation post stroke, more studies using varying outcome measures are needed; especially measures with diverse domains including patient and family perceptions and participation instead of just activities of daily living. In this cross-sectional cohort study among 229 consecutive subacute stroke rehabilitants, the utility of two short ICF (International Classification of Functioning, Disability and Health) -based measures in differentiating three discharge categories (rehabilitants discharged into the community without or with service or to an institution) was investigated and compared with two traditionally used outcome instruments. All these instruments, the self-reported 12-item World Health Organization (WHO) Disability Assessment Scale (WHODAS), the 7-item WHO minimal generic data set covering functioning and health, Functional Independence Measure (FIM) and modified Rankin Scale differentiated the three discharge categories. No WHODAS proxy responses were missing, but thirty patients were not fit to respond themselves. Significant differences were found in all component, domain and item level comparisons between the subgroups discharged home and those institutionalized in proxy ratings, some fewer in patient ratings. The items that differentiated all three discharge categories in both patient and proxy ratings were standing, walking, washing, dressing and household activities. The accuracy of WHODAS proxy sum and FIM total score at discharge for predicting institutionalization were high (AUC WHODAS 0.88 and FIM 0.95), the optimal cut-off scores being 30 and 80 points, respectively. WHODAS-12 is recommended for determining discharge destination and allocation of social services.

Keywords: Discharge disposition; Inpatient; Rehabilitation; Stroke; Subacute; WHODAS

Abbreviations

WHODAS: World Health Organization Disability Assessment Scale; FIM: Functional Independence Measure; mRS: modified Rankin Scale; AUC: Area Under Curve: ROC: Receiver Operating Curve; IQR: Interquartile Range; Cl: Confidence limits

Introduction

A team of rehabilitation specialists is largely responsible for determining the most appropriate discharge destination after subacute inpatient stroke rehabilitation. It is important to identify accurately and efficiently the rehabilitants´ discharge disposition to secure a timely, safe and successful transition. Functioning assessed with Functional Independence Measure (FIM) has been the most common predictor of discharge disposition, however, yielding variable cut-off scores [1-9]. Several outcome measures have been utilized [6-8,10,11], but usually these instruments are time-consuming and measure only motor or cognitive functions or activities of daily living (ADL) leaving out participation, which is considered the ultimate goal of all treatment and rehabilitation and of great importance when returning into the community.

After the acute stage of stroke, instruments encompassing other variables besides ADL should be added to obtain a longitudinal insight into the seriousness of consequences in diverse domains [11]. Better use of existing validated measures to describe stroke symptoms and outcomes would facilitate comparison between studies and allow pooling of data [7]. For a more comprehensive assessment a more multidimensional measure including ability to participate in personal life and society would be needed [12,13]. Also, individualization of assessment including patient and family perceptions [7,14], using self-reported measures [15-17] and shifting weight from merely patient- to more family-centered operational models [4] would be beneficial. In addition, more information on the influence of discharge functional status on these decisions is needed as most studies have concentrated on admission scores [1,18-22]. In the search for the best instruments that are easy to use [11] more studies using varying outcome measures are needed to determine which measures to prioritize [8]. The search for the best instrument has not yet been closed [11].

The objective of this study was to evaluate the utility of the shortest International Classification of Functioning, Disability and Health (ICF) -based instruments, the 12-item patient and proxy World Health Organization (WHO) Disability Assessment Scale (WHODAS) and the WHO minimal generic data set covering functioning and health in differentiating discharge dispositions (home without or with service or institution) at discharge of subacute inpatient stroke rehabilitation. These measures encompass items from body functions, activities and participation and they have not been used before in this context. For comparison, two traditional tools for measuring stroke rehabilitation outcomes, Functional Independence Measure (FIM) and modified Rankin Scale (mRS) we used.

Patients and Methods

On a university hospital inpatient rehabilitation ward, 229 consecutive stroke patients were included in the study between August 2015 and March 2019. The rehabilitants were divided into three subgroups, those discharged home without (n=65) or with (n=85) social service (assistance), and those institutionalized (n=79). Patients and methods are described in more detail in part one of this study [23].

A rehabilitation nurse qualified in agreement with the Uniform Data System standards assessed the level of dependence of each rehabilitant at admission and discharge using an electronic FIM® tool. At discharge, a neurologist assessed functioning using the World Health Organization (WHO) minimal generic data set and mRS. The rehabilitants and their significant others filled in the 12-item patient and proxy WHODAS 2.0. To avoid missing data, in some cases the participants were assisted by a clinician. However, thirty patients were not capable of responding themselves because of aphasia or severe stroke with cognitive impairment. The participants were blinded for each others´ responses.

Scales

FIM [24] was designed to measure physical and cognitive disability in 18 items on a scale 1-7 ("no activity" – "complete independence"). It is focused on dependence and need of assistance in ADL [9]. (http://udsmr.org).

