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FEATURES AND PREDICTORS OF ACTIVITY LIMITATIONS AND PARTICIPATION RESTRICTION 2 YEARS AFTER INTENSIVE REHABILITATION FOLLOWING FIRST-EVER STROKE.

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ABSTRACT

Background. Although stroke-related disability has been extensively studied, only few studies have investigated Participation restriction in chronic stroke survivors.

Aims. To identify features and predictors of Activity limitation and Participation restriction in the chronic phase of a first-ever stroke.

Design. Cross-sectional observational study.

Setting. Comprehensive stroke unit with outpatient rehabilitation facility.

Population. Subjects submitted to intensive rehabilitation after first-ever stroke, from 1st January 2009 to 31st December 2010.

Methods. Participation was investigated through the Frenchay Activity Index (FAI) and the Functional Status Questionnaire (FSQ) at 2.4 ± 0.5 years after the event. Basic activities of daily living (ADL) and mood were also assessed through the Modified Barthel Index (MBI) and the Beck Depression Inventory (BDI). A retrospective search of the medical records looked for: type/side of brain lesion, stroke clinical syndromes, comorbidities and functional condition at discharge from intensive rehabilitation (upper limb motricity index-ULMI-, Functional Ambulation Category-FAC, MBI, cognitive deficits).

Results. Forty-five subjects (17 female, age 70.1±11.5 years) were enrolled. They showed a striking restriction in their Participation, mainly for FAI-outdoor activities (median FAI score was< 50% of the theoretical maximum). A poor gait function (FAC) and an impaired mood (BDI) were the only independent predictors of FAI indoor (F=6.1; p=,005; R^2= 64%) and outdoor activities (F=4.1; p=.01; R^2= 48%), respectively. The univariate analysis showed a strong dependence of all FSQ scores from global disability (MBI), motor function impairment (ULMI and FAC) and cognitive deficits. Depression influenced "psychological function" score, whereas gait capacity was the only factor significantly associated with the "work performance" score.

The gait function level, achieved after intensive rehabilitation, was extrapolated by the multivariate analysis, as the most powerful independent predictor of the chronic activity limitations, as measured by MBI (F=33.8, p<,0001,R^2=,539).

Conclusion. Gait dysfunction is the main factor of Activities limitation and Participation restriction in chronic stroke. Participation is restricted by global disability, depression, older

age and dementia. More than 50% variance of Participation measures cannot be explained by the quoted factors.

Clinical Rehabilitation Impact. The study results support the need to integrate the standard rehabilitation approach with vocational rehabilitation in order to reduce Participation restriction.

Key words: stroke, participation, disability, evolution.

Introduction

Stroke is one of the principal causes of morbidity and mortality in adults and the leading cause of dependence in activities of daily living (ADL) in all industrialized countries.[1] The impairment in motor Functions and the consequent limitations in Activities (according to the ICF concept)[2] are the main cost drivers of stroke care, charging the national health and social services of a considerable economic burden, while accounting for the poor quality of life of stroke survivors. In fact, in spite of intensive and effective rehabilitation, approximately 50-60% of stroke patients will still experience some degree of motor impairment, being partly dependent in ADL, for the rest of their life.[3]

The achievement of independence in ADL is the main goal of rehabilitation; to this aim, an early accurate prediction of outcome in the subacute phase of stroke is crucial to set realistic and attainable therapeutic goals, foster proper discharge planning, anticipate the need for home adjustments and community support, and establish a therapeutic alliance with the patient and caregiver in order to fulfil the rehabilitation project.[4-6] In recent years, Participation has emerged as a new concept in the field of rehabilitation,[7] thus improving the old ICIDH- International Classification of Impairment Disability and Handicap- model focusing on handicap.[8] The International Classification of Functioning, Disability and Health (ICF) (WHO, 2001) has defined Participation as the involvement of the person in domains of life situations.[2] Since its introduction, the concept of Participation has progressively become a reference frame for all health professionals, now being considered a critical component of successful rehabilitation outcome.[9]

Unfortunately, there has not been any consensus, so far, on how Participation should be measured: while the different aspects of Participation require a multidimensional assessment to be ascertained in their entirety, it is possible that some of its components exhibit one-

dimensional properties. Therefore, some unsolved issues are: “What are the major aspects of Participation that should be measured?” or “ Do people form "types" of "participants" that can be categorized?”.[10] Probably due to such uncertainty, the inclusion of participation measures in randomized controlled trials in stroke research is not frequent. Furthermore, none of the most used participation measures fully cover all the ICF domains of Activities and Participation[11]: in fact, while these measures most frequently address issues related to Community, Social and Civic Life, Domestic Life, and Mobility, they disregard Learning and Applying Knowledge, General Tasks and Demands, and Communication.

