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A comparison between WHODAS 2.0 and Modified Barthel Index: which tool is more suitable for assessing the disability and the recovery rate in orthopedic rehabilitation?

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Purpose: The aim of the present study was to compare 2 clinical assessment tools, the Modified Barthel Index (currently administered to patients admitted into inpatient rehabilitation units after elective hip or knee arthroplasty) with the World Health Organization Disability Assessment Schedule (WHODAS) 2.0 scale, in order to identify which tool is more suitable for assessing the disability and the "recovery rate".

Patients and methods: A perspective multicenter observational study was developed, involving 2 hospital authorities in Italy. Eighty consecutive cases of inpatients were enrolled. Patient's disability was evaluated using both of the aforementioned tools, before and after the rehabilitation program.

Results: The WHODAS 2.0 score was, on average, 12.21% higher than the Modified Barthel Index, before the surgical intervention. Modified Barthel Index measures could be considered as a determinant and a predictor of length of stay.

Conclusion: The Modified Barthel Index is limited, since it does not consider a patient's perspective. The WHODAS 2.0 scale fully considers a patient's perception of disability. Therefore, both assessment scales should be administered in clinical practice, in order to provide integration of clinical information with a patient's reported outcome measures.

Keywords: disability, Modified Barthel Index, WHODAS 2.0, orthopedics, rehabilitation

Introduction

The process of rehabilitation should allow patients admitted into inpatient rehabilitation units (IRUs) after elective hip or knee arthroplasty to attain the highest possible level of functioning and participation,[1] (from a bio-psycho-social perspective), leading to a significant reduction of disability.[2] Information with regard to disability has become more relevant, providing important data concerning the effectiveness of healthcare interventions and supporting policy strategies.

In 2001, the World Health Organization (WHO) developed the International Classification of Functioning, Disability and Health (ICF),[3] a framework informing rehabilitation professionals that all activities aimed at defining and solving disabilities, should not be limited to damaged structures and body functions,[4] but should be aimed also at involving and improving a patient's activity and participation, considering both environmental and personal factors. In this view, it emerged that rehabilitation is a multidimensional system that considers several aspects, such as the body, person,

and related environmental context.[3] This suggests that the outcome and the usefulness of rehabilitative activities should be measured with tools that focus on a patient's needs, considering the entirety of the patient. With regard to the clinical practice, it emerged that the ICF, in 1424 categories, is not applicable as an assessment tool in routine healthcare[5] as its implementation would be excessively time consuming. Thus, there is the need to develop new tools that are able to measure the overall disability of an individual.

In the Italian context, and, in particular, the Lombardy Region, the evaluation of the orthopedic and rehabilitative disabilities of patients, in clinical routine, is performed using the Barthel Index of Independence in Activities of Daily Living modified scale (ADL BI). This is probably due to the fact that ADL BI, in the literature evidence, is considered as the "gold standard" approach and, also, as a prognostic tool,[6] implemented worldwide. Even though it has been much improved and modified over the years, ADL BI cognitive dimension still requires additional investigations.[7] In order to address this, the WHO published the World Health Organization Disability Assessment Schedule (WHODAS), a tool adapted within the Italian setting in the year 2010, and based on the ICF; WHODAS 2.0.

WHODAS 2.0 assesses the nature of disability from an individual's responses and self-perception, considering individuals with normal activity and disabilities.[8] This tool was designed to evaluate the behavioral limitations and restrictions of an individual to function and participate, regardless of the medical diagnosis.[7] Both ADL BI and WHODAS 2.0 have been translated in Italian, validated for Italian language,[9,10] and applied in numerous specialized settings, not only mental health and psychiatry, cardiovascular and cardiac, but also neurological fields.[11–23]

However, despite the relevance of the topic, available scientific evidence shows few implementations of these tools within the rehabilitation context.[24] To the best of the authors' knowledge, no studies regarding the orthopedic setting exist, in particular the comparing of the ability of ADL BI and WHODAS 2.0 in order to assess patients' disability, in the Italian context.