A more simple tool of disability or dependence, mRS, encompasses seven levels; 0: independent patients with no residual symptoms, 1: no significant disability despite symptoms, able to carry out all previous duties and activities 2: slight disability, unable to carry out all previous activities, but able to look after own affairs without assistance 3: moderate disability, requiring some help but able to walk independently 4: moderately severe disability, unable to walk and attend to bodily needs without assistance 5: severe disability, bedridden, incontinent and requiring constant nursing care and attention, 6 death [17,25].

Both WHODAS 2.0 (http://www.who.int/classifications/icf/whodasii/en/) and the WHO minimal generic data set are generic ICF-based measures. The 12-item WHODAS includes 12 items from six domains in two components, i.e. activities: cognition (learning and concentration), mobility (standing and walking), and self-care (washing and dressing oneself) and participation: relationships (dealing with strangers and maintaining friendships), life activities (doing housework and ability to work or study), and social participation (emotional functions and engaging in community). Each item is scored 0-4 (no, mild, moderate, severe or total/ extreme difficulty). Total scores 1-4 mean mild, 5-9 moderate, and 10-48 severe disability [26-28].

The WHO minimal generic data set covering functioning and health consists of seven domains: energy and drive functions, emotional functions, sensation of pain, carrying out daily routine, walking, moving around, and remunerative employment. The scoring system is similar to WHODAS, the sum score ranging from 0 to 28 [29]. In this study, both assessments were made according to the current functional status at the time of discharge.

The same dataset was used in part 1 of this study. Part of the participants were also included in previous studies [15,30,31].

Statistical analysis

The comparisons between the three rehabilitant subgroups for continuous variables were carried out using the non-parametric Kruskal-Wallis test and for pairwise comparisons the Mann-Whitney U-test with Bonferroni correction was used. Difference on Hodges-Lehmann estimate for median difference was used. Sensitivity and specificity were determined by using different thresholds for discharge FIM scores to find out which previously defined cut-off point placed the most rehabilitants in the three discharge categories. Finally, receiver operating characteristic (ROC) curves using WHODAS and FIM scores were generated to compare their discriminative accuracy (area under curve, AUC) and Yanden index applied to calculate the optimal cut-off point on the ROC curve. WHODAS proxy rating was used as no proxy responses were missing.

Results

Patient and proxy WHODAS sum score clearly differentiated the three discharge categories. Between the subgroups discharged home (n=150) and those institutionalized (n=79), significant differences were found in all component, domain and item level comparisons in proxy ratings, some fewer in patient ratings. Between all three subgroups, significant differences were found in all pairwise component, domain and item level comparisons in proxy ratings except between the two categories discharged home in 3 domains and 7 items (learning, concentrating, joining in community, emotional functions, dealing with people, maintaining friendships and work/ study), in patient ratings again some fewer. The items that differentiated all three subgroups in both patient and proxy ratings were standing, walking, washing, dressing and household activities (Table 1).

Table 1. Functioning of the rehabilitant subgroups (discharge categories) assessed with WHODAS-12 using Kruskal-Wallis test. Between-group difference on Hodges-Lehmann estimate for median difference. All pairwise comparisons are Bonferroni corrected.

