



Original article

Physical disability and personality traits in multiple sclerosis

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Introduction

Multiple sclerosis (MS) is a disease with several clinical phenotypes running from forms that rapidly render sufferers disabled to others with only a low level of handicap. In the light of the varying progressions that can be found in the illness, for forms have been standardized (Karussis, 2014). Most patients with MS, between 80% and 85%, have the relapsing remitting form (RRMS) and approximately 80% of these evolve into the Secondary Progressive form of Multiple sclerosis (SPMS). In contrast, some 10%–20% of patients present primary progressive Multiple sclerosis (PPMS) (Lublin et al., 1996).

MS is the second commonest cause of neurological origin leading to limitation of activity in young adults, surpassed only by traumatic lesions (Scheinberg and Smith, 1987). Patients with MS must live with varying degrees of physical handicap or deterioration affecting functional systems such as pyramidal tract, cerebellar, cerebral, sensorial, intestinal and bladder, among others (Kurtzke, 1983).

In recent decades, there has been growing interest in the emotional repercussions of MS from this deterioration in family, work and social contexts. This is because the disease normally appears between the teens and the age of forty, cutting short patients' lives, but also seriously affecting their quality of life (Kidd et al., 2017; Clemens and Langdon, 2018) and the five personality factors Neuroticism, Extraversion, Openness to Experience, Agreeableness and Conscientiousness (Cattell, 1945; Cordero Pando et al., 1999; Costa and McCrae, 2002).

In 2004, research by Schneider noted that Neuroticism predicts and assesses threatening situations. It is linked to negative emotional experiences both in individuals who feel threatened, and in those whose resources for coping with or facing up to problems are proportional to those of healthy individuals (Schneider, 2004). Authors like to point out that after a stressful occurrence, such as the diagnosis of an illness, it is common to see so-called adjustment disorder during the following three months (American Psychiatric Association. and American Psychiatric Association. DSM-5 Task Force., 2018). In contrast, other authors like (Reznikova et al., 2007) investigated the presence of psychotic and neurotic features in MS, noting the prevalence of neurotic characteristics. Likewise, (Benedict et al., 2009) demonstrated the existence of a

relationship between an individual's personality features and that person's level of cortical atrophy. Moreover, there is wide awareness of the alterations in cognitive functions in SPMS (Andreu-Català et al., 2008; Korakas and Tsolaki, 2016) and of how states of anxiety affect information processing in this illness (Goretti et al., 2014). Furthermore, in all forms of the disease there are clinical syndromes such as affective and anxiety disorders, the combination of which with MS increases the risk of suicide, alcohol abuse, physical complaints and the like, downgrading emotional and social functioning (Theodore and Rogers, 1998; García et al., 2013).

Hence, an attempt will be made to analyse the relationships of patients suffering from MS in the light of the degrees of disability typical of that disease and of personality factors that any healthy individual may manifest. Additionally, it will be investigated whether a patient's sex impacts on the handicaps of MS or on facing up to the illness. Thus, this research should assist in early interventions, enhance prognoses, avoid complications, both physical and psychological, and consequently improve the life of patients and conceivably reduce the costs of looking after them.

In the light of the above, this piece of research was undertaken with the aim of reducing as far as possible the lacunae, limitations, or both observed in this field of study. It was hypothesized that: (a) The level of disability would be worse in secondary progressive than in RRMS; (b) There would be differences in personality factors between secondary progressive and RRMS; (c) The degree of handicap from MS would be greater in men than in women; (d) Personality factors would differ from men to women patients with MS; (e) The level of disability in patients with MS would affect their personalities.

The objectives set were the following:

- To establish the relation between patients suffering the RRMS, SPMS and degrees of handicap and personality factors.
- To determine the link between a MS patient's sex and levels of handicap and personality factors.
- To specify the relationship between degrees of disability and personality factors.

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Method

The design of the study was observational and transverse. It was carried out in the Neurology Service of the University Hospital in Leon and the Bierzo Hospital in Ponferrada. All subjects signed an informed consent form approved by the Ethics committee of the University of León. We followed national and international guidelines (Code of Ethics and Declaration of Helsinki), and we followed the legal regulations on data confidentiality (Spain's organic law 15/1999 of 13 December on the protection of personal data).