In order to give a contribution to the quest for features and predictors of Participation restriction in the chronic phase of a first-ever stroke, we sought to design a cross-sectional observational study by applying two widely known measures: the Frenchay Activities Index (FAI)[12] and the Functional Status Questionnaire (FSQ).[13] Moreover, we considered that the clinical and personal factors that may restrict Participation are numerous; among them, dependence in basic ADL plays a major role, through hampering meaningful occupations and preventing life satisfaction.[14] For this reason we sought to ascertain the main factors of activity limitation as a secondary research aim.

Materials and methods

Study design: cross-sectional investigation of Activity limitation and Participation restriction 2 years after a first-ever stroke; a retrospective search in the stroke unit medical records was pursued to find out predictors of poor Participation in the chronic phase.

Subjects. The cross-sectional investigation took place from 1 January 2013 to 30 June 2013 on subjects selected on the basis of the following inclusion criteria: a) first-ever stroke more

than 2 years before; both ischemic strokes and intra-parenchimal haemorrhages were considered eligible, while subarachnoid haemorrhages and subdural hematomas were excluded; b) moderate to severe stroke-related disability, as assessed at discharge from the acute ward; c) fulfilment of an intensive rehabilitation program within the first 6 months of event; d) informed written consent to the investigation. Subjects were excluded if they had suffered from recurrent strokes within the last 2 years or exhibited severe comorbidities (like neoplasms, liver or renal failure, severe osteoarthritis, senile dementia) possibly accounting for Participation restriction. To this aim, the Cumulative Illness Rating Scale-CIRS was applied, and all subjects scoring > 3 in any domain (not concerning stroke-related brain damage) were excluded. In order to find eligible subjects, the clinical records of the 225 patients consecutively admitted, for a first-ever stroke, to the Stroke Unit, from 1st January 2009 to 31st December 2010, were systematically checked.

From the original sample, 130 subjects were immediately discarded: 29 died during the acute stay, while 101 did not meet the inclusion criteria (disability was too mild- 45 cases- or too severe –56 cases- to refer the patients for an intensive rehabilitation treatment). Among the remaining 95 subjects, who received in-patient rehabilitation, 3 had died within the last 12 months, 14 had suffered from recurrent strokes, 8 were excluded due to concomitant problems (prostate cancer, severe renal failure, recent hip fracture) that adversely affected functional prognosis, while 15 could not be traced.

The remaining 45 patients gave their consent to receive an interview concerning their Activities and Participation while undergoing a detailed clinical and functional examination.

Assessment protocol. FAI and FSQ were chosen as main outcome measures. The former has been appraised as a reliable stroke-specific participation measure.[11] FAI is a 15-item scale that assesses frequency of "lifestyle" activities in the areas of domestic chores, leisure/work,

and outdoor occupations, each item scoring 5 to 20.[12,15] The FSQ was intended as a tool for a comprehensive, not-disease specific functional assessment of mentally competent ambulatory patients.[13] It is a 34-item self-administered questionnaire, that can be completed in about 15 minutes, thus providing a thorough assessment of basic ADL, intermediate ADL, mental health, social activity and quality of social interaction. Moreover, the Modified Barthel Index (MBI),[16] was applied to measure the basic Activities of Daily Living (ADL), while the Beck Depression Inventory (BDI)[17] for assessing mood.

A retrospective investigation extrapolated comprehensive clinical and functional data from the medical records of the 45 subjects, concerning their stay as inpatients in the rehabilitation facility after stroke. Among the many available variables, we focused our attention on the following ones, in order to investigate their predictive role towards the functional outcome achieved by patients in the chronic phase:

a) type and side of the cerebral lesion,
b) clinical syndrome severity (categorized at stroke onset, before obtaining the CT brain imaging, into total anterior circulation syndrome-TACS, partial anterior circulation syndrome-PACS, posterior circulation syndrome-POCS and lacunar syndrome-LACS) [18] ,
c) number of concomitant diseases,
d) upper limb motricity index (ULMI)[19] at discharge,
e) Functional Ambulation Category (FAC)[20] at discharge,
f) MBI at admission and discharge, and, eventually,
g) the presence of dementia as diagnosed based on the findings of a standard neuropsychological assessment[21] of attention, language, memory, executive

functions, visual-spatial and praxis skills, conducted later than one month after stroke.

In particular, we disregarded most functional measures taken at rehabilitation admission, since their prognostic value would have been likely explained by the scores achieved on the same functional measures at rehabilitation discharge. Moreover, we only took MBI scores as measures of independence in ADL, while overlooking the FIM values; we did so in order to dispose of measures easily comparable to those taken in the chronic phase, where FIM score was not available.

