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Abstract

Background and Objectives Multiple sclerosis (MS) has a broad spectrum of physical, social, psychological effects and significant impact on quality of life (QoL). Several studies has showed the importance of self-efficacy as a predictor of QoL in patients with MS.

This study aims at evaluating the robustness of the relationship between self-efficacy and QoL. Specifically it aims to test whether such relation will vanish under the following conditions: using a general measure of self-efficacy and controlling for level of impairment defined as a broad construct dealing with physical, social and working changes due to the illness condition.

Methods One hundred-fifty five participants responded to a questionnaire, including QoL and general self-efficacy measures, socio demographic and clinical variables. Two nested structural

equation models that differ for the presence or absence of the path connecting self-efficacy and QoL was estimated.

Results and Conclusions The hypothesis of the vanishing of the relationship between self-efficacy and QoL had to be rejected. These results support the genuineness of this relation and emphasize the importance of interventions promoting self-efficacy to improve QoL in chronic diseases such as MS. From a methodological perspective this study is an example of the usefulness of formative indicators in QoL studies.

Keywords: Quality of life, multiple sclerosis, self-efficacy, structural equation model, formative and reflective indicators.

Introduction

Multiple sclerosis (MS) is a chronic and potentially debilitating disease of the central nervous system with an usual onset in early adult life (20-50 years old). It is the major cause of non-traumatic disability in young adults [1] and is characterized by a decline in neurological and cognitive function. Patients with MS experience a variety of physical and psychological symptoms that are difficult to adjust to and reduce their quality of life (QoL). While doctors focus primarily on symptoms of MS, MS patients have identified their limited emotional functions and consequent lifestyle alterations as the most important factors impacting their health-related QoL (HRQoL) [2]. An increasing number of studies evaluating HRQoL in MS patients have found that physical and psychological HRQoL scores were lower in those patients than in the general population [3,4]. Nevertheless, a large number of patients report having an acceptable and good QoL [5].

One review [6] that examined the relationship between adjustment outcomes and psychological factors found that self-efficacy appeared to be a key predictor of well-being and better QoL [7,8]. Self-efficacy influences the way people feel, think, and behave. It has been defined as "people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances… concerned not with the skills one has but with judgements of what one can do with whatever skills one possesses" [9].

In the past three decades, many studies [10-12] have examined the role of self-efficacy in health (i.e., managing MS symptoms, mood control, or maintaining a social life; [6]). These studies have shown that a significant relationship exists between self-efficacy and better adjustment and QoL.

Self-efficacy can be either specific or general [13]. Specific self-efficacy is domain and task specific and has been shown to mediate the relationship between both disease severity [14,15] and physical activity [16] and QoL. Schwarzer, however, has argued that it can also be applied to general situations where general self-efficacy (GSE) refers to the global ability to cope with a wide range of situations [17].

When the study aim measures predictors that are broad outcomes, such as QoL or well-being, it is better to use a correspondingly broad measure of GSE [18,19]. Specific measures likely artificially inflate the strength of the relationship between self-efficacy and QoL since they behave as QoL components rather than as an independent psychological measure. For instance, a more disease-specific construct seemed to have a stronger relationship with adjustment outcomes than generalized self-efficacy [6].

The aim of this study was to evaluate the robustness of the relationship between self-efficacy and QoL in patients suffering from MS. The relationship was studied under conditions that could weaken it, including: the use of a GSE measure and the presence of a controlling latent variable which should greatly influence both self-efficacy and QoL and could also be the cause, if omitted from the analysis, of their spurious relationship. Many studies have looked at self-efficacy in patients with chronic diseases, including MS. However, to our knowledge, this is the first attempt to study general self-efficacy in MS patients.

Materials and Methods

Sample

The sample consisted of 155 out-patients attending the MS Referral Regional Centre (CReSM) of the San Luigi Hospital, Orbassano in Turin, Italy. Patients affected by psychiatric disorders at diagnosis were excluded from the study. Patients were recruited from January 2009 through September 2010 during their periodical clinic visit and invited to fill in a questionnaire. The questionnaire included QoL and generalized self-efficacy measures and was given in the presence of a trained psychologist who could assist patients in case of difficulties. The time required to complete the questionnaire was approximately 35 to 45 minutes. Clinical data were assessed by a neurologist who either reviewed case records or performed neurological examinations. All participants gave their written informed consent. The study was approved by the local Ethics Committee (A.B., Multiple Sclerosis Center, Clinical Neurology, S. Luigi Hospital,

Orbassano, n° 07/09 - 26/01/2009)[1].