2.1 Sample

A group of 65 patients diagnosed with MS confirmed by a neurologist according to the criteria put forward by McDonald (Mantero et al., 2018) were studied. Of these, 49 had the RRMS subtype, 8 of them being men (16.3%) and 41 women (83.7%). There were 16 patients with the SPMS subtype, 9 of them men. Among the RRMS cases, 30 (61.2%) were aged between 24 and 40 years, while 19 (38.8%) were over 40 years of age. Of the 16 SPMS patients, 5 (31.1%) were aged between 24 and 40, while 11 (68.7%) were over 40. The highest level of education was secondary, this being true for both RRMS (42.9%) and SPMS (56.2%). The majority of patients lived with other people, this being slightly more so for SPMS (68.7%) than for RRMS (55.1%). Finally, it was noted that the proportion of retired people was 4.1% among RRMS patients, but 31.1% for those with SPMS. (See Table 1).

2.2 Measurement Tools

The instruments used for evaluation of the sample were socio-demographic variables, the Expanded Disability Status Scale (EDSS), and the NEO Reduced Five-Factor Personality Inventory (NEO-FFI). Dos investigadores realizaron las pruebas, la EDSS fue realizada por un medico neurologo con amplia experiencia y, la NEO-FFI y las variables sociodemographic fueron recogida por un psicologo capacitado.

The sociodemographic variables (sex, age, educational level, living alone or with others, and whether retired) were collected through an interview.

The physical disability or handicap of the MS patients was registered by means of the Expanded Disability Status Scale (EDSS) (Kurtzke, 1983). This quantifies the status of functional systems. This scale allows a classification on the basis of a score of up to 2 points for no handicap, while a minimum to moderate disability scores from 2 up to 4 points, with handicaps affecting the ability to walk being scored at 4 or more points. The full range goes from 0 to 10 points, with 0 points equating to a wholly normal neurological examination and 10 to death from MS. The EDSS has limited intra and inter evaluator reliability (Goodkin et al., 1992), but it is the most used instrument in clinical

Table 1
Sociodemographic characteristics of sample.

		RRMS (n = 49)	SPMS (n = 16)
Sex	Man	8 (16.3%)	9 (56.2%)
	Woman	41 (83.7%)	7 (43.8%)
Age	24 to 40 years	30 (61.2%)	5 (31.3%)
	over 40 years	19 (38.8%)	11 (68.7%)
Level of Education	Primary	15 (30.6%)	2 (12.5%)
	Secondary	21 (42.9%)	9 (56.2%)
	Tertiary	13 (26.5%)	5 (31.3%)
Living	Alone	22 (44.9%)	5 (31.3%)
	With others	27 (55.1%)	11 (68.7%)
Retired	No	47 (95.9%)	11 (68.7%)
	Yes	2 (4.1%)	5 (31.3%)

RRMS: Relapsing Remittent Multiple Sclerosis
SPMS: Secondary Progressive Multiple Sclerosis

trials that evaluate the evaluation of complications and is the risk of an endpoint tool by different authorities in the theme (Meyer-Moock et al., 2014).

Personality factors were recorded with NEO-FFI. This is one of the most prestigious measurement instruments for evaluation in accordance with the “five majors” model: Neuroticism, Extraversion, Openness to Experience, Agreeableness and Conscientiousness. The questionnaire comprised a total of 60 items to which responses are given on a five-option Likert scale as a function of the degree of concurrence with the statement: 0 = Disagree totally, 1 = Disagree, 2 = Neutral, 3 = Agree, 4 = Agree totally. At the present time, the model of five major personality factors is generally accepted and there are numerous tools designed for measuring them. The internal consistency of the NEO-FFI was high across the five domains (ordinal α 's ranged from 0.866 to 0.918) (Costa and MacCrae, 1992). Of these the most typical is NEO Personality Inventory - Revised, while NEO-FFI is a shortened version. According to this model, personality is built up of five broad factors or dimensions, involving stable and consistent tendencies to respond. Each factor is made up of six scales or facets (Cordero Pando et al., 1999).

Statistical Analysis

In view of the size of the sample (n = 65 subjects), the Central Limit Theorem was taken into account. This permits correction of the normality of a variable as a function of sample size. Hence it may be inferred that all the variables under study behave normally, which allows them to be investigated parametrically.