All clinical and functional assessments were performed by trained researchers who applied each tool according to the instructions detailed in the cited references.[12,13,16-20]

Data analysis. Demographic and clinical variables in the whole sample were described using mean and Standard Deviation (SD) for parametric measures and median, range for non-parametric continuous variables, or rates for categorical parameters. The normal distribution of the main outcome measures (MBI, FAI and FSQ) was checked by considering the *skewness*, *excess kurtosis* of baseline scores and the *z-tests* for both *skewness* and *kurtosis*. In addition, the visual assessment of the Q-Q plot, served to confirm normality.[22]

The distribution of MBI, FAI and FSQ was therefore analysed by using the stroke clinical syndrome as grouping variables and the unpaired t-Student test to estimate inter-group differences. MBI evolution was assessed by means of ANOVA for repeated measures, with the hospital length as covariate factor, and the clinical syndrome as grouping variable. With respect to FAI and FSQ measures, both subscores and total scores were considered.[12]

MBI, FAI and FSQ scores, recorded at 2 years of stroke, during the cross-sectional investigation, were contrasted to the following independent variables provided by the

retrospective search: age, gender, type (ischemic/haemorrhagic) of stroke, clinical severity, motor (ULMI) and functional impairment (FAC score, MBI score), as well as the presence (YES/NO) of global cognitive impairment, dysphagia, bladder incontinence and depression, at discharge from intensive rehabilitation. Either the analysis of variance (ANOVA) or the simple regression test were applied to perform the univariate analysis, according to the categorical or continuous nature of the independent variables. A multivariate analysis was applied to extrapolate independent predictors of FAI, FSQ and MBI scores in the chronic phase; the model included age, hospital length, comorbidities, motor impairment (ULMI and FAC), MBI at rehabilitation discharge and BDI. Moreover, we looked into the impact of single cognitive dysfunctions on Participation measures. To this scope, we assumed that performances on attention, executive, memory, language and praxis tasks were pathological if the score obtained at the formal tests fell under the cut-off scores.[21] The FAI and FSQ scores were also dichotomized into normal and pathological, by applying the cutoffs obtained by investigating the general adult and elderly healthy population. [23, 13] A Chi-square test was then applied to find out raw correlations between pathological scores, exhibited by stroke subjects in single cognitive tasks, in the rehabilitation phase, and the pathological scores, shown by the same subjects, in Participation measures at 2 years of stroke.

Results

Clinical and functional features.

The analyzed sample consists of 45 patients (17 female), suffering from a first-ever moderate- severe stroke, without any previous disability. At the time of assessment, i.e. 2.4 ± 0.5 years after the event, they were 70.1 ± 11.5 years old (range: 49-92). Thirty-two of them (age: 71.1 ± 11.9 years, 12 female) presented an ischemic stroke while the remaining 13

(age: 66.8 ± 10.6 years, 5 female) had a cerebral hemorrhage. A lacunar syndrome (LACS) had been diagnosed in 18 cases (42%) (all suffering from an ischemic stroke), a partial anterior circulation syndrome (PACS) in 11 (24%) (3 ischemic and 8 hemorrhagic strokes), a total anterior circulation syndrome (TACS) in 11 (24%) (6 ischemic and 5 hemorrhagic strokes) and a posterior circulation syndrome (POCS) in the remaining 5 (11%) (all ischemic strokes). Patients with a TACS were significantly younger than those with LACS or POCS syndromes (t= 2.3 , p =.04; t = 2.3, p =.03 respectively). Table I details demographic, clinical and functional data at the time of the cross-sectional investigation.

Activity limitation in the chronic stroke phase and its predictors

In the chronic phase, patients suffering from a TACS scored significantly worse in ADL independence measure (MBI) and arm function (ULMI) with respect to those with LACS (t= 3.9 , p =.0007; t= 4.2; p =.0003 respectively) or PACS (t = 2.4, p =.03; t = 2.2, p =.04 respectively). The median FAC score was 3 (=***Supervision***: the patient is able to ambulate without manual contact from another person but requires stand-by guarding of one person for safety) in all stroke clinical syndromes, except for those with TACS, who showed a median FAC score of 2 (=***Physical assistance level –I***: manual contact is required from one person during ambulation to prevent falling. Manual contact may be continuous or intermittent light touch to assist balance or coordination) (Chi-square: 9.2; p=.02).

The retrospective analysis of MBI score changes after stroke, highlighted that independence in ADL significantly improved during intensive rehabilitation, in all subjects (repeated measures ANOVA time effect: F=63.7; p<.0001). After discharge from intensive rehabilitation, MBI score further increased, in all patients, except those with the severest neurological impairment (TACS). The overall time effect was statistically significant (repeated measures ANOVA time effect: F=8.2; p=.0076) (Fig.1). Hospital length was

longer for TACS with respect to PACS (t = -2,.3 p = .03) and LACS (t = -4.5; p=.0001) and was significantly influenced by admission MBI score (AdjR^2:40%; F= 25.9; p<.0001).