	Home without service	Home with service	Institution	Group 1 vs 2	Group 1 vs 3	Group 2 vs 3	Groups 1+2 vs 3
	Group 1	Group 2	Group 3	difference between medians (95% Confident limits), p			
	patient n = 65	patient n = 79	patient n =55				
Variables (Median, IQR, range)	proxy n = 65	proxy n = 85	proxy n = 79				
WHODAS patient sum	12 (6, 18; 0-43)	18 (12, 23; 1-48)	24 (17, 31; 7-40)	-5 (-8, -2), 0.002	12 (9, 15), <0.0004	6.5 (3, 10), <0.0004	9 (6, 12), <0.0004
items:							
standing	1 (0, 2; 0-4)	2 (1, 4; 0-4)	3 (1, 4; 0-4)	-0.5 (-1, 0), 0.003	1.5 (1, 2), <0.0004	0.5 (0, 1), 0.1	1 (0, 2), 0.0004
household activities	1 (0, 2; 0-4)	2 (1, 4; 0-4)	4 (2, 4; 0-4)	-1 (-1, -1), <0.0004	1.5 (1, 2), <0.0004	0.5 (0, 1), 0.005	1.5 (1, 2), <0.0004
learning	1 (0, 2; 0-4)	1 (0, 2; 0-4)	1 (0, 3; 0-4)	0 (0, 0), 1.0	0.5 (0, 1), 0.3	0.5 (0, 1), 0.8	0.5 (0, 1), 0.03
joining in community	1 (0, 1; 0-4)	1 (0, 2; 0-4)	2 (0, 3; 0-4)	-0.5 (-1, 0), 0.6	0.5 (0, 1), 0.006	0.5 (0, 1), 0.007	0.5 (0, 1), 0.009
emotional functions	1 (0, 2; 0-4)	1 (0, 2; 0-4)	1 (1, 2; 0-4)	-0.5 (-1, 0), 1.0	0.5 (0, 1), 0.3	0.5 (0, 1), 1.0	0.5 (0, 1), 0.5
concentrating	1 (0, 2; 0-4)	1 (0, 2; 0-4)	1 (0, 2; 0-4)	0 (0, 0), 1.0	0 (0, 0), 1.0	0 (0, 0), 1.0	0 (0, 0), 1.0
walking	1 (0, 2; 0-4)	2 (1, 4; 0-4)	4 (4, 4; 0-4)	-1 (-2, 0), <0.0004	2.5 (2, 3), <0.0004	1 (0, 2), <0.0004	1.5 (1, 2), <0.0004
washing	0 (0, 1; 0-4)	1 (0, 2; 0-4)	3 (1, 4; 0-4)	-0.5 (-1, 0), <0.0004	2.5 (2, 3), <0.0004	1.5 (1, 2), <0.0004	1.5 (1, 2), <0.0004
dressing	0 (0, 1; 0-4)	1 (0, 2; 0-4)	2 (1, 3; 0-4)	-0.5 (-1, 0), 0.003	1.5 (1, 2), <0.0004	1.5 (1, 2), <0.0004	1.5 (1, 2), <0.0004
dealing with people	0 (0, 1; 0-4)	0 (0, 1; 0-4)	0 (0, 1; 0-4)	0 (0, 0), 1.0	0 (0, 0), 1.0	0 (0, 0), 1.0	0 (0, 0), 1.0
maintaining friendships	0 (0, 1; 0-4)	0 (0, 1; 0-4)	0 (0, 2; 0-4)	0 (0, 0), 1.0	0 (0, 0), 1.0	0 (0, 0), 0.9	0 (0, 0), 0.9
work/ study	3 (1, 4; 0-4)	3 (2, 4; 0-4)	4 (2-4; 0-4)	0 (0, 0), 1.0	0.5 (0, 1), 0.2	0.5 (0, 1), 0.3	0.5 (0, 1), 0.1
domains:							
cognition	0.5 (0, 1.5; 0-4)	1 (0, 1.5; 0-4)	1 (0.5, 2; 0-4)	-0.25 (-0.5, 0), 1.0	0.25 (0, 0.5), 0.3	0.25 (0, 0.5), 0.9	0.25 (0, 0.5), 0.4
mobility	1 (0, 2; 0-4)	2 (1, 3.5; 0-4)	3.5 (2, 4; 0-4)	-1 (-1.5, -0.5), <0.0004	2 (1.5, 2.5), <0.0004	1 (0.5, 1.5), 0.0008	1.5 (1, 2), <0.0004
self-care	0 (0, 1; 0-4)	1 (0, 2; 0-4)	2.5 (1.5, 3.5; 0.5-4)	-0.5 (-1, 0), <0.0004	2 (1.5, 2.5), <0.0004	1.25 (1, 1.5), <0.0004	1.5 (1, 2), <0.0004
getting along	0.5 (0, 1; 0-4)	0.5 (0, 1; 0-4)	0.5 (0, 1; 0-4)	0 (0, 0), 1.0	0 (0, 0), 1.0	0 (0, 0), 1.0	0 (0, 0), 1.0
life activities	2 (1, 2.5; 0-4)	2.5 (1.5, 3.5; 0-4)	3 (2.5, 4; 0-4)	-0.5 (-1, 0), 0.02	1.25 (1, 1.5), <0.0004	0.5 (0, 1), 0.006	0.75 (0.5, 1), <0.0004
social participation	1 (0.5, 1.5; 0-3.5)	1 (0.5, 2; 0-4)	1.5 (1, 2.5; 0-4)	-0.25 (-0.5, 0), 0.5	0.5 (0, 1), 0.009	0.5 (0, 1), 0.2	0.5 (0, 1), 0.02
components:							
activities (mean)	0.7 (0.3, 1.3; 0-4)	1.3 (0.8; 2; 0-4)	2.5 (1.5, 2.8; 0.7-3.8)	-0.6 (-0.8, -0.3), <0.0004	1.4 (1.2, 1.7), <0.0004	0.8 (0.5, 1.2), <0.0004	1.1 (0.8, 1.3), <0.0001
participation (mean)	1.2 (0.7, 1.7; 0-3.8)	1.5 (1, 1.8; 0-4)	1.7 (1.2, 2.3; 0.5-4)	-0.25 (-0.5, 0), 0.1	0.6 (0.3, 0.8), <0.0004	0.3 (0, 0.7), 0.06	0.4 (0.2, 0.7), 0.0004