Measures

Demographic and clinical data

Demographic information was collected on age, gender, marital status, educational qualification, occupational and employment status, and job change and social habit modifications due to MS. The clinical variables included MS type, disease duration, degree of disability as evaluated by the Expanded Disability Status Scale (EDSS) [20], presence of concomitant disorders, current medication, and the request of aid for daily activities.

Quality of life

HRQoL was evaluated by patients using a Visual Analogue Scale (VAS) and the Italian version of the short form 36-item health survey (SF-36) [21-23]. The 36 items were summarized into 8 sub-scales (physical function, role-physical, pain, general health perception, vitality, social function, role-emotional, and mental health) ranging from 0 to 100 with higher scores indicating a better QoL. Moreover, physical and mental composites were created as a weighted sum of the 8 scales, and a general composite score of the average of the 8 scales was also calculated.

Self-efficacy

Self-efficacy was measured using the Italian adaptation of the GSE Scale [17]. The GSE scale is composed of 10 items and was originally developed by Matthias Jerusalem and Ralf Schwarzer in 1981 and validated in the Italian contest [24,25]. The GSE scale measures self-efficacy as a general psychological construct, and there is evidence that the scale is reliable, homogeneous, and unidimensional across 25 nations [24]. Patients responded to items (e.g., "*I can always manage to solve difficult problems if I try hard enough*.") using a Likert-type scale ranging from *strongly*

[1] This study is part of a larger work in which both traditional questionnaires and Discrete Choice Experiments are used to study QoL in MS patients.

disagree (1) to *strongly agree* (4). Responses were summed, and a mean score was calculated. Higher scores indicated greater self-efficacy.

Statistical Analysis

Structural equation models (SEMs) were used to test whether the relationship between GSE and QoL was genuine.

Model specification

Theoretical models were composed using three latent variables: physical and social impairment, GSE, and QoL (Figures 1 and 2a). A traditional factorial model, in which arrows go from construct to indicators (reflective indicators model), was used for the measurement model of GSE and QoL. The 10 items of the GSE scale were randomly split into two groups, forming two parcels (Y1 and Y2). QoL was measured by the VAS (Y3) and composite score of the SF-36 (Y4), i.e., the average of the 8 sub-scales.

Figure 1 about here.

Figure 2 about here.

Both GSE and QoL latent variables were influenced by the physical and social impairment latent variable which summarized the extent that MS conditions altered daily living in terms of: physical disability as measured by EDSS (X1); changes in job aspects as measured by a dummy (0 = never worked or no changes, 1 = changed one or more job aspects, X2); and changes in social habits as measured by a dummy (0 = no changes, 1 = one or more changes in hobbies, sport activities, or social life; X3). X1, X2, and X3 were defined as formative indicators (arrows go from indicators to construct) since they cause the level of impairment rather than being an interchangeable manifestation of it. For an instructive guide in determining whether a construct is formative or reflective, see [26].

Two models were examined: Model A, in which the parameter connecting GSE to QoL was constrained to zero, and Model B, in which this parameter was freely estimated. In Model A, all

parameters were identified (i.e., they can be estimated separately). Model B was under-identified, so a partially reduced form model with proportionality constraints was used to test its overall fit and estimate some of its parameters [27]. In the partially reduced form model, the X's directly influenced GSE and QoL, and the path from GSE to QoL was substituted by the residual covariance of their disturbance variances (Figure 2b). If Model B is valid, then its partially reduced form should be as good as and comparable to Model A.

Models estimation and evaluation

Analyses were performed using LISREL 8.7 [28]. The maximum likelihood (ML) estimator[2] was applied to the covariance matrix. The goodness of fit of the models was evaluated by the root mean square error of approximation (RMSEA), the comparative fit index (CFI), and the standardized root mean squared residual (SRMR). The following criteria were used to determine whether a model fit was acceptable: RMSEA <0.08; CFI >0.95; and SRMR <0.08 [29,30].

A difference chi-square (X^2) test was used to directly compare the goodness of fit of the two models.

Results

A total of 155 patients filled out the questionnaire, and 7 patients were excluded from the analysis because they gave incomplete or incoherent answers. Table 1 shows descriptive data of these patients. Overall, patients were young (mean age: 39.6 yrs), female (72% of sample), had a rather short disease duration (mean duration: 7.9 yrs), and had low disability (EDSS mean score: 2.5). Most patients (86%) had a relapsing/remitting form of MS and about half the sample had modified their social habits. Additionally, about half of the employed sub-sample had changed aspects of their job due to MS.