MBI score attained in the chronic phase appeared to be influenced both by clinical syndromes and the residual disability after rehabilitation completion: in particular, low MBI and FAC scores, cognitive deficits, and urinary incontinence at rehabilitation discharge were all significantly related to persistent disability, late after stroke (Table II: Correlations of Participation measures, FAI, FSQ, with demographic, clinical and functional features - univariate analysis). Finally, the multivariate analysis extrapolated FAC score (t=2.3; p=.03) as the most powerful independent predictor of the MBI score in the chronic phase (F=33.8, p<,0001,R^2=,539).

Participation restriction in the chronic stroke phase and its predictors

Chronic stroke subjects showed a striking restriction in their participation.

In fact, the FAI total score hardly reached the mean value of 31.3 ± 10.0 (median: 32; women: 32.2 ± 9.2; men: 30.6 ± 10.6). The FAI-outdoor activity section disclosed the major problems, the mean score being 7.8 ± 3.3 (median: 7; women: 7.0 ± 2.7; men: 8.5 ± 3.6), The FAI-indoor reached the score of 23.5 ± 8.1 (median: 25; women: 24.4 ± 7.9; men 22.8 ± 8.3).

No differences were found across groups with different clinical syndromes.

The FAI total score was mostly influenced by upper limb impairment (ULMI), and, to a lesser extent, by dysphagia and urinary incontinence, whereas MBI score did not exert any significant influence (Table II). None of these factors maintained their predictive value on the multiple regression analysis (global model predictive value: AdjR^2:55%; F= 4.1; p=.02).

A poor gait function (FAC score) and an impaired mood (BDI score) were the independent predictors of FAI indoor and outdoor activities, respectively (FAI indoor activities: multiple

regression model: global score F=6.1; p=,005; R^2= 64%; FAC: t = 2.5; p = .03); FAI outdoor activities: multiple regression model: global score: F=4.1; p=.01; R^2= 48%; BDI: t = -2.3; p = .03) (Table II).

Global cognitive impairment adversely affected the FAI indoor activities (Table II), though not the global and outdoor activity scores. No significant impact of single cognitive dysfunctions on the FAI scores was appreciated.

All FSQ item scores fell within the warning zone, except for the frequency of social contact. Subjects with TACS exhibited a greater social disability than other clinical syndromes, albeit the difference was not statistically significant (Fig. 2). The univariate analysis showed a strong dependence of all FSQ scores from global disability (MBI), motor function (ULMI and FAC) and global cognitive impairment. No single cognitive deficit was significantly associated to FSQ pathological scores. Depression (BDI score) influenced "psychological function" score, whereas gait capacity was the only factor significantly associated with the "work performance" score. No further findings were provided by the multiple regression analysis (Table II).

Discussion

This observational study provides evidence that subjects undergoing intensive rehabilitation after a moderate to severe first-ever stroke, still exhibit a conspicuous restriction of their participation two years after the event, in spite of a recovered independence in the basic ADL: in fact, they score at least 50% of the maximum achievable value in standard measures of participation, while showing a proxy to optimum recovery in ADL measures (mean MBI score ranging from 60% to 85%). The intermediate ADL, the social activities and the work

performance are the most constrained, and, generally speaking, outdoor occupations are more impaired than indoor activities.

FAI and FSQ, albeit not-disease specific, have been preferred to other disease-specific measures of Activities and Participation, like the Stroke Impact Scale (SIS) [11,24-27]. In fact, while SIS checks the difficulty perceived by patients in doing outdoor activities,[24] both FAI and FSQ measure the frequency of the activities really performed by the individuals, covering a wide range of behaviors belonging to the Activities and Participation domains of the ICF. Moreover, not-disease specific tools provide data comparable to those collected in other series of age-matched healthy individuals, thus allowing a more precise estimate of the stroke impact on daily living activities.

Independent of the participation measure applied, the global level of participation was not significantly modulated by the clinical syndrome, that is to say, stroke severity. The intermediate ADL depended on the global functional status (as measured by independence in basic ADL), the cognitive functions, the upper limb motricity and the functional level of walking. Moreover, the outdoor activities, the social activities and work performance showed to depend also on age and urinary incontinence. On the multiple regression analysis, indoor activities (FAI score) were mostly influenced by a complex relationship between age, comorbidities, global and focal disabilities and mood depression, that explained up to 64% of the variance, while the FAC score came out as the only independent predictor of a good level of participation in these domains. Depression (BDI score) was the only independent predictor of participation in outdoor activities (FAI score).

