



OPEN Alexithymia and illness perceptions in persons with multiple sclerosis and their partners

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Illness perceptions (IPs) encompass opinions regarding the nature, severity and curability of a disease. The aim of this cross-sectional study was to investigate the association between alexithymia and IPs among persons with multiple sclerosis (PwMS) and their partners, as well as within the dyads composed of PwMS and partners. PwMS referred to the Multiple Sclerosis Center of the University Hospital "Policlinico-San Marco" from 11th August 2021 to 7th January 2022 and their partners completed a battery of questionnaires, including the Toronto Alexithymia Scale-20 and the Illness Perception Questionnaire Revised. A dyadic data analysis (Actor-Partner Interdependence Model) was performed to test the effect of alexithymic traits both on a person's own illness perceptions (actor effect) and on the partner's illness perceptions (partner effect). 100 PwMS (71 women; mean age 47.6 ± 10.4 years) and 100 partners (29 women; mean age 49.1 ± 10.8 years), with a mean partnership duration of 20.1 ± 11.7 years, were enrolled. At the dyadic analysis, statistically significant small-to-moderate actor and partner effects were found considering alexithymia (total score and alexithymic facets) and IPs, whereby higher alexithymic traits related to higher negative perceptions (i.e. consequences, emotional representations) and lower positive ones (i.e. coherence, treatment control). Our findings support the relationship between alexithymia and negative illness appraisals. This data may inform therapeutic interventions aimed at reducing alexithymic traits, which in turn may reduce negative, and potentially dysfunctional, illness perceptions.

Keywords Illness perceptions, Alexithymia, Multiple sclerosis, Dyad, Spouse

Individuals with a medical condition construct personal appraisals of their illness. Such appraisals, namely "illness perceptions" (IPs), pertain to several aspects (i.e. consequences, emotional burden) and impact the individuals' adaptation to the disease^{1,2}. Previous studies have reported an association between alexithymia, defined as a deficit of emotional awareness (difficulty in identifying, describing and expressing one's own feelings and bodily sensations of emotional arousal), and negative IPs (e.g. higher illness-related consequences and concern) in several medical conditions, including cancer and dermatological disorders^{3,4}.

However, to date, there are no studies testing the link between alexithymia and illness appraisals in Persons with Multiple Sclerosis (PwMS). This is surprising, since a crucial theme arising from the PwMS' accounts of their lived experience pertains to "making sense" of their bodily sensations which, in turn, requires efficient body awareness⁵, typically impaired by alexithymia⁶.

Despite the assessment of alexithymia being extremely rare during neurological visits, alexithymic traits are rather common among PwMS⁷, thus deserving special attention in this population. Indeed, MS is a challenging disease from a physical, emotional and interpersonal point of view⁸, thus requiring adaptive efforts that alexithymic persons might find it more difficult to make. In fact, alexithymia alters the understanding of one's own bodily sensations⁹, impairs emotional processing¹⁰ and favors conflictual interpersonal communications¹¹. In light of this, alexithymia could impact on various aspects (physical, emotional, interpersonal) of MS, thus representing a good candidate for being associated with IPs not only at the individual, but also at the dyadic level.

Qualitative data consistently indicate fear and shock as common emotions following diagnosis among PwMS and their caregivers⁸. Considering that caregivers also hold beliefs regarding MS, they could potentially influence

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the PwMS's view of the condition. According to the cognitive-transactional model (CTM) of couples' adaptation to chronic illness, making sense of the illness and effective communication within the couple are crucially important for dyadic coping¹². Building upon this model, and somewhat expanding it, this study hypothesizes alexithymia as a possible barrier to both making sense of the illness and effective communication within the couple. To the best of our knowledge, this is the first study focusing on the impact of alexithymic traits on IPs from a dyadic perspective, in any clinical condition.

Methods

Study aims

The aims of this cross-sectional study were:

- 1) investigate the possible association between alexithymic traits and IPs among PwMS and their partners (actor effects);
- 2) explore the possible association between alexithymic traits and IPs within the couples (dyads) composed of PwMS and their partners (partner effects), while investigating the effect sizes of the actor and partner effects of alexithymic traits in accordance with the Actor-Partner Interdependence Model (APIM).