Moving on from these premises, the primary objective of the present study was to compare ADL BI and WHODAS 2.0, in order to understand which of these 2 clinical tools is more suitable in the specific field of orthopedics.

The hypothesis is as follows: WHODAS 2.0 is more suitable for measuring the level of disability and the recovery rate of the patient.

The "disability" is the different measure of declared and perceived disability by the patients enrolled in the study. The "recovery rate" is the ability to return to daily activities and to movement, declared by the patients and measured using 2 scales comparing baseline and follow-up.

Secondary objectives of the study were as follows: 1) to investigate if disability could be a predictor of the length of stay; and 2) the feasibility of the application of ADL BI and the WHODAS 2.0 in terms of minutes needed for their administration in the daily organizational routine.

The hypotheses related to the secondary objective of the study are as follows: length of stay is not always a measure predicting the disability of the patients; and the measures of disability are more feasible if less time is needed for administration.

Methods

The present study adhered to the STROBE guidelines for standard of reporting.[25]

Study design

A prospective multicenter observational study was conducted in the following phases: 1) enrollment of the patients; 2) administration of 2 disability tools, ADL BI and WHODAS 2.0, by trained healthcare professionals (a doctor of "Physical Therapy and Rehabilitation" and a physiotherapist, respectively), both at "baseline" (patients' hospital admission) and at "follow-up" (discharge to the IRUs for ADL BI, and 30 days after IRU discharge for WHODAS 2.0. The different timing is due to the specific characteristics of the 2 tools: ADL BI measures the patients disability at the time of the administration of the questionnaires; WHODAS 2.0 requires and measures information about the 30 days following discharge); 3) collection of quantitative data concerning length of stay, and time needed for administration.

Setting

The IRUs of 2 Lombardy Region Hospitals enrolled already hospitalized patients, who had undergone elective hip or knee arthroplasty during the period 15 March 2011 to 15 July, 2011; patients were invited into the study by the medical staff of IRUs (clinicians and physiotherapists). First, the medical staff verbally informed patients about the study objective and the method of participation. All patients who participated in the study provided written informed consent for participation in the study and the use of data.

It should be noted here that the enrollment phase started only after having received the approval of the Ethics Committees of the 2 hospitals involved (Hospital of Saronno and

Hospital of Busto Arsizio, Hospital Authority "ASST Valle Olona", Italy) for this study.

As authorization to use WHODAS 2.0 was required, the study protocol was submitted to the WHO, who issued a "Royalty Free License Classification, Assessment, and Epidemiology Team of the World Health Organization, Global Program on Evidence for Health Policy". In addition, a copy of the appropriate manual was provided for the correct administration of WS.[1]

As previously mentioned, rehabilitation data were collected from the patients, both at admission into the hospitals for the surgery, and at discharge, after they had attended the rehabilitation program.

Participants

All the consecutive cases were taken into consideration during the study period, having the following inclusion criteria: 1) adults ≥18 years old; 2) hospitalization for elective hip or knee arthroplasty, followed by a period of rehabilitation in an IRU; and 3) approval and completion of the informed consent form.

The exclusion criteria were as follows: 1) patients with diagnosis of cognitive function disorders; and 2) patients with no proper understanding of the Italian language.

Bias

No selection bias was present as all patients received standard rehabilitation after surgery and were assessed using both tools. In order to minimize the detection bias, the outcomes and methods for their assessment were clearly defined.

Description of the tools and the variables of the study

ADL BI[26] consists of an ordinal rating scale ranging from 0 ("completely dependent") to 20 ("completely independent"), with 10 different items. It is based on the objective and external assessment of the patient, conducted by a professional examiner (specifically, a clinician), considering that no patient-reported outcomes are evaluated by this tool.[27] ADL BI evaluates the patient's complexity at the precise moment of its administration: it is usually applied when the patient is admitted and discharged. A higher score derived from using ADL BI evaluation indicates a lower level of disability for the patient. A trained independent investigator (clinician), reported all the ADL BI scores.