This study shows a good external validity, since the demographic, clinical and functional profiles of the subjects enrolled are homogeneous with those described in larger population-based studies on stroke-related disability, published in the late 20th century.[1]

With respect to the primary aim of this research, our findings agree with other studies: first, it emerges that the relationship between disease, performance in basic ADL and participation is complex. Shortly, patients with greater difficulties in basic ADL rarely participate in community activities, compared to those who have achieved independence in basic ADL, who declare to participate in everyday community activities, more often. However, the relationship between basic and intermediate ADL, social activities or work performance is not a linear one, as confirmed by the literature.[25-27] Desrosiers et al[27] argued that measures of interpersonal relationship and leisure are warranted in order to better outline the functional profile of stroke survivors. In the present research, we sought to analyze the social role, the interpersonal relationships and the leisure activities, by means of FAI and FSQ: we observed that even though the level of participation strongly depends on global and focal disabilities, the whole range of explicative variables is far from being unveiled. Even the severity of symptoms at stroke onset, [28] while accounting for the functional recovery in the subacute phase, cannot adequately predict how the subject's participation will be in the chronic phase. Functional ambulation category and cognition were shown to influence several aspects of participation, in contrast with age, that did not seem to play an important role. Also Desrosiers et al[29] did not highlight a strong relation between age and participation restriction in the social activities. They reported that only the 85+ group consistently scored lower than the 65–69-year-old group, in social roles. In fact, the elderly people often perceive less restriction in their social activities than the young people, when affected by motor disability, thus reporting that they can participate satisfactorily in valued activities. As a matter-of-fact, satisfaction with activity and participation cannot simply be inferred from body functions, because it depends on complex interactions between functional, personal, and environmental factors.[30]

Authors, who were concerned with the adverse role of axial symptoms,[31,32] underlined the negative influence of gait, balance and falls on activities and participation after stroke. Schmid et al[32] reported that both balance and self-efficacy, that is the subject's ability at assessing his/her own risk of falls, are better predictors of participation, compared to either gait speed or walking capacity[33]. Walking assessment and gait training are acknowledged components of stroke rehabilitation: however, on the basis of the above-mentioned phenomena, an increased focus on the psychological and cognitive profile of a stroke subject is warranted in order to yield a greater impact on the recovery of health status perception. In fact, like others before, our research showed that the overall level of participation is limited by cognitive deficits. Viscogliosi et al[33] also reported that selected cognitive deficits, namely language and executive impairments, may progressively affect interpersonal relationships, community life and responsibilities. Indeed, we failed at showing any correlation between single cognitive dysfunctions and Participation measures. Beyond the small sample size, the fact that the correlation analysis compared cognitive abilities assessed during the intensive rehabilitation phase, to Participation measures taken around two years later, may help to understand such negative finding. Viscogliosi et al[33] reported that stroke subject participation keeps improving after home discharge irrespective of the impairment in single cognitive abilities. Moreover, while motor deficits remain quite stable over time, cognitive functions show a trend towards deterioration, so that dementia rate is expected to reach 30-50% at 1-3 years after stroke,[34] mainly depending on the MMSE score at stroke onset[35]

On such premises, it is possible to confirm that the occurrence of global cognitive impairment (e.g. dementia), though not of single cognitive deficits, after stroke, represents a predictor of long-term Participation restriction, thus supporting the need for a careful monitoring of non-motor symptoms in chronic stroke survivors.

In fact, apart from cognition, also mood depression, swallowing and bladder dysfunction play an adverse prognostic influence on participation. The functional consequence of depression following stroke has been measured in terms of an increased mortality, higher burden of care, enhanced cognitive decline, worse recovery potential and poorer quality of life.[36,37]

Swallowing and bladder dysfunctions have been found to affect the quality of life while augmenting the risk of severe complications among adults with acquired disabilities.[38,39]

Although we confirmed the power of several clinical factors at influencing different domains of participation, the multiple regression analysis highlighted that a large percentage of variance in participation measures could not be explained by the factors in the equation. This finding claims for the role of latent variables, both personal (personal willingness, fear of social rejection), and environmental (availability of services for the community integration of disabled persons, rehabilitation facilities, occupational therapy, architectural barriers).

Recently, patient's motivation emerged as a powerful prognostic factor of rehabilitation-dependent functional recovery after stroke.[40] Indeed, motivation is the result of internal personality traits, social factors, inter-subjects interactions and expectations of patient and caregivers; it may be regarded as the effort that a patient shows while performing all exercises/activities. [41]

Therefore, further studies should consider the opportunity of measuring motivation through specific tools, in order to quantify its predictive role towards rehabilitation-dependent outcome.