Study population

Persons with multiple sclerosis

PwMS referred to the Multiple Sclerosis Center of the University Hospital “Policlinico-San Marco” from 11th August 2021 to 7th January 2022 were invited to participate. Inclusion criteria were: men and women aged ≥ 18 years with a diagnosis of relapsing-remitting MS according to the revised McDonald diagnostic criteria¹³; Expanded Disability Status Scale (EDSS)¹⁴ between 2 and 5.5; Montreal Cognitive Assessment (MoCA) ≥ 26 ¹⁵; being a cohabiting partner, willingness to participate in the study of both members of the couple (signed informed consent). Exclusion criteria were: current MS flare up, history of recent attack (< 3 months); concomitant neurological diagnosis of any type, current psychiatric and/or psychological treatments.

Partners

Cohabiting partners (men and women aged ≥ 18 years) of the person with relapsing-remitting MS were invited to participate. Inclusion criteria were Montreal Cognitive Assessment (MoCA) ≥ 26 ¹⁵ and willingness to participate in the study of both members of the couple (signed informed consent). Exclusion criteria were: current psychiatric and/or psychological treatments.

Sample size

Previous studies investigating the impact of alexithymia on IPs from an individual perspective suggested medium-to-large effect sizes ($d = 0.6$ – 0.7)^{3,4,16}. Building on the available data, an online calculator (retrieved from <https://robert-a-ackerman.shinyapps.io/apimpower/>) for power analysis for the APIM was used. In order to detect an actor effect with 80% power ($\alpha = 0.05$) expecting a medium effect size ($d = 0.6$), the number of dyads required was 90–100. For this study, 160 potentially eligible PwMS were invited to participate from 11th August 2021 to 7th January 2022. Twenty-eight were not eligible. Of the 132 persons meeting the inclusion criteria, 22 declined participation and 10 did not complete the questionnaires, leading to a sample size of 100 PwMS (and their partners).

Assessment instruments

The following questionnaires were administered:

- 1) *Illness Perception Questionnaire Revised, IPQ-R section II, belief scale*¹⁷: it consists of 38 statements requiring an answer ranging from 1 (“strongly disagree”) to 5 (“strongly agree”). These statements address seven different IPs dimensions, namely acute/chronic timeline, cyclical timeline, coherence (understanding of the disease), consequences, emotional representations (emotional burden), personal control and treatment control. Higher scores indicate stronger beliefs in relation to the specific dimension. When interpreting the scores of each different IP dimension, one can empirically attach positive (functional) characteristics to the dimensions “personal control”, “treatment control” and “coherence” [expressing confidence (coherence) and optimism (personal and treatment control) towards the illness] and negative (dysfunctional) characteristics to the dimensions “emotional representations” and “consequences” [alluding to the illness-related suffering (emotional representations) and impact (consequences) in everyday life].

The partners completed a version adapted for their use¹⁸. All IP dimensions addressed in section II were considered in the descriptive statistics, so as to comprehensively characterize the sample. However, timeline acute/chronic and cyclical were excluded from further analyses. Indeed, not mobilizing any particular coping strategy, timeline may have a limited clinical value¹⁹.

- 2) *Toronto Alexithymia Scale-20, TAS-20*²⁰: this 20-items most used self-administered questionnaire for alexithymia consists of three subscales: difficulty in identifying feelings (DIF), difficulty in describing feelings (DDF) and externally-oriented thinking (EOT). Every item can be answered through a Likert scale, from 1 (“completely disagree”) to 5 (“completely agree”).
- 3) *Patient Health Questionnaire-4, PHQ-4*²¹: it is an ultra-brief 4-items composed of the first two items of the Generalized Anxiety Disorder-7 scale and the Patient Health Questionnaire-8, respectively addressing anxious and depressive symptoms.