With regard to WHODAS 2.0, this tool measures disability using a scale ranging from 0 ("completely healthy") to 100 ("completely disabled"): a higher score indicates higher limitation(s) for the patient in daily life. WHODAS 2.0 is able to take into account the patient's or their caregiver's perception related to the 30-day period before the date of administration, and is conducted by a trained interviewer (in the present study, a physiotherapist). A complete version with 36-items (able to evaluate both functioning scores and 6 specific active daily living domains) was administered. The short form with 12 items was also calculated (the 12-item version allows computation of the overall functioning scores, explaining 81% of the variance of the 36-item version).[4] The 2 versions of WHODAS 2.0 were implemented only to verify the impact of the 2 scales on the feasibility of the adoption of WHODAS 2.0 in clinical practice, considering the different time needed for the administration of the questionnaires.

After investigating "disability", the present study then turned to the "recovery rate", the difference between the ADL BI or the WHODAS 2.0 values of disability, measured at baseline and follow-up. Baseline was defined as "the admission of a patient into the hospital setting", and follow-up as "the discharge to the IRU for ADL BI, and 30 days after IRU discharge, for WHODAS 2.0".

The length of stay was observed and assessed as the number of days spent in the hospital, considering the clinical pathway from admission into the orthopedic and traumatology unit, to discharge from the IRU.

The feasibility of the 2 scales in clinical practice was determined as the average time (in minutes) required by the trained healthcare professionals to administer the tools under investigation: ADL BI, and WHODAS 2.0 36-item and 12-item.

Data processing

Data were first analyzed considering descriptive statistics, frequencies and distributions. In addition, inferential analyses were conducted, using the Statistical Package for Social Science (SPSS - version 22.0) software.

Parametric variables were studied with mean and standard deviation, and variables not assuming a normal distribution were analyzed by median and percentiles as indicators of central tendency.

Linear regression models, Kruskal–Wallis and Wilcoxon tests were applied to define differences between groups.

The relationship between variables was investigated using the Person Product-Moment Correlation coefficient to test the existence of small, medium or large correlations among them.

The predictors of the length of stay, were studied using a hierarchical sequential regression model, with "enter" methodology. In this view, relationships between ADL BI,

WS (both at baseline and at follow-up), and the hospital length of stay were recorded to define which of the 2 assessment tools better predicts the average value of length of stay variance.

In the present study, WHODAS 2.0 was inverted in order to be consistent with ADL BI: a higher final value suggests a decrease in the disability perceived by the patient. For the direct comparison of the disability measures within the 2 scales, the SPSS special feature was used to collapse the number of categories, and have 2 scales perfectly superimposable.[28]

In the case of the presence of missing data or forms and tools not completely filled, the patient was not included in the analysis.

Results

Description of the sample under assessment

In 2011, the hospitals in the present study carried out 708 prosthetic hip or knee replacements, from which 80 were enrolled into the study (CI of 95% and power of the sample 80%): 48 elective hip prostheses (60%) and 32 elective knee prostheses (40%) were performed (Table 1), in line with the distribution of the procedures performed during the year.

The sample was composed of 25 men (31.25%) and 55 women (68.75%). The mean age of the patients was 70.1±1.067 years old (range 32–89 years). The majority of the patients in the sample were married (61.25%) and, with regard to the working condition, 73.75% of patients were retired (see Table 2).

With the exception of 1 patient who died (due to principal pathology related reasons) and did not complete the follow-up evaluation, all the patients completed the phases of the study design (follow-up assessment 79/80, 98.75% of the study population), with no missing data.