When compared to the normative score of 50.0, the QoL in these patients was significantly lower

[2] The multivariate normality test was unsatisfactory by the Skewness (z=3.4, p<0.001) but satisfactory by the Kurtosis (z=0.7, p=0.509) tests. For this reason and because of the small sample size, no robust ML estimator was applied.

for both physical ($t(147)=-6.0$, $p<0.001$) and mental ($t(147)=-5.3$, $p<0.001$) composite SF-36 scores. A less significant difference was observed for GSE when compared to the normative score of 31.0 ($t(147)=-2.3$, $p<0.05$).

***Table 1 about here*.**

Table 2 shows summary statistics for the formative and reflective indicators used in the measurement part of the SEMs. All correlation coefficients were statistically significant ($p<0.01$).

Table 2 about here.

Model A, where GSE and QoL were independent when controlling for the level of impairment, was inconsistent with the empirical data, and none of the fit indexes reached the cut-off criteria. In contrast, the fit of Model B was excellent (Table 3). Additionally, the fit of Model B was significantly better than that of Model A ($X^2(1) = 32.33$, $p<0.001$).

Table 3 about here.

Figure 3 about here.

In Model B, all the estimated values were significant ($p<0.05$; Figure 3). The X's reduced both GSE and QoL, and the standardized error covariance between GSE and QoL was positive and of an appreciable magnitude (0.41).

The goodness of performance of Model B signified that the influence of the X's (disability and forced work or social changes) are mediated by the impairment latent variable (i.e., the formative model for the impairment construct was consistent with the empirical data). Additionally, the impact

of GSE on QoL could not be removed from the model. Unfortunately, the model structure of Model B made it impossible to report a unique estimated value for the impact of GSE on QoL. Only their correlation of 0.41 is known.

Discussion and conclusion

The principal aim of the study was to test whether the relationship between patients QoL and their perception of self-efficacy was genuine or due to how self-efficacy is typically measured or the omission of common antecedents of both QoL and self-efficacy. Several studies have shown that the perception of task-specific self-efficacy can influence MS adjustment [31,14]. The effect of the perception of general self-efficacy remains controversial, however, due to differences in study design, outcome variables, and definition [6]. Some studies have found that self-efficacy perception can appreciably influence MS adjustment, but these did not use variables that controlled for broad content [32,33]. Consequently, part of the influence of GSE on QoL could be due to the action of common predictors that were omitted.

Our results support the existence of a relationship between self-efficacy perception and QoL and, therefore, have practical implications for professions working with MS patients. They confirm that cognitive remediation programs aimed at improving cognitive skills may also improve the QoL for patients with MS [34]. Self-efficacy changes with life experiences [9]. In our study, we found a negative effect by the level of impairment on the perceived GSE of MS patients. This negative effect can be addressed by reinforcing patients' beliefs of their own capacity to cope with situations.

From a methodological point of view, this study was the first attempt, to our knowledge, to use formative indicators to model QoL predictors in patients suffering from a chronic disease. In formulating a SEM, attention must be paid to not only the structural part of the model, i.e., the paths connecting the latent variables to each other, but also the measurement that links the latent variables to their indicators. As noted by Anderson and Gerbing [35], the "proper specification of the measurement model is necessary before meaning can be assigned to the analysis of the structural

model" (p. 453). Researchers should carefully evaluate from a theoretical perspective whether the observed variables are formative or reflective indicators of the constructs since a measurement misspecification could bias the estimates of the relationship between constructs [26].

Some limitations to the generalization of these results should be acknowledged. First, the sample size was relatively small for accurate ML estimations. Additionally, the measurement of the controlling latent variable could be improved by adding others indicators of forced changes in daily-living due to the illness. The most important limitation was that this sample was of mildly impaired patients (as evidenced by the EDSS mean of 2.5). As Rapley and Fruin [36] have shown, generalized self-efficacy perceptions have great importance at the onset of illness while task-specific self-efficacy perceptions play a role as disease progresses. Therefore, further studies are needed to extend these findings to everyone affected by MS.

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Table 1. Descriptive data (N=148)

Characteristic	**Number (%)**
Female	107 (72)
Age §	39.6±10.3 (17-66)
Marital status	
Never married	59 (40)
Married	72 (49)
Separated/divorced	15 (10)
Widowed	2 (1)
Educational status (schooling years)	
Primary (8)	48 (32)
Secondary (13)	78 (53)
University (13+)	22 (15)
Paid job	109 (74)
Changes in job aspects	48 (44)
Social habit modifications	72 (49)
Request for aid in daily activities	26 (18)
MS type	
Relapsing/remitting	127 (86)
Others ^	21 (14)
Disability (EDSS)	2.5± 2.1 (0-8.5)
No (0)	14 (10)
Mild (1-2)	75 (51)
Moderate (2.5-3.5)	27 (18)
Severe (4-8.5)	32 (22)