- 4) *Dyadic Adjustment Scale, DAS*²²: this is a self-report questionnaire composed of 32 items investigating different aspects of marital quality through the following subscales: dyadic satisfaction (happiness for the relationship), dyadic consensus (agreement on different topics), dyadic cohesion (participating together in activities) and dyadic affectional expression (agreement regarding the expression of feelings). In addition, a DAS total score can be obtained, whereby higher values indicate higher quality of the relationship for both subscales and total score.
- 5) *Multiple Sclerosis Impact Scale-29 version 2, MSIS-29v2*²³ (administered only to PwMS): this is a 29-item self-report measure of the psycho-physical impact of MS, whereby higher values indicate worse health.

Demographic data were recorded for both PwMS and their partners. The EDSS score¹⁴ was calculated for PwMS.

COVID-19 restrictions applied in the study

In the temporal frame of study conduction, Italian COVID-19 restrictions were not so stringent as to limit study participation. The obligation to wear a mask, that people had to respect for accessing the Hospital and undergoing any visit, was also applied when conducting the research, since the nature of the study did not require any further restriction.

Statistical analysis

Data were analyzed with the Statistical Package for the Social Sciences, version 28. We cleaned the data by considering range (i.e. scores of a questionnaire falling into a particular range of numbers) and consistency (i.e. partnership duration being consistent among PwMS and their partners) checks. Continuous data (e.g. age, education) were expressed as mean and standard deviation, categorical variables (e.g. sex, work) as number and percentage. Scale scores comparisons between PwMS and partners at the TAS-20 (total score and subscales) and the IPQ-R (all the seven dimensions) questionnaires were performed using t-test analyses. The relationship between TAS-20 with IPQ-R scores in both PwMS and partners was tested using Pearson's correlations.

A dyadic data analysis was then performed in accordance to the APIM²⁴, implying the nonindependence of couple data, whereby a variable (predictor) of one member of the dyad can affect the outcome of the other member and vice versa. The analytic method adopted to conduct the dyadic analysis was that of multilevel linear modeling²⁴, advancing the idea of data structure as having multiple levels (level I is the person, level II is the dyad within which the person is nested).

To evaluate if alexithymia was associated with illness perceptions in PwMS and their partners, both the effect of the person's own alexithymic traits [actor effect] and the effect of their partner's alexithymic traits [partner effect] on IPs were estimated. As the dyads are distinguishable due to their role (PwMS vs. caregiver), both actor effects and partner effects were obtained for each member of the couple. More specifically, different statistical models separately including each alexithymic feature (DDF, DIF, EOT or TAS-20 total score) as predictor and each IP dimension (coherence, consequences, emotional representations, personal control or treatment control) as outcome were run. All APIM models (unadjusted and adjusted for possible confounders) were tested in R through an open-source online software interface (retrievable from https://davidakenny.shinyapps.io/APIM_MM/). The statistical significance level was set at a p value < 0.05.

Results

The final sample consisted of 100 PwMS (71 women; mean age 47.6 ± 10.4 years) and 100 partners (29 women; mean age 49.1 ± 10.8 years). For more details, see Supplemental Table 1.

The DAS and the PHQ-4 total scores in the whole sample were respectively 107.3 ± 17.2 and 4.4 ± 3.2 (Supplemental Table 1). Considering the perceived impact of MS (MSIS-29 v2) among PwMS, the physical subscale was 32.3 ± 22 and the psychological one was 41.5 ± 25.4 .

PwMS presented a statistically significant higher TAS-20 total score and DIF sub-scale than their partners (Supplemental Table 2).

As for IPs, PwMS presented statistically significant higher levels of perception of illness-related consequences and lower illness coherence than their partners (Supplemental Table 3).

Concerning the relationship between alexithymia and IPs, a statistically significant negative correlation was found between TAS-20 total score and coherence (in both PwMS and partners), as well as between TAS-20 total score and treatment control (partners only). On the contrary, a significant positive correlation was found between TAS-20 total score and emotional representations (in both PwMS and partners). Moreover, TAS-20 total score showed a significant positive correlation with consequences among partners only (Supplemental Table 4).

Concerning the dyadic analysis, both actor (the relationship of the person's own alexithymia with their own IPs) and partner (the relationship of the alexithymia of one dyad member with the IPs of the other member) effects were detected when considering alexithymic traits as predictors of IPs, as detailed below.