Level of disability and recovery rate

The disability results were shown as collapsed data, using the same scale, ranging from 0 to 100 (the original measures of the 2 scales are shown in Table 3). The baseline evaluations showed an average value of disability for ADL BI (55.06±1.380) and WHODAS 2.0 (62.72±1.010) that substantially overlapped. The level of disability declared by the patients assessed by the WHODAS 2.0-reported outcome scale was lower, if compared with the disability assessed by clinicians using ADL BI, and the patients had a different and lower perception of their disability in comparison with the evaluation and perception proposed by the clinicians of reference.

Also, at discharge, the patients reported a different vision of their disability, if compared with the clinicians' assessment: the average declared WHODAS 2.0 value was equal to 84.35±1.300, whereas the average ADL BI value was equal to 93.19±1.210. The average ADL BI value was higher than the average declared WHODAS 2.0 value (+10.48%). The data, expressed as mean and applying both scales, showed a slight residual disability at the discharge phase (see Table 3).

Both measures at follow-up showed a gain in terms of reduction of disability during the entire clinical and rehabilitation pathway; however, comparing the baseline and follow-up values measured with the same scales, the patients reported a "perceived" recovery rate of +36.39% (from 62.72

Table 1 Enrolled patients in the study

	Knee replacements	Prosthetic hip
Hospital 1	16 (50%)	17 (35.42%)
Hospital 2	16 (50%)	31 (64.58%)
Total	32 (100%)	48 (100%)

Table 2 Characteristics of the study sample (N=80)

	Study population	Hospital 1	Hospital 2
Gender male (n) (%)	25 (31.25)	10 (30.30)	15 (31.91)
Age (mean)	70.1±1.067	71.21±1.863	69.38±1.267
Education (mean years of study)	7.11±1.000	7.18±0.085	1.47±0.074
Relationship status			
Married (n) (%)	49 (61.25)	17 (51.52)	32 (68.09)
Widowed (n) (%)	21 (26.25)	10 (30.30)	1 (2.13)
Unmarried (n) (%)	5 (6.25)	3 (9.09)	2 (4.26)
Separated (n) (%)	4 (5.00)	3 (9.09)	1 (2.13)
Divorced (n) (%)	1 (1.25)	–	1 (2.13)
Employment status			
Retired (n) (%)	59 (73.75)	27 (81.82)	32 (68.09)
Housewife (n) (%)	12 (15.00)	4 (12.12)	8 (17.02)
Skilled worker (n) (%)	8 (10.00)	1 (3.03)	7 (14.89)
Unemployed (n) (%)	1 (1.25)	1 (3.03)	

Note: Data presented as n (%) or mean ± SD.

Table 3 Modified BI and WHODAS 2.0 mean values at admission and follow-up phase

Assessment tool	Baseline measure	Follow-up measure	Recovery rate
ADL BI (original measure)	11.01±0.275	18.64±0.101	77.69%
ADL (after rescaling)[a]	55.06±1.376	93.19±0.505	
WHODAS 2.0 (original measure)	37.28±9.070	15.65±11.658	36.69%
WHODAS 2.0 (after rescaling)[b]	62.72±1.014	84.35±1.303	

Notes: Data presented as % or mean ± SD. [a]In reprocessing data, ADL BI was rescaled on a rating scale from 0 to 100, in order to compare the previous scale with WHODAS 2.0. [b]In reprocessing data, WHODAS 2.0 was inverted to be consistent with the ADL BI tool: a higher final value suggests a decrease in the disability perceived by the patient.

Abbreviations: ADL, Activities of Daily Living; BI, Barthel Index; WHODAS, World Health Organization Disability Assessment Schedule.

to 84.35), whereas the recovery rate measured using ADL BI was equal to +77.69% (from 55.06 to 93.19).

Although there were different results in the disability and recovery rate measurement process, using the 2 scales, strong relationships were found between baseline and follow-up measures, considering both ADL BI and WHODAS 2.0.

In general, the patients' gain of ability rate had a correlation with the baseline score achieved during the administration of the 2 assessment tools. However, while the recovery rate derived from ADL BI implementation impacted the length of stay, the perception of the patients regarding their own functional well-being and disability did not correlate with the time spent in the hospital (see Table 4).