WHODAS proxy sum	13 (7, 16; 0-43)	20 (12, 27; 0-42)	34 (31, 39; 8-48)	-7 (-10, -4), <0.0004	-22 (-25, -19), <0.0004	15 (12, 18), <0.0004	18 (15, 21), <0.0004
items:							
standing	1 (0, 2; 0-4)	2 (1, 4; 0-4)	4 (3, 4; 0-4)	-1 (-2, 0), 0.0008	-2.5 (-3, -2), <0.0004	1.5 (1, 2), <0.0004	1.5 (1, 2), <0.0004
household activities	1 (0, 2; 0-4)	2 (1, 4; 0-4)	4 (4, 4; 1-4)	-1.5 (-2, -1), <0.0004	-2.5 (-3, -2), <0.0004	1.5 (1, 2), <0.0004	2 (2, 2), <0.0004
learning	1 (0, 2; 0-3)	1 (0, 2; 0-4)	2 (1, 3; 0-4)	-0.5 (-1, 0), 0.1	-1.5 (-2, -1), <0.0004	0.5 (0, 1), 0.0004	1.5 (1, 1.5), <0.0004
joining in community	1 (0, 2; 0-4)	1 (1, 2; 0-4)	3 (2, 4; 0-4)	-0.5 (-1, 0), 0.5	-2 (-2, -2), <0.0004	1.5 (1, 2), <0.0004	1.5 (1, 2), <0.0004
emotional functions	1 (1, 2; 0-4)	2 (1, 3; 0-4)	2 (1, 3; 0-4)	-0.5 (-1, 0), 0.5	-1 (-1, -1), <0.0004	0.5 (0, 1), 0.0084	0.5 (0, 1), <0.0004
concentrating	1 (0, 2; 0-4)	1 (0, 2; 0-4)	2 (1, 3; 0-4)	-0.5 (-1, 0), 1.0	-0.5 (-1, 0), 0.0044	0.5 (0, 1), 0.04	0.5 (0, 1), 0.003
walking	1 (0, 2; 0-4)	3 (1, 4; 0-4)	4 (4, 4; 0-4)	-1.5 (-2, -1), <0.0004	-3 (-3, -3), <0.0004	1 (0, 2), <0.0004	2 (1, 3), <0.0004
washing	0 (0, 1; 0-3)	1 (0, 3; 0-4)	4 (3, 4; 0-4)	-1 (-1, -1), <0.0004	-3 (-3, -3), <0.0004	1.5 (1, 2), <0.0004	2.5 (2, 3), <0.0004
dressing	0 (0, 1; 0-3)	1 (0, 2; 0-4)	3 (2, 4; 0-4)	-0.5 (-1, 0), <0.0004	-2.5 (-3, -2), <0.0004	2 (2, 2), <0.0004	2.5 (2, 3), <0.0004
dealing with people	1 (0, 2; 0-3)	1 (0, 2; 0-4)	2 (0, 3; 0-4)	0 (0, 0), 1.0	-0.5 (-1, 0), 0.0004	0.5 (0, 1), 0.007	0.5 (0, 1), 0.0004
maintaining friendships	0 (0, 1; 0-3)	1 (0, 2; 0-4)	2 (0, 3; 0-4)	0 (0, 0), 1.0	-1.5 (-2, -1), <0.0004	1 (0, 2), <0.0002	1.5 (1, 2), <0.0004
work/ study	3 (2, 4; 0-4)	3 (2, 4; 0-4)	4 (4, 4; 1-4)	-0.5 (-1, 0), 0.1	-1 (-1, -1), <0.0004	0.5 (0, 1), <0.0002	1 (1, 1), <0.0004
domains:							
cognition	1 (0.5, 1.5; 0-3.5)	1.5 (0.5, 2; 0-4)	2 (1, 3; 0-4)	-0.25 (-0.5, 0), 0.2	-1 (-1.5, -0.5), <0.0004	0.75 (0.5, 1), 0.0008	0.75 (0.5, 1), <0.0004
mobility	1 (0, 2; 0-4)	2.5 (1, 4; 0-4)	4 (3.5, 4; 0-4)	-1 (-1.5, -0.5), <0.0004	-2.5 (-3, -2), <0.0004	1 (0.5, 1.5), <0.0004	2 (1.5, 2), <0.0004
self-care	0 (0, 1; 0-3)	1.5 (0.5, 2.5; 0-4)	3.5 (2.5, 4; 0-4)	-0.75 (-1, -0.5), <0.0004	-2.75 (-3, -2.5), <0.0004	1.75 (1.5, 2), <0.0004	2.25 (2, 2.5), <0.0004
getting along	0.5 (0, 1.5; 0-3)	0.5 (0, 1.5; 0-3.5)	2 (0.5, 3; 0-4)	-0.25 (-0.5, 0), 1.0	-1 (-1.5, -0.5), <0.0004	0.75 (0.5, 1), <0.0004	0.75 (0.5, 1), <0.0004
life activities	2 (1, 2.5; 0-4)	2.5 (2, 3.5; 0.5-4)	4 (4, 4; 1-4)	-0.75 (-1, -0.5), <0.0004	-1.75 (-2, -1.5), <0.0004	1 (0.5, 1.5), <0.0004	1.75 (1.5, 2), <0.0004
social participation	1 (0.5, 2; 0-4)	1.5 (1, 2.5; 0-4)	2.5 (2, 3; 0-4)	-0.25 (-0.5, 0), 0.3	-1.25 (-1.5, -1), <0.0004	1.25 (1, 1.5), <0.0004	1.25 (1, 1.5), <0.0004
components:							
activities (mean)	0.7 (0.3, 1.3; 0-3.5)	1.7 (1, 2.3; 0-3.8)	3 (2.7, 3.5; 0.7-4)	-0.8 (-1.2, -0.5), <0.0004	-2.1 (-2.3, -1.8), <0.0004	1.25 (1, 1.5), <0.0004	1.7 (1.3, 2), <0.0001
participation (mean)	1.2 (0.8, 1.7; 0-3.7)	1.7 (1, 2.2; 0.2-3.7)	2.8 (2.3, 3.3; 0.7-4)	-0.4 (-0.7, -0.2), 0.1	-1.5 (-1.8, -1.2), <0.0004	1.1 (0.8, 1.3), <0.0004	1.25 (1, 1.5), <0.0001