In a model with DDF as a predictor of IPs, this alexithymic feature showed statistically significant correlations with coherence, consequences and emotional representations. Full details are shown in Table 1. In particular, a statistically significant actor effect was observed in both PwMS and their partners for coherence, whereby an increase in DDF correlated with a reduction of coherence. Moreover, a statistically significant actor effect was observed (among partners only) for consequences, whereby an increase in DDF related to an increase in consequences. Concerning emotional representations, a statistically significant actor effect was observed in both groups, whereby an increase in DDF correlated with an increase of emotional representations. Moreover, a statistically significant partner effect was observed, whereby an increase of DDF in the partners correlated with higher emotional representations in PwMS. See Table 1.

	ROLE	EFFECT ESTIMATE	95%CI	p-value	Beta-value	r	ES
IPs' dimensions							
	Coherence						
	PwMS	Actor	-0.263				
		Partner	0.012	0.003	-0.298	-0.290	Small
Partners	Actor		-0.158 to 0.182	0.894	0.013	0.014	/
	Partner		-0.494 to -0.178	<0.001	-0.380	-0.390	Medium
			-0.192 to 0.129	0.698	-0.036	-0.039	/
Consequences							
	PwMS	Actor	0.133	0.165	0.134	0.140	/
	Partner		-0.054 to 0.320	0.185	0.126	0.134	/
			-0.059 to 0.309	0.007	0.273	0.265	Small
Partners	Actor		0.074 to 0.466	0.715	-0.038	-0.037	/
	Partner		-0.236 to 0.162				
Emotional representations							
	PwMS	Actor	0.409	<0.001	0.331	0.325	Medium
	Partner		0.172 to 0.647	0.007	0.261	0.265	Small
			0.089 to 0.556	0.001	0.298	0.319	Medium
Partners	Actor		0.150 to 0.587	0.188	-0.121	-0.133	/
	Partner		-0.371 to 0.072				
Personal control							
	PwMS	Actor	-0.083	0.302	-0.098	-0.104	/
	Partner		-0.239 to 0.074	0.650	0.042	0.046	/
			-0.118 to 0.190	0.182	0.142	0.135	/
Partners	Actor		-0.055 to 0.294	0.411	0.089	0.083	/
	Partner		-0.103 to 0.252				
Treatment control							
	PwMS	Actor	-0.080	0.173	-0.130	-0.137	/
	Partner		-0.194 to 0.034	0.637	0.044	0.048	/
			-0.085 to 0.139	0.112	-0.167	-0.160	/
Partners	Actor		-0.227 to 0.023	0.297	-0.111	-0.106	/
	Partner		-0.195 to 0.059				

Table 1. APIM model, predictor: Difficulty describing feeling. Abbreviations. APIM: Actor-Partner Interdependence Model; PwMS: persons with multiple sclerosis; CI: confidence interval; ES: effect size. Bold values: $p < .05$.

In a model with DIF as a predictor of IPs, this alexithymic feature showed statistically significant correlations with coherence, consequences, emotional representations and treatment control. Full details (including the magnitude of the effects) are shown in Table 2. In particular, a statistically significant actor effect was observed in both groups for coherence, whereby an increase of DIF related to a decrease of coherence. Concerning consequences, a statistically significant actor effect was recorded in both groups, whereby an increase of DIF correlated with an increase of consequences in PwMS and their partners. Moreover, a statistically significant actor effect was detected in both groups for emotional representations, whereby an increase of DIF correlated with an increase of emotional representations. Finally, a significant actor effect, for partners only, was observed for treatment control, whereby an increase of DIF determined a reduction of treatment control. See Table 2.

In a model with EOT as a predictor of IPs, this alexithymic feature showed statistically significant correlations with coherence, personal control and treatment control. Full details (including the magnitude of the effects) are shown in Table 3. More specifically, a statistically significant partner effect was observed, whereby an increase of EOT in PwMS correlated with a reduction of coherence in their partners. In addition, a statistically significant actor effect was recorded, among PwMS only, for personal control, whereby an increase of EOT related to a decrease of personal control. Finally, a significant actor effect, among partners only, was observed for treatment control, since an increase of EOT was linked to a decrease of treatment control. See Table 3.