The results from WHODAS 2.0, grounded on personal perception and being a patient's reported outcome measure, showed that some clinical aspects would need improvement even if clinical information derived from ADL BI showed that, on average, all the patients could return to their normal life without any problems, since this scale is focused on the activity of daily living difficulties.

WHODAS 2.0 showed potential benefits in conducting a new evaluation, integrating and complementing the tools currently used, allowing a total and whole evaluation of a patient, from both the clinical perspective and a patient's reported outcomes.

The predictors of the length of stay

Analyzing the predictors of the length of stay, ADL BI, administered only at the baseline, showed an ability to consistently predict a patient's length of stay in the orthopedic and traumatology units (adjusted R^2=33.70%) (Table 5).

These results are consistent with the nature of ADL BI, a mandatory tool, designed as an administrative support to be used in close relation with costs and reimbursement information concerning a patient's intervention and hospitalization.

WHODAS 2.0. however, did not predict the length of hospitalization; neither the 12-item nor the 36-item; the WHODAS 2.0 baseline measures explained only 8.30% of the variance of the length of stay (see Table 5).

The feasibility of the 2 tools in clinical practice

In a complex organization, such as a hospital, time is an important factor in managing activities and processes. The average measured time for the evaluation of the patients using ADL BI was around 6±0.159 minutes per subject, while the average time for the administration of WHODAS 2.0 was around 25±0.749 minutes per patient; a significant statistical difference between the investigated tools ($p \leq 0.001$).

With regard to the 12-item WHODAS 2.0, it emerged that it needed, on average, 10±0.295 minutes to be administered.

Although the 12-item WHODAS 2.0 would require a slightly longer time of around 4 minutes more per patient, in comparison with ADL BI ($p \leq 0.001$), this "disadvantage" seemed more than acceptable if the support provided by its introduction is taken into consideration. In this view, at least in the investigated Italian context, results suggested that the 12-item WHODAS 2.0 may be considered the preferable

Table 5 Predictors of length of stay, taking into consideration the ADL BI measures and WHODAS 2.0 measures (beta weights)

	Length of stay ADL BI	Length of stay WHODAS 2.0
	Model 1	Model 1
ADL BI baseline	–0.588**	0.307**
R^2	0.345	0.094
Adjusted R^2	0.337	0.083
F value	41.143**	8.123*
ΔR^2	0.345	0.094
F (ΔR^2)	41.143**	8.123*

Note: Significance levels: *p<0.05; **p<0.001.
Abbreviations: ADL, Activities of Daily Living; BI, Barthel index; WHODAS, World Health Organization Disability Assessment Schedule.

Table 4 Correlation between Modified BI and WHODAS 2.0 in the total population

	ADL BI baseline measure	ADL BI follow-up measure	ADL BI recovery rate	WHODAS 2.0 baseline measure	WHODAS 2.0 follow-up measure	WHODAS 2.0 recovery rate	Length of stay
ADL BI baseline measure	1						
ADL BI follow-up measure	0.363**	1					
ADL BI recovery rate	–0.979**	–0.203	1				
WHODAS 2.0 baseline measure	0.335**	–0.272*	–0.323**	1			
WHODAS 2.0 follow-up measure	0.256*	0.348**	–0.215	0.503**	1		
WHODAS 2.0 recovery rate	–0.221*	–0.137	–0.203	–0.824**	0.002	1	
Length of stay	–0.562**	–0.315**	–0.544**	–0.243*	–0.451**	–0.017	1

Notes: Significance levels: *p<0.05; **p<0.001. Source: Study data.
Abbreviations: ADL, Activities of Daily Living; BI, Barthel index; WHODAS, World Health Organization Disability Assessment Schedule.

scale to be implemented in hospitals (if compared with the 36-item WHODAS 2.0), in order to assess the self-reported disability of patients admitted for orthopedic rehabilitation ($p \leq 0.001$), and thus a valid alternative where the patient-reported outcomes information was absent.