IQR=Interquartile range; WHODAS=World Health Organization Disability Assessment Schedule

Domain and component score = mean score of item scores

Table 1: Functioning of the rehabilitant subgroups (discharge categories) assessed with WHODAS-12 using Kruskal-Wallis test. Between-group difference on Hodges-Lehmann estimate for median difference. All pairwise comparisons are Bonferroni corrected

Significant pairwise between-group differences were also found in the WHO minimal generic data set score and in all separate item comparisons except for the items energy and drive functions and pain between the two subgroups discharged home (Table 2). mRS score and the FIM total score, motor and cognitive sub-score, the domain and item scores also differentiated the three subgroups (Table 3).

Variables (Median, IQR, range)	**Home without service**	**Home with service**	**Institution**	**Group 1 *vs.* 2**	**Group 1 *vs.* 3**	**Group 2 *vs.* 3**	**Groups 1+2 *vs.* 3**
	Group 1 n= 65	Group 2 n= 85	Group 3 n= 79	difference between medians (95% Confidence limits), p			
WHO data set sum	8 (7, 10; 4-17)	12 (10, 14; 6-26)	18 (16, 20; 6-27)	-4 (-5, -3), <0.0004	-9 (-10, -8), <0.0004	6 (5, 7), <0.0004	7 (6, 8), <0.0004
energy and drive	1 (1, 1; 0-2)	1 (1, 2; 0-3)	2 (2, 3; 0-4)	0 (0,0), 0.4	-1 (-1, -1), <0.0004	1 (1, 1), <0.0004	1 (1,1), <0.0004
pain	0 (0, 1; 0-2)	0 (0, 1; 0-3)	1 (0, 2; 0-4)	0 (0, 0), 1.0	-0.5 (-1, 0), <0.0004	0.5 (0, 1), <0.0004	0.5 (0, 1), <0.0004
daily activities	1 (1, 2; 0-2)	2 (2, 2; 1-3)	3 (2, 3; 1-4)	-0.5 (-1, 0), <0.0004	-1.5 (-2, -1), <0.0004	1 (1, 1), <0.0004	1 (1,1), <0.0004
walking	1 (0, 1; 0-3)	2 (1, 3; 0-4)	3 (3, 4; 0-4)	-1 (-1, -1), <0.0004	-2.5 (-3, -2), <0.0004	1 (1, 1), <0.0004	2 (2, 2), <0.0004
moving around	1 (1, 1; 0-3)	2 (1, 3; 0-4)	3 (3, 4; 0-4)	-1 (-1, -1), <0.0004	-2.5 (-3, -2), <0.0004	1 (1, 1), <0.0004	2 (2, 2), <0.0004
work/ study	4 (3, 4; 1-4)	4 (4, 4; 2-4)	4 (4, 4; 4-4)	0 (0, 0), 0.01	0 (0, 0), <0.0004	0 (0, 0), 0.001	0 (0, 0), <0.0004
WHO = World Health Organization; IQR = Interquartile range							

Table 2: Functioning of the subgroups assessed with the WHO minimal generic data set using Kruskal-Wallis test. Between-group difference on Hodges-Lehmann estimate for median difference. All pairwise comparisons are Bonferroni corrected.