In a model with TAS-20 total score as a predictor of IPs, the scale showed statistically significant correlations with coherence, consequences, emotional representations and treatment control. Full details (including the magnitude of the effects) are shown in Table 4. Detailing, a statistically significant actor effect was observed in both groups for coherence, whereby an increase of TAS-20 total score correlated with a decrease of coherence. Concerning consequences, a statistically significant actor effect was observed among partners only, whereby an increase of TAS-20 total score related to an increase of consequences. Moreover, a significant actor effect was recorded when considering emotional representations in both groups, whereby an increase of TAS-20 total score was linked to an increase of emotional representations. Moreover, an actor effect was detected, among partners only, for treatment control, whereby an increase of TAS-20 total score related to a decrease of treatment control. Lastly, a statistically significant partner effect was observed, whereby an increase of TAS-20 total score in PwMS related to a decrease of treatment control in the partners. See Table 4.

Sensitivity analysis

A sensitivity analysis considering sex, EDSS and DAS total scores as covariates was performed.

After adjusting, the actor effects previously observed between alexithymic traits and consequences disappeared in both groups. For all the other IPs, the majority of the actor effects were confirmed. In particular, as for DDE, the statistically significant actor effect was confirmed in both groups for coherence (PwMS $r = -.271, p = .009$; partners $r = -.296, p = .002$) and emotional representations (PwMS $r = -.296, p = .003$; partners $r = -.227, p = .022$). Considering DIF, the statistically significant actor effect was confirmed only in partners for coherence ($r = -.278, p = .004$) and treatment control ($r = -.251, p = .013$) and in both groups for emotional representations (PwMS $r = .438, p < .001$; partners $r = .266, p = .007$). Concerning EOT, the statistically significant actor effect among PwMS for personal control ($r = -.207, p = .041$) was confirmed. Finally, also for the TAS-20 total score, in both groups, the statistically significant actor effect for coherence (PwMS $r = -.280, p = .006$; partners $r = -.288, p = .002$) and emotional representations (PwMS $r = .366, p < .001$; partners $r = .207, p = .037$) were confirmed. However, the actor effect for treatment control was confirmed only in the partner group ($r = -.238, p = .018$).

The previously found statistically significant partner effect, whereby an increase of EOT in PwMS correlated with a reduction of coherence in their partners ($r = -.277, p = .006$) was also confirmed. All the other previously detected partner effects were not confirmed in the sensitivity analysis.

Discussion

In the present study, alexithymia was found to be associated with IPs from both an individual and dyadic perspective.

At the individual level, alexithymic traits were positively associated with negative IPs and negatively associated with positive ones, with small-to-medium effect sizes, in both PwMS and their partners. Interestingly, the TAS-20 total score related to almost all IPs. However, a closer look at the alexithymic facets showed peculiar trends. In particular, externally-oriented thinking had no impact on consequences and emotional representations, while being the only facet influencing personal control, whereby higher externally-oriented thinking correlated with lower personal control in PwMS. On the other hand, higher difficulty describing feelings and difficulty identifying feelings were both related to higher emotional representations in PwMS and their partners. Moreover, higher difficulty identifying feelings and difficulty describing feelings were related to higher consequences in both groups and among partners only, respectively.

The differential impact of alexithymic traits on IPs may reflect the nature of alexithymic facets. Indeed, since difficulty describing feelings and difficulty identifying feelings are usually accountable for over-responding to emotionally challenging situations²⁵, their relationship with higher consequences and emotional representations may indicate an exaggeratedly negative appraisal of MS. Conversely, externally-oriented thinking is characterized by concrete thinking, which reduces the sense of mastery over situations²⁶, the latter potentially explaining the negative correlation between externally-oriented thinking and personal control in our sample.

Concerning the partner effects, alexithymic traits in a member of the couple were associated with negative IPs in the other member. More specifically, higher difficulty describing feelings in the partners related to higher emotional representations in the PwMS; higher TAS-20 total score in PwMS related to lower treatment control in the partners; higher externally-oriented thinking in PwMS related to lower coherence in the partners.