As this was an observational study, mathematical analysis concentrates fundamentally on the drawing up of bi-variant contingency tables (Pearson's χ^2), comparisons of means (Student's T-test), and analysis of variance (Fisher-Snedecor distribution). The significance level was set at 95% 1 - α . The statistical analysis package SPSS 23.0 (SPSS Incorporated, Chicago, Illinois, U.S.A.) was used.

Results

Table 2 shows the results for the relationship between the degree of disability according to EDSS and personality factors in the types of ME (RRMS and SPMS). Values for EDSS are given as averages and frequencies, as they are qualitative variables. In contrast, values for NEO-FFI are given as averages and standard deviations, since they are quantitative variables. This being said, it is observable that the relationship between the degree of handicap and the type of ME was statistically significant, it being shown that the range indicating no

Table 2
Relationships between Degree of Handicap and Personality Factors According to NEO-FFI in Types of Multiple Sclerosis (RRMS and SPMS).

	RRMS (n = 50)	SPMS (n = 15)	p
EDSS			
No Disability	27 (55.1%)	2 (12.5%)	< 0.001
Minimum to Moderate	19 (38.8%)	6 (37.5%)	
Affecting walking	3 (6.1%)	8 (50.0%)	
NEO-FFI			
Neuroticism (M \pm SD)	23.6 \pm 9.2	23.8 \pm 10.4	0.930
Extraversion (M \pm SD)	26.7 \pm 9.1	22.4 \pm 8.0	0.111
Openness (M \pm SD)	26.6 \pm 7.3	23.6 \pm 7.4	0.167
Agreeableness (M \pm SD)	31.4 \pm 5.4	32.4 \pm 5.7	0.528
Conscientiousness (M \pm SD)	30.7 \pm 7.1	30.9 \pm 6.8	0.934

RRMS: Relapsing Remitting Multiple Sclerosis
SPMS: Secondary Progressive Multiple Sclerosis
NEO-FFI: NEO Reduced Five-Factor Personality Inventory
EDSS: Extended Disability Status Scale
M \pm SD: Average (arithmetical mean) plus or minus Standard Deviation

Table 3
Relationships between Levels of Physical Disability and the Sex of Patients in the Multiple Sclerosis Sample.

	Men (n = 17)	Women (n = 48)	p
EDSS –Absence of Disability	3 (10.3%; 17.6%)	26 (89.7%; 54.2%)	0.023 (a)
EDSS –Minimum to Moderate Disability	9 (36.0%; 52.9%)	16 (64.0%; 33.3%)	
EDSS – Affects Walking	5 (45.45%; 29.4%)	6 (54.54%; 12.5%)	

EDSS: Expanded Disability Status Scale

(a) Chi-squared test (χ^2)

Risk α = 0.05

disability is more prevalent in RRMS (55.1%), while the range of disability affecting walking is more predominant in SPMS (50%). Furthermore, no significant differences were found in respect of the five factors in the NEO-FFI inventory and the types of ME (SPMS, RRMS).

Moreover, with regard to relationships between degrees of disability and sex of the patient statistically significant differences ($p = 0.023$) were found. A comparison of the frequency figures at different levels of handicap showed that women presented higher values than men in the ranges of absence of disability, at 10.3% versus 89.7%, of minimum to moderate handicap at 36% versus 64%, and of disability affecting walking at 45.45% versus 54.54% (see Table 3).

Likewise, it may be observed that in the relationship of the extent of handicap in men and in women: (a) the highest frequency in men was for the minimum to moderate level of disability, at 52.9%; and (b) in women it was the absence of handicap level, at 54.2 % (Table 3).

Table 4 gives evidence for differences in several personality factors relating to the sex of patients. There were significant differences in the factors Extraversion ($p = 0.01$) and Openness to Experience ($p = 0.03$). In contrast, the factors Neuroticism, Agreeableness and Conscientiousness showed no significant differences.