As a secondary aim, our research revealed that all stroke subjects, apart from the TACS subgroup, achieved a significant improvement in the basic ADL (MBI) and motor functions (upper limb motricity, FAC) after the discharge from inpatient rehabilitation. Other studies

indicated that the largest part of motor recovery is almost completed within 10 weeks of stroke.[42] On average, stroke recovery plateaus three- to six-months after onset.[43] The disability level at onset and the improvement observed within the first weeks after stroke are important indicators of the outcome at six-months. Strong evidence has been provided that both age and the neurological symptom score in the acute stroke phase are strongly associated with the basic ADL score at three-months: our retrospective search of functional evolution of stroke survivors in the subacute phase replicates these findings. Further data on the functional progression of stroke survivors beyond the first year is sparse.[42,43] Our study showed that stroke severity is the main obstacle hindering functional recovery in the chronic phase: in fact, only subjects with mild to moderate stroke continued to improve their disability level, in spite of an unchanged motor impairment, after being discharged from intensive rehabilitation. Some authors argued that the concept of the motor recovery plateau after a brain lesion may not be reliable,[3] and there is need for further evidences. Nevertheless, it is plausible that both functions and activities undergo a progressive, though not unlimited, improvement at home, if adequately stimulated, thanks to neuroplasticity mechanisms and adaptation.

Study Limitations

This is a cross-sectional investigation aimed at characterizing Activity limitations and Participation restriction (that is to say, performances in ADL and instrumental ADL) in 45 survivors to moderate-severe stroke 2 years after the event. The topic is not original in its aim, though in the methodological approach since it appears to be the first one where measures of Participation are contrasted with clinical and functional features recorded in the acute and post-acute stroke phase.

The involvement of subjects referred to a single inpatient rehabilitation facility and the small sample size may have reduced the external validity of our findings. Moreover the retrospective retrieval of clinical data may have reduced their reliability and completeness.

We extracted the studied subjects from a larger sample of 225 people, half of whom were discarded since they did not meet the criteria for intensive rehabilitation, being either too much or too little disabled. Among those who performed rehabilitation, 50% developed complications or could not be traced. Applying a "worst scenario" approach to the management of missing data, we could easily suppose that people enrolled in this investigation represent the category of subjects who most benefit from intensive rehabilitation after stroke. Therefore, the outlining of activity limitations and participation restriction in this small sample may help to figure out the larger relevance of such problems in the chronic stroke population.

Conclusions

In chronic stroke survivors, Participation restriction was associated with functional ambulation category, global disability, mood depression, age and other non-motor features, like dementia and autonomic dysfunctions, whereas Activity limitations only depended on the severity of brain lesion and gait impairment. Remarkably, more than the 50% of the variance of participation measures could not be explained. With respect to social roles, stroke survivors were more likely to fulfil family responsibilities and less likely to work. With respect to social activities, they were more likely to perform indoor activities and less likely to perform tasks outside of the home. Since intensive rehabilitation is mainly provided on a hospital basis, it can hardly address problems experienced by single individuals in their

routine life, by targeting the interventions to specific domains of participation. A better understanding of the clinical and vocational patients' features, that may influence participation in daily activities and social roles, is warranted to improve rehabilitation outcomes. The integration of a standard stroke rehabilitation approach, based on motor/cognitive skill training, with vocational rehabilitation could hopefully determine a more effective impact on patient's involvement in real life situations, thus reducing depression and, likely, all complications related to movement restriction.

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TITLES OF TABLES

Table I - Functional profile of the chronic stroke subjects, at the time of the cross-sectional investigation. Clinical and functional data of the post-acute phase, retrospectively collected from the medical records of rehabilitation stay, are also provided.

Table II - Correlations of Participation measures (FAI, FSQ) with demographic, clinical and functional features (univariate analysis).

TITLES OF FIGURES

Fig. 1 - Evolution of MBI scores in the studied subjects, from the acute to the chronic stroke phase. A significantly different course may be observed in the TACS, with respect to the other stroke clinical syndromes.

Fig. 2 - Mean values attained by the studied subjects in the FSQ domains. Most scores fall below the cut-off for the warning zone (dotted lines), indicating a severe restriction of Participation in all relevant life activities, irrespective of stroke severity.

Table I: Functional profile of the chronic stroke subjects, at the time of the cross-sectional investigation. Clinical and functional data of the post-acute phase, retrospectively collected from the medical records of rehabilitation stay, are also provided.