	ROLE	EFFECT ESTIMATE	95%CI	p-value	Beta-value	r	ES
IP's dimensions							
	Coherence						
	PwMS	Actor	-0.150				
		Partner	-0.019	0.003	-0.284	-0.295	Small
Partners	Actor		-0.135 to 0.096	0.746	-0.036	-0.033	/
	Partner		-0.313 to -0.098	<0.001	-0.391	-0.356	Medium
			-0.144 to 0.035	0.235	-0.104	-0.120	/
Consequences							
	PwMS	Actor	0.120	0.025	0.204	0.224	Small
	Partner		-0.102 to 0.148	0.719	0.039	0.037	/
	Actor		0.036 to 0.305	0.014	0.289	0.245	Small
Emotional representations	Partner		-0.106 to 0.119	0.912	0.011	0.011	/
	Actor		0.199 to 0.455	<0.001	0.444	0.453	Medium
	Partner		-0.091 to 0.216	0.426	0.085	0.081	/
Partners	Actor		0.126 to 0.419	<0.001	0.371	0.347	Medium
	Partner		-0.063 to 0.181	0.346	0.080	0.095	/
Personal control							
	PwMS	Actor	-0.144 to 0.032	0.213	-0.112	-0.126	/
	Partner		-0.103 to 0.108	0.959	0.006	0.005	/
	Actor		-0.088 to 0.154	0.592	0.066	0.054	/
Treatment control	Partner		-0.071 to 0.131	0.560	0.060	0.059	/
	Actor		-0.113 to 0.015	0.134	-0.135	-0.151	/
	Partner		-0.086 to 0.067	0.809	-0.026	-0.025	/
Partners	Actor		-0.219 to -0.060	<0.001	-0.383	-0.328	Medium
	Partner		-0.126 to 0.007	0.082	-0.163	-0.175	/

Table 2. APIM model, predictor: Difficulty identifying feelings. Abbreviations. APIM: Actor-Partner Interdependence Model; PwMS: persons with multiple sclerosis; CI: confidence interval; ES: effect size; Bold values: $p < .05$.

	ROLE	EFFECT ESTIMATE	95%CI	p-value	Beta-value	r	ES
IPs' dimensions							
<i>Coherence</i>							
	Actor	−0.040	−0.211 to 0.130	0.644	−0.049	−0.047	/
	Partner	−0.055	−0.228 to 0.118	0.535	−0.067	−0.063	/
<i>Partners</i>							
	Actor	−0.088	−0.249 to 0.074	0.290	−0.106	−0.107	/
	Partner	−0.178	−0.337 to −0.019	0.030	−0.216	−0.217	Small
<i>Consequences</i>							
	Actor	−0.051	−0.231 to 0.130	0.584	−0.055	−0.056	/
	Partner	−0.016	−0.199 to 0.168	0.868	−0.017	−0.017	/
<i>Partners</i>							
	Actor	0.041	−0.158 to 0.240	0.688	0.044	0.041	/
	Partner	−0.031	−0.227 to 0.165	0.755	−0.034	−0.032	/
<i>Emotional representations</i>							
	Actor	0.022	−0.223 to 0.268	0.859	0.019	0.018	/
	Partner	0.105	−0.144 to 0.355	0.410	0.091	0.084	/
<i>Partners</i>							
	Actor	−0.008	−0.235 to 0.220	0.984	−0.007	−0.007	/
	Partner	0.006	−0.218 to 0.229	0.961	0.005	0.005	/
<i>Personal control</i>							
	Actor	−0.173	−0.319 to −0.028	0.021	−0.221	−0.230	Small
	Partner	0.042	−0.106 to 0.190	0.580	0.053	0.056	/
<i>Partners</i>							
	Actor	−0.118	−0.290 to 0.053	0.178	−0.151	−0.136	/
	Partner	0.031	−0.138 to 0.200	0.717	0.040	0.037	/
<i>Treatment control</i>							
	Actor	−0.021	−0.130 to 0.088	0.709	−0.037	−0.038	/
	Partner	0.000	−0.111 to 0.111	0.995	0.001	0.001	/
<i>Partners</i>							
	Actor	−0.143	−0.262 to −0.025	0.019	−0.252	−0.234	Small
	Partner	−0.096	−0.212 to 0.021	0.110	−0.168	−0.161	/

Table 3. APIM model, predictor: externally-oriented thinking. Abbreviations. APIM: Actor-Partner Interdependence Model; PwMS: persons with multiple sclerosis; CI: confidence interval; ES: effect size. Bold values: $p < .05$.