Similarly, analysis of the psychological profile of the sample ($N = 65$) yields a classification based on NEO-FFI for each of the three principal groups according to the EDSS scaling. Table 5 presents the values for means and standard deviations. The first group ($n = 29$), those not showing any physical handicap on the EDSS scale, present a well-adapted personality profile on the NEO-FFI scale, with low scores for Neuroticism and high scores for Extraversion, Openness to Experience, Agreeableness and Conscientiousness. The second group ($n = 25$), having minimum to moderate disability as rated by EDSS, presents a profile contrasting with that of the first group, with high scores for Neuroticism, and low for Extraversion, Openness to Experience, Agreeableness and Conscientiousness. The third group ($n = 11$), with a handicap affecting walking as seen by EDSS, does not show the most negative or worst adjusted profile, since its scores for Neuroticism lie

Table 4
Relationships between Personality Factors (NEO-FFI) and Sex of Patients in the Multiple Sclerosis Sample.

	Men (n = 17)	Women (n = 48)	p
NEO-FFI			
Neuroticism (M \pm SD)	24.4 \pm 9.9	23.4 \pm 9.3	0.69
Extraversion (M \pm SD)	21.2 \pm 8.6	27.2 \pm 8.6	0.01
Openness (M \pm SD)	22.8 \pm 7.6	27.1 \pm 7.0	0.03
Agreeableness (M \pm SD)	29.9 \pm 5.6	32.2 \pm 5.3	0.12
Conscientiousness (M \pm SD)	29.2 \pm 7.5	31.3 \pm 6.8	0.31

NEO-FFI: NEO Reduced Five-Factor Personality Inventory

M \pm SD: Average (arithmetic mean) plus or minus Standard Deviation

(a): Student's T-test

Risk α = 0.05

around the arithmetic mean for the sample as a whole. Nonetheless, this group scores lowest in Extraversion, Openness to Experience and Agreeableness. Furthermore, all the groups proved to have statistically significant differences one from another, except with regard to Agreeableness.

Discussion

This study evaluated relationships between types of MS, degrees of handicap and personality factors. Its main findings were the following: a) the linkage between the type of MS and degree of disability was statistically significant, the absence of handicap range being commonest in RRMS (55.1%) and the handicap affecting walking range most frequent in SPMS (50%); b) no significant differences were found between the types of MS (SPMS, RRMS) and the five factors in the NEO-FFI inventory; c) the relationship between the level of physical disability and the sex of MS patients showed significant differences; d) the linkage between personality factors and the sex of patients was statistically significant in respect of Extraversion and Openness; and e) relationships between personality factors and the various levels of handicap showed that the groups had statistically significant variations one from another.

As might have been expected data relating the type of MS and the degree of disability showed statistically significant differences. This is because the evolution and remissions of the two types are not the same. Data for handicap in RRMS gave higher scores for the lower points on the EDSS scale, as has been noted by other researchers in Neurology Clinic in Kosovo (Zeqiraj et al., 2014). The figures being reported here for EDSS scores in the SPMS form of the illness coincide with those in research by La Rocca, who observed that 41% of the population with MS under study had difficulties in walking, which in many cases was the worst aspect of the disease (La Rocca, 2011).

With regard to the relationship between the forms of MS (SPMS, RRMS) and the five personality factors, it was observed that the manner in which the illness was faced in thoughts, feelings and behaviour was not linked to the sort of evolution of MS. This leads to a suspicion that what affects these aspects is the diagnosis of a degenerative disease in itself. It has not proved possible to find comparisons in the literature consulted covering such a correspondence of characteristics. Indeed, on the contrary, there are authors who link poorly adapted personality traits in MS with cognitive deterioration (Roy et al., 2018), and others who feel that neocortical atrophy is associated with an unfavourable impact on personality (Benedict et al., 2008).

In respect of the sex of patients in the MS sample, it is noteworthy that the number of women affected is higher, as was observed in other recent epidemiological studies (Rommer et al., 2018). The relationship between the sex of a patient and the degree of disability was statistically significant, with a greater frequency of women in the absence of handicap grouping, and of men in the grouping of handicap affecting walking. This finding concurs with those of other studies of MS that have shown that being male, the age at onset, a prolonged duration of the illness, not using immune-suppressants for a period of more than three months, and a background of relapses are linked to a higher probability of worsening disease (Ahmad et al., 2018). It is also possible that there is a link with a perception of lessened health and capacity for recovery, and with reduced participation in day-to-day activities by men with MS (Ploughman et al., 2017).