		Subjects (N)	Age (years) (m ± s.d.)	GENDER (F/M)	LOS (days) (m ± s.d.)	MBI (rehabilitation admission) (m ± s.d.)	MBI (Chronic phase) (m ± s.d.)	ULMI (Chronic phase) (m ± s.d.)	FAC (Chronic phase) Median [range]
TOTAL		**45**	**70.1 ± 11.5 [range: 49-92]**	**17/28**	**30.4 ± 33.5**	**38.7 ± 24.4**	**64.9 ± 27.9**	**62.7 ± 36.6**	**3 [0-5]**
Stroke severity	**TACS**	**11 (24%)**	**61.9 ± 13.7**	**3/8**	**51.5 ± 24.8**	**17.0 ± 14.5**	**59.7± 22.2**	**31.5± 32.1**	**2 [0-3]**
	PACS	**11 (24%)**	**69.3 ± 10.4**	**7/4**	**23.0± 23.0***	**44.3 ± 28.6***	**85.2 ± 15.0***	**66.6 ± 31.5***	**3 [0-5]**
	POCS	**5(11%)**	**78.3 ± 0.5***	**1/4**	**24.8 ± 11.7**	**36.8 ± 23**	**72.8 ± 35.6**	**75.0 ± 50.0**	**3 [0-5]**
	LACS	**18(41%)**	**72.9 ± 11.1***	**6/12**	**19.1 ± 13.6***	**50.8 ± 25.6***	**74.1 ± 22.7***	**78.5 ± 25.1***	**3 [0-5]**

Legend. N: number; F: female, M: male; m: mean, s.d.: standard deviation; LOS: Length Of rehabilitation Stay; MBI: modified Barthel Index; ULMI: upper limb motricity index; FAC: functional ambulation category; TACS: total anterior circulation syndrome; PACS: partial anterior circulation syndrome; LACS: lacunar anterior circulation syndrome; POCS: posterior circulation syndrome; *: $p<.05$ for the comparison *versus* TACS

Table II: Correlations of Participation measures (FAI, FSQ) with demographic, clinical and functional features (univariate analysis)

		Demographic and clinical factors		Clinical and functional features at discharge from intensive rehabilitation							Clinical and functional features in the chronic stroke phase	
		Age	**Stroke severity**	**Depression**	**Global cognitive impairment**	**Urinary incontinence**	**Dysphagia**	**MBI SCORE**	**ULMI**	**FAC**	**MBI SCORE**	**BDI**
MBI		n.s.	F = 4.3 p = .01	n.s.	**F = 11.4 p<.002**	**F = 11.6 p = .002**	n.s.	**F=28.7 p<,0001 (aR^2 = .45)**	n.s.	**F = 21.7 p < .0001 (aR^2 = 39)**	-	n.s.
FAI	**Total score**	n.s.	n.s.	n.s.	n.s.	F = 4.7; p = .04	F = 4.2 p = .047	n.s.	**F=21.1; p<.0001; (aR^2=.36)**	n.s.	n.s.	n.s.
	Indoor activities	n.s.	n.s.	n.s.	F = 7.2 p = .01	n.s.	n.s.	n.s.	**F = 8.0; p = .008; (aR^2 = .18)**	F = 7.5 p = .01 (aR^2 = .17)	F = 4.8 p = .03 (aR^2 = .12)	n.s.
	Outdoor activities	**F= 10.3 p = .003 (aR^2:.22)**	n.s.	n.s.	n.s.	**F = 11.8 p = .002**	n.s.	F = 4.8 p = .04 (aR^2 = .10)	n.s.	n.s.	n.s.	n.s.
FSQ	**Basic ADL**	n.s.	n.s.	F = 4.6 p = .04	**F = 14.9 p =.0005**	n.s.	n.s.	F = 6.5 p = .02 (aR^2 = .14)	F = l.3 p = .01 (aR2=.16)	n.s.	F = 6.4 p =.02 (aR^2=.16)	n.s.
	Intermediate ADL	n.s.	n.s.	n.s.	F = 5.6; p = .02	n.s.	F = 6.5 p = .02	**F = 8.3 p = .007 (aR^2 = .18)**	**F= 8.1 p = .008 (aR^2=.18)**	F=7.2 p=.01 (aR^2 = .17)	**F=8.5 p=.007 (aR^2=.21)**	n.s.
	Psychological function	n.s.	n.s.	n.s.	F = 4.5 p = .04	F = 4.9; p = .03	n.s.	n.s.	**F= 11.6 p=.0004 (aR^2=.31)**	**F= 12 p=.001 (aR"=.27)**	F=4.6 p=.04 (aR^2=.11)	F = 5.02 p = .03 (aR2 = .14)
	Work performance	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	F= 4.6 p=.03 (aR^2 = .9)	n.s.	n.s.
	Social activities	n.s.	n.s.	F = 5.6 p = .02	F = 6.1 p = .02	F = 4.3; p = .04	n.s.	F = 4.6 p =.04 (aR^2 = .10)	F= 5.3 p = .03 (aR^2 = .12)	F = 4.6 p = .03 (aR2 =.10)	**F = 10.3 p = .004 (aR^2 = .25)**	n.s.
	Quality of interaction	F = 4.8 p = .04 (aR^2:.10)	n.s.	n.s.	n.s.	n.s.	n.s.	F = 5.6 p = .02 (aR^2 = .12)	n.s.	n.s.	F = 6.6 p = .02 (aR^2 = .16)	n.s.