Table 3. Functioning of the subgroups assessed with FIM and mRS using Kruskal-Wallis test. Between-group differences on Hodges-Lehmann estimate for median difference. All pairwise comparisons are Bonferroni corrected.							
Variables (Median, IQR, range)	Home without service	Home with service	Institution	Group 1 vs 2	Group 1 vs 3	Group 2 vs 3	Groups 1+2 vs 3
FIM at discharge	Group 1 n= 65	Group 2 n= 85	Group 3 n= 79	difference between medians (95% Confident limits), p			
dependence level	6 (6, 6; 5-7)	6 (5, 6; 3-6)	3 (3, 5; 1-6)	0 (0, 0), <0.0004	2.5 (2, 3), <0.0004	-2 (-2, -2), <0.0004	-2.5 (-3, -2), <0.0004
total score	121 (118, 124; 100-126)	111 (104, 116; 62-123)	71 (54, 90; 18-114)	9.5 (7, 12), <0.0004	48 (42, 54), <0.0004	-36.5 (-43, -30), <0.0004	-41.5 (-47, -36), <0.0004
motor sub-score	89 (86, 91; 80-91)	82 (75, 87; 34-91)	49 (34, 64; 13-88)	16.5 (11, 22), <0.0004	39.5 (34, 45), <0.0004	-30.5 (-36, -25), <0.0004	-34.5 (-39, -30), <0.0004
self-care (mean score of items in the domain)	7 (6.8, 7; 5.8-7)	6.5 (5.8, 6.8; 3.2-7)	3.5 (3, 5; 1-7)	0.5 (0.3, 0.7), <0.0004	3.25 (3, 3.5), <0.0004	-2.5 (-3, -2), <0.0004	-2.8 (-3.2, -2.5), <0.0004
sfincter control (mean)	7 (7, 7; 3.5-7)	7 (6.5, 7; 1-7)	4.5 (1.5, 6.5; 1-7)	0.25 (0, 0.5), <0.004	2.5 (1.5, 3.5), <0.0004	-2 (-3, -1), <0.0004	-2.25 (-3, -1.5), <0.0004
transfers (mean)	7 (7, 7; 6-7)	6 (6, 7; 3-7)	4 (2, 5.3; 1-7)	0.5 (0, 1), <0.0004	3 (2.3, 3.7), <0.0004	-2,5 (.3, .2), <0.0004	-2.5 (-3, -2), <0.0004
locomotion	7 (6, 7; 5-7)	6 (6, 7; 3-7)	6 (4, 6; 1-7)	0.5 (0, 1), <0.0004	1 (1, 1), <0.0004	-0.5 (-1, 0), <0.0004	-1 (-1, -1), <0.0004
locomotion: stairs	6 (6, 7; 3-7)	4 (3, 6; 1-7)	1 (1, 2; 1-6)	1.5 (1, 2), <0.0004	4.5 (4, 5), <0.0004	-3 (-3, -3), <0.0004	-3.5 (-4, -3), <0.0004
cognitive sub-score	33 (31, 35; 19-35)	31 (27, 33; 14-35)	23 (17, 28; 5-35)	2 (1, 3), 0.0004	9 (7, 11), <0.0004	-6.5 (-9, -4), <0.0001	-7.5 (-0, -6), <0.0004
communication (mean)	6.5 (6, 7; 3-7)	6 (5, 7; 1.5-7)	4.5 (3, 6.5; 2-7)	0.5 (0, 1), 0.002	1.75 (1, 2.5), <0.0004	-1 (-1.5, -0.5), 0.002	-1.25 (-2, -0.5), <0.0001
social cognition (mean)	6.7 (6.3, 7; 3.7-7)	6.3 (5.7, 6.7; 3-7)	4.7 (3.3, 6; 1-7)	0.3 (0, 0.7), 0.002	1.8 (1.3, 2.3), <0.0004	-1.5 (.2, .1), <0.0004	-1.7 (-2, -1.3), <0.0004
mRS	2 (2, 3; 2-3)	3 (3, 4; 2-4)	4 (4, 4; 3-5)	-1 (-1, -1), <0.0004	-2 (-2, -2), <0.0004	1 (1, 1), <0.0004	1 (1, 1), <0.0004
IQR=Interquartile range; FIM=Functional Independence Measure; mRS= modified Rankin Scale							

Table 3: Functioning of the subgroups assessed with FIM and mRS using Kruskal-Wallis test.

In FIM ambulation analysis, of the 65 rehabilitants discharged home without service 98.5% were ambulatory and only one (1.5%) was sedentary at the time of discharge. Of those discharged home with service, 70.6% (n=60) were ambulatory, 25.9% (n=22) sedentary, and 3.5% (n=3) were able to walk but needed a wheelchair for longer distances. Of those institutionalized the numbers were 16.4% (n=13), 79.8% (n=63), and 3.8% (n=3), respectively ($p<0.0004$).

Table 4 shows sensitivity and specificity of previously defined FIM score thresholds for community discharge (FIM total 78 and 80) and for autonomy in everyday life and independence of social and familial assistance (FIM total 115) in the three discharge categories.

ROC curves using WHODAS and FIM scores were generated for comparing accuracy of these measures for predicting institutionalization. Table 5 shows the cut-off score on the ROC curve, sensitivity, specificity, and area under the curve (AUC) of WHODAS proxy sum and FIM total score at discharge. The median WHODAS proxy sum score for rehabilitants discharged home (n=150) was 16, interquartile range (IQR) 10, 25 and minimum to maximum 10 – 43. The corresponding figures for those institutionalized (n=79) are presented in Table 1.