Discussion

WS allowed the identification of an aspect of disability that had not previously been considered from a rehabilitative point of view: a patient's subjective perception concerning the difficulties that the illness causes in everyday life.

ADL BI is based on a model that considers a disease, in particular, for its medical aspects, allowing, over a short period of time, a "snapshot" of the patient and the related needs for care. ADL BI creates a measure reflecting the cultural background related to the medical-centered model, assigning a relevant value to functions, such as continence or mobility.[9]

With ADL BI, all the patients in the present study showed higher scores on discharge and there appeared the "ceiling effect". Even if patients believe that they get advantage from rehabilitation activities, this scale does not allow investigation of how much "effort" a patient makes in using stairs or walking, and/or the time spent to perform these 2 activities, particularly from a perceived point of view. The ADL BI measure is derived from a quantitative evaluation carried out by the clinician.

In contrast, WS seemed to be more suitable for measuring the changes that occurred over a long period of time. The WHODAS 2.0 measure is derived from the perception of a patient, being an additional and different measure compared with the one proposed by ADL BI. As mentioned in the Results section, this measure did not correlate with the length of stay, being substantially unable to predict the rehabilitative time needed by a patient.

ADL BI being an administrative measure of the length of stay is typically related with the days of length of stay. WHODAS 2.0, measuring the perception of a patient's disability, is not able to include a quantitative measure, such as the length of stay. For this reason, it could be important for the healthcare hospitals to link the 2 different measures.

Another positive aspect of WHODAS 2.0 was to allow a patient to "self-assess" for personal problems, allowing them to appreciate the obtained and/or expected improvements.

In the present study, all the patients responded positively to the questionnaire and many of them expressed feelings of relief as, finally, they were able to tell a healthcare professional about the difficulties resulting from their illness and daily life.

Also, the patients responded positively to the follow-up, and those who were still experiencing difficulties related to their intervention, expressed appreciation in having someone interested in their condition.

Conclusion

The main strength of the present study was that it represents, for the first time with regard to the orthopedic setting, a comparison of the ability of ADL BI and WHODAS 2.0 to assess a patient's disability, in terms of "disability" and "recovery rate", in the Italian context.

The results of the study show WHODAS 2.0 could be a suitable tool for the evaluation of a patient in a rehabilitation setting of care. The most obvious problem concerning its application, in the daily routine, is the time spent for the administration of the questionnaire. This aspect could, however, be solved through the application of the 12-item WHODAS 2.0.

With regard to the significant predictive impact of WHODAS 2.0, concerning the difficulties of a patient, it could be a useful prognostic management tool for assessing the burden of care and rehabilitation required for a patient, not only inside, but also outside, the hospital rehabilitative pathway.

In this view, the administration of WHODAS 2.0 could integrate, though not substitute for, all the clinical information derived from ADL BI analysis, giving a more complete health state of a patient undergoing an orthopedic intervention.

The results suggested that ADL BI could be applied for a baseline patient evaluation, with a positive impact on the forecast of length of stay and the duration of a rehabilitative program, whereas WHODAS 2.0 could be administered at follow-up, after the discharge, giving reliable information concerning the daily difficulties of a patient and suggesting additional/alternative rehabilitation activities.

The present study confirmed that one of the most relevant complications occurring within the evaluation of functioning and disability is due to the fact that the self-assessed and reported measure of a patient's well-being may not agree with that of the clinician(s) of reference. This consideration is widely accepted in literature where, in 2010, Kayes and McPherson[29] declared that "using both objective and subjective measures may be the appropriate and the only way of truly capturing the phenomenon of interest" (page 1011).

In conclusion, the selection of the best tool(s) to support an effective and rapid evaluation process needs to be considered, particularly with regard to the Italian context that is characterized by continual spending review actions; therefore, impacting in a positive way the healthcare expenditure.

Disclosure

The authors report no conflicts of interest in this work.

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