With regard to the relationship between the sex of patients and the five personality factors in the NEO-FFI inventory, it is noteworthy that women seem to cope with the disease better, with higher scores for all the positive factors. Furthermore, the data show that this was statistically significant for Extraversion and Openness. This is perhaps because the social roles played by men and the way they are brought up make them less flexible in facing changes and expressing feelings. Moreover, these results coincide with those of recent work by Mac Giolla and Kajonius (2018) with a normal healthy population which detected

Table 5
Relationships between Personality Factors (NEO-FFI) and Levels on the Physical Handicap Scale (EDSS).

	EDSS -Absence of Disability (n = 29)		EDSS -Minimum to Moderate Disability (n = 25)		EDSS - Disability Affecting Walking (n = 11)		p
NEO-FFI							
Neuroticism (M ± SD)	20.90	± 8.3	27.2	± 9.4	22.5	± 10.9	0.048
Extraversion (M ± SD)	30.1	± 8.7	23.4	± 7.5	20.6	± 9.9	0.010
Openness (M ± SD)	28.6	± 7.7	24.3	± 6.3	21.4	± 6.3	0.013
Agreeableness (M ± SD)	32.5	± 5.3	31.2	± 5.5	30.4	± 5.8	0.228
Conscientiousness (M ± SD)	34.2	± 6.5	28.4	± 7.0	29.3	± 4.2	0.010

NEO-FFI: NEO Reduced Five-Factor Personality Inventory

EDSS: Expanded Disability Status Scale

greater differences between the sexes (with women generally attaining higher scores) in personality traits in countries where there was greater equality of status between the sexes, which would be the case for the sample under study here (Mac Giolla and Kajonius, 2018). In the specific field of neurology, the data go to back up previous investigations in which men with MS showed a decline in social capacity and in positive male roles (Addis and Mahalik, 2003; Courtenay, 2000).

The relationship between personality factors and degrees of physical disability showed significant differences, with the exception of Agreeableness. It would seem that this situation may arise because the facets trust, straightforwardness, altruism, compliance, modesty and tendermindedness are aspects of character prior to the illness. Moreover, it is striking that people with a minimum to moderate disability had personality factor scores that were higher in Neuroticism and lower in the remaining factors, when they are the group most suited to physical and psychological treatment. This is likely to be because they are discovering day-to-day tasks that they can no longer perform and it is hard for them to accept how handicap is affecting their quality of life. The results of this research project are similar to what was found in previous studies of populations with physical or psychological disorders showing high levels of Neuroticism associated with strategies involving poor adjustment (Penley and Tomaka, 2002; Taillefer et al., 2003) and where Extraversion was related to a greater capacity to cope with stressful situations (Watson and Hubbard, 1996).

With reference to the limitations of this study, it must be noted that there is some difficulty in the methodology with regard to the sample size. In particular, there were differences in sample size between the sexes, but this is very typical of the illness concerned.

It may be concluded that a response was found for the objectives set for the work. Relationships were found between the forms of MS (RRMS and SPMS) and the degree of handicap. However, they were not found with personality factors, even if their impact is different.

In those suffering from MS the sex of the patient affects the degree of handicap. In women it is commoner to find an absence of disability, while in men minimum to moderate disability is frequent.

In almost all the personality factors there are differences between the sexes. It was found that women's scores were higher, as they cope with the disease better. They had greater Extraversion and Openness, as occurs in healthy female individuals as well.

All the above confirms that MS is an incapacitating disease with strong repercussions on the life of those suffering from it. It is noteworthy that this impact differs both by form of MS, and by degree of handicap, and by sex. It is especially striking that the patients in the second group, with moderate deterioration, are those who have a worse profile for adjustment than those in the first and third groups. Similarly, it is noteworthy that women present a better profile for adjustment than do men. On this point, a possible future line of research might incorporate study of psychological interventions with an eye to providing coping strategies in accordance with personality profiles. This would permit a reduction of some of the lacks and limitations suffered by patients with MS.

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Declaration of transparency

As lead author, Estrada López, Mar, on behalf of all those signing, warrants the accuracy, transparency and honesty of the data and information comprised in this study; and declares that no relevant information has been omitted; and that all differences of opinion between authors have been adequately resolved and described.

Ethical standards

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1964, as adjusted by later revisions.

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