Discharge FIM score	**Home without service (%) Group 1 (n=65)**	**Home with service (%) Group 2 (n=85)**	**Institution (%) Group 3 (n=79)**	**Group 1 *vs.* 2**	**Group 1 *vs.*3**	**Group 2 *vs.* 3**	**Group 1+2 *vs.* 3**	**p**
				sensitivity % and specificity %				
<78	0 (0)	5 (6)	48 (61)	100	100	94	97	<0.0001
≥ 78	65 (100)	80 (94)	31 (39)	6	61	61	61	
< 80	0 (0)	6 (7)	50 (63)	100	100	93	96	<0.0001
≥ 80	65 (100)	79 (93)	29 (37)	7	63	63	63	
<115	6 (9)	54 (64)	79 (100)	91	91	36	60	<0.0001
≥115	59 (91)	31 (36)	0 (0)	64	100	100	100	
FIM = Functional Independence Measure								

Table 4: Sensitivity and specificity of discharge FIM score thresholds for predicting discharge to the community.

	Cut-off score	**Sensitivity**	**Specificity**	**AUC**	**95% Cl**	**p**
WHODAS proxy	30.0	0.81	0.87	0.88	0.83, 0.93	<0.0001
FIM	80.2	0.92	0.85	0.95	0.93, 0.98	<0.0001
WHODAS = World Health Organization Disability Assessment Scale; FIM = Functional Independence Measure; AUC = area under curve; Cl = Confidence limits						

Table 5: Discriminative accuracy of WHODAS sum and FIM total score for institutionalization in subacute stroke rehabilitants.

Discussion

In search for the instruments that accurately and efficiently distinguish different discharge dispositions after subacute inpatient stroke rehabilitation both brief ICF-based measures, the 12-item WHODAS and the WHO minimal generic data set showed their utility. The traditional instruments FIM and mRS were used as comparators also differentiating the three subgroups but being either time-consuming and requiring resources (FIM) or extremely rough (mRS). Previous studies using FIM and other instruments like NIHSS, Barthel index, Mobility Scale for Acute Stroke, Motor Assessment Scale [10] and Cognitive Screening Test have also shown utility of these instruments to predict discharge disposition after acute and subacute stroke care and rehabilitation [6-8,10,11,32]. However, easy to use measures with diverse domains would be beneficial when assessing discharge disposition. Furthermore, previously only few studies have used discharge scores to distinguish those returning home from those institutionalized [1,18-21], and studies investigating those discharged home according to service need are lacking.

FIM is focused on dependence and need of assistance in ADL, but has no widely accepted valid or reliable cut-off score for home discharge [9]. In the present study, a discharge FIM total rating of 80, which has usually been considered the target value associated with community discharge, was reached by 100%, 93% and 37% of those discharged home without service, with service and those institutionalized, respectively. These findings are in line with previous figures which have varied from 85% [21] to 94% [22] for community discharge and from 35% [22] to 38% [21] for institutionalization. Previously defined thresholds of FIM 78 [18] and 80 [21,22] for community discharge were found to have very high sensitivity and moderate specificity in the present population the optimal cut-off score being 80. The thresholds of FIM 115 for autonomy in everyday life and independence of familial and social assistance [33] was also

found to have high sensitivity and moderate specificity for community discharge without service need. Even if the median grade of 6 in FIM (modified independence) was achieved by both subgroups discharged home, in closer scrutiny significant differences in ADL were found.

Disability in later phases of stroke cannot, however, be explained solely by the level of dependence in ADL. There has been a call for research comparing traditional task specific measures highlighting burden of care like FIM and other instruments measuring functional impairment and difficulties in several domains including participation [34]. mRS, a rough measure of functional independence, incorporating the ICF components body functions, activity and participation, has substantial clinical threshold between each point in the scale and the difference between one or more grades is clinically meaningful [17]. The present finding of mRS score clearly differentiating the three discharge categories from each other is in accordance with a previous study showing discharge destination to provide high predictive value for death and disability at 3 months post stroke, as defined by an mRS score from 2 to 6 [35]. In the present population, however, mRS could differentiate even beyond that by distinguishng also the two subgroups discharged home.