Legend. FAI: Frenchay Activity Index; FSQ: Functional Status Questionnaire; ADL: Activity of Daily Living; MBI: Modified Barthel Index; ULMI: Upper Limb Motricity Index; FAC: Functional Ambulation Category; BDI: Beck Depression Inventory; aR^2: Adjusted R squared.

Fig.1. Evolution of MBI scores in the studied subjects, from the acute to the chronic stroke phase. A significantly different course may be observed in the TACS , with respect to the other stroke clinical syndromes

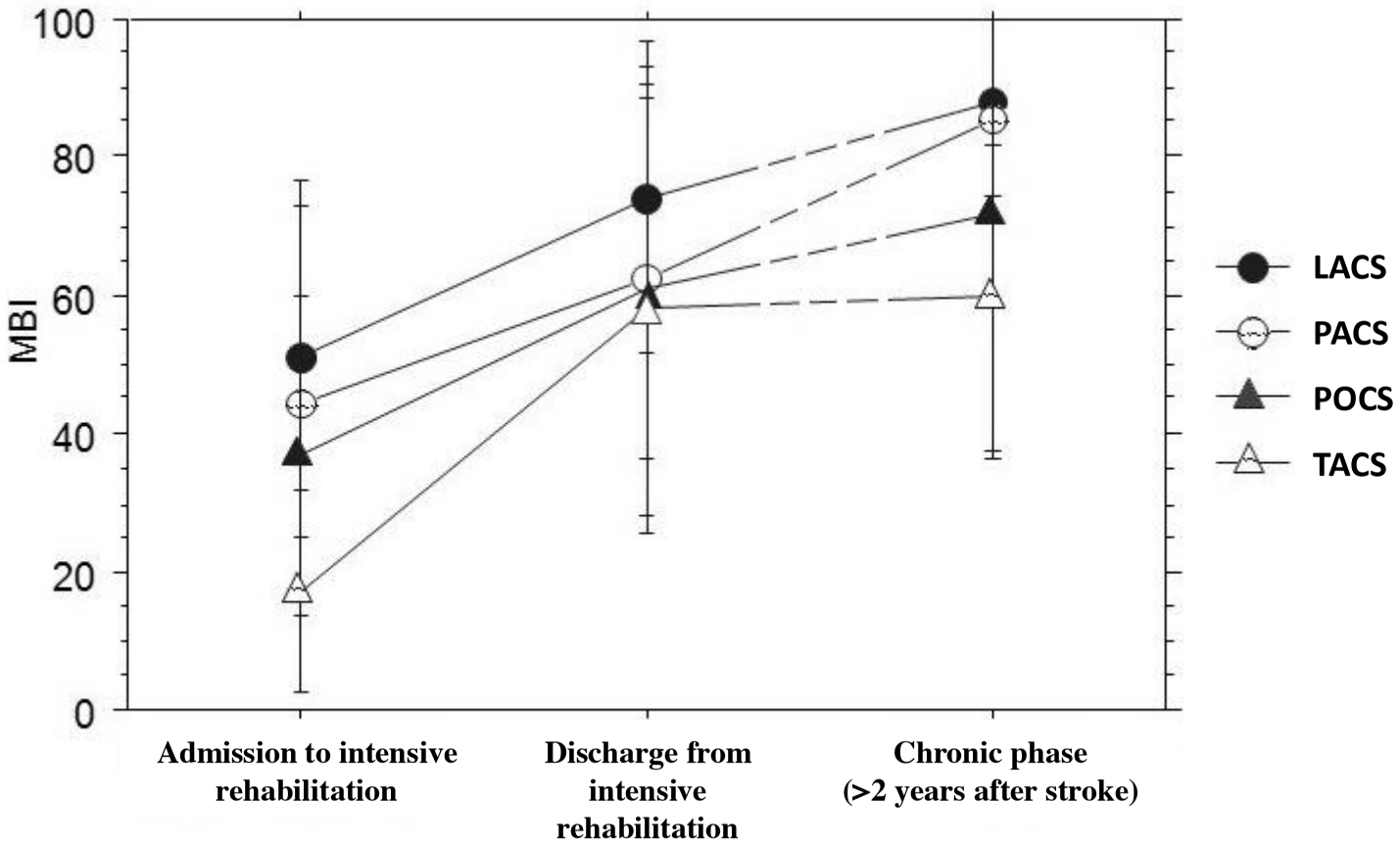

Fig. 2 Mean values attained by the studied subjects in the FSQ domains. Most scores fall below the cut-off for the warning zone (dotted lines), indicating a severe restriction of Participation in all relevant life activities, irrespective of stroke severity.