Concomitant disorder	52 (35)
Disease duration §	7.9±6.3 (0-29)
Disease modifying treatment Immunomodulatory* Others** Symptomatic treatment	126 (85) 70 (47) 40 (27) 48 (32)
SF-36 physical composite score §	44.0± 11.5 (13-67.5)
SF-36 mental composite score §	44.6± 12.2 (17.6-67.1)
SF-36 summary score §	62.6± 21.8 (7-96.7)
General self-efficacy (GSE score) §	29.9±5.6 (14–40)

§ mean±SD (min-max); ^ Secondary Progressive, Primary Progressive

*Interferon, Glatiramer Acetate; **Tysabri, Azatioprina, Methotrexate

Table 2. Correlations, means and standard deviations of the observed variables used in the structural equation models

	X1	X2	X3	Y1	Y2	Y3	Y4
EDSS (X1)	1.00						
Changes in job aspects (X2)	0.24	1.00					
Social habit changes (X3)	0.27	0.23	1.00				
GSE_1 (Y1)	-0.26	-0.22	-0.22	1.00			
GSE_2 (Y2)	-0.26	-0.23	-0.22	0.82	1.00		
VAS_QoL (Y3)	-0.46	-0.29	-0.33	0.51	0.50	1.00	
SF-36 composite mean (Y4)	-0.40	-0.38	-0.45	0.48	0.45	0.65	1.00
Mean	2.52	0.47	0.49	2.94	3.05	67.43	62.56
Standard deviation	2.11	0.50	0.50	0.58	0.59	17.66	21.77

* all correlations are significant at $p<0.01$

Table 3. Goodness of fit indexes (N=148).

Model	X^2(df)	p value	RMSEA (90% CI)	CFI	SRMR
Model A without GSE-QoL relationship	40.8 (10)	<0.001	0.14 (0.092- 0.190)	0.94	0.11
Model B with GSE-QoL relationship	8.47 (9)	0.49	0.00 (0.000-0.088)	1.00	0.024

Note: RMSEA: root mean square error of approximation; CI: confidence interval; CFI: comparative fit index; SRMR: standardized root mean residual.

Figure 1. Model A: the parameter connecting GSE to QoL has been constrained to zero

Figure 2. Model B: the parameter connecting GSE to QoL has been freely estimated for structural (a) and partially reduced (b) models.

Figure 3. Standardized parameters for the partially reduced form of Model B (all estimates are significant at $p<0.05$).

Figure 1. Model A: the parameter connecting GSE to QoL has been constrained to zero

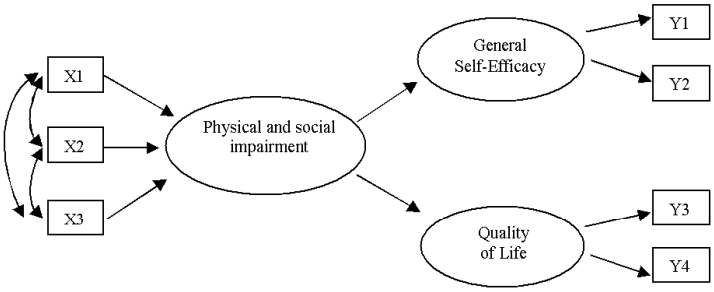

Figure 2. Model B: the parameter connecting GSE to QoL has been freely estimated for structural (a) and partially reduced (b) models.

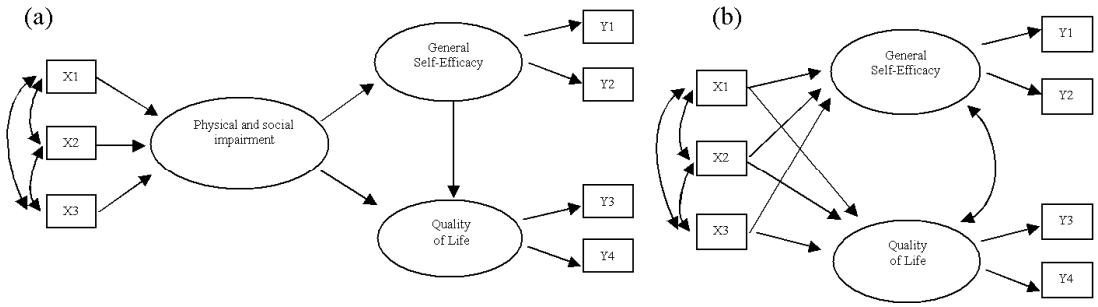

Figure 3. Standardized parameters for the partially reduced form of Model B (all estimates are significant at $p<0.05$).