Previously, no studies have used the 12-item WHODAS or the WHO minimal generic data set in assessing discharge disposition. In the present population, the rehabilitants discharged home and those institutionalized had significant between-group differences in all component, domain and item level comparisons in WHODAS proxy ratings, some fewer in patient ratings. The optimal cut-off score for institutionalization was 30 denoting severe disability. When considering all three discharge categories, significant differences were found in all pairwise component, domain and item level comparisons in proxy ratings except between the two categories discharged home in 3 domains and 7 items (learning, concentrating, joining in community, emotional functions, dealing with people, maintaining friendships and work/ study), in patient ratings again some fewer. The WHODAS items that differentiated all three subgroups in both patient and proxy ratings were standing, walking, washing, dressing and household activities; at the same time, the mean difference in total FIM score between the two subgroups discharged home was only 10 points, i.e. clearly under the minimal clinically important difference of 22 FIM points [36]. However, for discharge disposition smaller differences may be of importance because of the composite effect of factors affecting the choice of discharge destination and service need. The differences found between patient and proxy responses can partly be derived from the larger variance in proxy scores as the most severely affected rehabilitants who could not respond themselves had only proxy ratings. In a previous study, the correlation between WHODAS-12 patient and proxy responses was found to be strong, but lower in mild compared with moderate to severe stroke, however, without any systematic differences [15]. The only previous research using WHODAS in predicting discharge destination was a large register study using the 36-item version [12]; WHODAS was the only instrument used and the conclusion was that at least six months after stroke the 36-item WHODAS could predict institutionalization of stroke patients. Especially the sum score and the cognition and mobility domain scores facilitated a moderately high accuracy of discrimination for the risk for institutionalization in a long-term care facility. However, it was pointed out that the responses may have been biased; only patient responses were available or in case of cognitive impairment, dementia, or aphasia some caregivers could represent the patients for the interview, which caused inconsistency of subjectivity in the responses. Closer comparison of the results with the previous study are challenging as the current study included a selected population of inpatient rehabilitants while the previous study encompassed all stroke survivors with an even wider range of cognitive but also motor severity and disability and only two discharge categories. However, the discriminative accuracy of WHODAS for institutionalization was high in both these studies, even higher in the present study (AUC 0.88 *vs.* 0.74 in the previous study) and almost as high as of FIM (AUC 0.95). Thus, the results of both these studies support the utility of WHODAS in assessing discharge dispositions post stroke. Yet the 12-item WHODAS would be beneficial as it is less time-consuming.

Rehabilitation process does not end at rehabilitation hospital discharge. Even if the rehabilitation team plays a key role in evaluating the most appropriate discharge destination, patient- and family perspective is crucial in a successful discharge process. Incorporation of patients in stroke outcome assessment has been demanded previously, since ultimately patient perceptions are critical measures of outcome, success or failure [17]. Especially in severe stroke, however, the patients may not always be cognitively fit to respond [15]. In the current study, the proxy responses were found to differentiate the three discharge categories even better. Since no proxy responses were missing the responses of significant others´ were a valuable asset when making decisions about possible home discharge, often with the aid and support of these very same people as caregivers. In proxy ratings, in sum score, both component scores and most domain and item scores significant pairwise differences were found between the three discharge dispositions except for cognition, relationships, social participation and work/ study between the two subgroups discharged home. Informal caregiving provided by spouses, family members and significant others is as valuable as paid assistance and formal care [37]. It has been estimated that in most industrialized countries one in eight adults provides some form of care for a family member living in the community with a serious health condition [4]. Especially among those with severe stroke, the significance of an informal caregiver at home has previously been found to increase significantly the odds of home discharge in many countries around the world [2,38]. Even if cohabiting was not found to be an independent predictor for discharge disposition in the present population [23], the perception and participation of proxies is often essential in discharge and service planning. In health care, a systematic approach to this group of significant others and potential caregivers using reliable and validated instruments should be developed. The 12-item WHODAS offers a seemingly easy tool for survaying change in functioning across several constructs after stroke [15] and

allows clinicians to evaluate patients´ and families´ current perspective and prognostic indexes associated with discharge disposition.

The other ICF-based measure, the WHO minimal generic data set has been designed to be the starting point for comparisons between different studies and populations [28]. It has not been used previously in studies investigating discharge disposition. In the current study, this 7-item measure could differentiate the three discharge categories not only on the sum score level but also on item level; only the score in items energy and drive functions and sensation of pain did not differ between the two subgroups discharged home. Despite the brevity these two ICF-based measures, the 12-item WHODAS and the 7-item minimal generic data set seem to have utility in differentiating conditions, severity levels, and outcomes [15,39-43].

There are some limitations to this study. Although the size of the study was limited, it was large enough for the purpose of this study. In addition, no data were missing in this prospective study. Multidisciplinary inpatient rehabilitation population is always selected so the results cannot be generalized to the entire stroke population. The data were collected in one facility only. However, WHODAS and the WHO minimal generic data set have been created to ensure comparability across different populations and nations. The application of cross-sectional study design does not allow confirmation of causal relationships of disability, i.e. whether they are based on the disease itself or its secondary consequences. Compared with motor impairments, the variance in cognitive abilities was more limited as the rehabilitants were selected to have sufficient mental capacity to be able to participate actively in rehabilitation.

Conclusion

Despite the brevity of the two ICF-based measures, the 12-item WHODAS and the 7-item WHO minimal generic data set seem to have utility in determining discharge destination and service need in subacute stroke rehabilitants.

Consent

Patients have given their informed consent for participation in the research study.

Ethical Approval

The Ethics Committee of the University and University Hospital approved the study (19.5.2015, 73/2015). The ethical standards of the World Medical Association Helsinki Declaration of 1975, as revised in 1983 were followed.

Conflicts of Interest

The authors certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

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