	ROLE	EFFECT ESTIMATE	95%CI	p-value	Beta-value	r	ES
IPs' dimensions							
	Coherence						
	PwMS	−0.085	−0.142 to −0.029	0.003	−0.286	−0.289	Small
	Partner	−0.009	−0.071 to 0.052	0.767	−0.031	−0.030	/
Partners	Actor	−0.117	−0.173 to −0.061	<0.001	−0.393	−0.384	Medium
	Partner	−0.042	−0.093 to 0.009	0.110	−0.141	−0.161	/
Consequences							
	Actor	0.047	−0.014 to 0.109	0.132	0.142	0.152	/
	Partner	0.020	−0.048 to 0.087	0.570	0.058	0.058	/
	Actor	0.090	0.019 to 0.162	0.014	0.270	0.243	Small
Emotional representations	Partner	−0.007	−0.072 to 0.059	0.838	−0.020	−0.021	/
	Actor	0.154	0.078 to 0.231	<0.001	0.370	0.371	Medium
	Partner	0.072	−0.012 to 0.156	0.093	0.174	0.169	/
Partners	Actor	0.129	0.049 to 0.209	0.002	0.309	0.305	Medium
	Partner	0.004	−0.069 to 0.077	0.917	0.009	0.011	/
Personal control							
	Actor	−0.049	−0.100 to 0.001	0.057	−0.174	−0.191	/
	Partner	0.010	0.045 to 0.066	0.718	0.036	0.037	/
	Actor	0.008	−0.056 to 0.072	0.811	0.028	0.024	/
Treatment control	Partner	0.020	−0.039 to 0.078	0.510	0.069	0.067	/
	Actor	−0.029	−0.066 to 0.009	0.133	−0.139	−0.151	
	Partner	0.001	−0.039 to 0.042	0.944	0.007	0.007	
Partners	Actor	−0.074	−0.116 to −0.032	<0.001	−0.358	−0.329	Medium
	Partner	−0.041	−0.080 to −0.002	0.038	−0.199	−0.207	Small

Table 4. APIM model, predictor: TAS-20 total score. Abbreviations: APIM: Actor-Partner Interdependence Model; PwMS: persons with multiple sclerosis; CI: confidence interval; ES: effect size. Bold values: $p < .05$.

These findings make sense in light of the interpersonal repercussions of alexithymia. Indeed, individuals with greater alexithymia may appear detached in emotionally charged situations¹¹. Hence, their interpersonal life might be more stressful compared to other individuals²⁷. In a marital context, persons with alexithymic traits may show (at various levels) lack of empathy and support^{11,28,29}. Generally speaking, the spouse of an alexithymic individual might feel restrained in showing vulnerability³⁰. These considerations may help in interpreting the partner effects arising from the APIM analysis.

Indeed, it is easy to envision how a PwMS with a partner presenting high difficulty describing feelings might experience higher MS-related emotional burden, since there is little room for sharing emotions and receiving sympathy within the couple. Interestingly, in a study investigating the relationship between alexithymia and dyadic adjustment in a community sample, a negative correlation was reported between difficulty describing feelings and the partner's dyadic adjustment, with females being more affected by their partner's emotional repression³⁰. This is particularly relevant in our cohort, considering that the group of PwMS is mainly composed of females.

Considering the other partner effect, higher alexithymia in PwMS related to lower perception of treatment as effective in controlling MS in their partners. Alexithymic persons (here, alexithymic PwMS) facing stressors tend to avoid uncomfortable topics of discussion (here, MS) and are likely to exhibit behavioral disengagement and denial³¹. In this context, their partners, left alone to deal with medical information, may develop a more pessimistic view of MS as a completely uncontrollable condition.

Considering the finding linking higher externally-oriented thinking in the PwMS to lower understanding of MS (coherence) in their partners, it should be noted that externally-oriented cognitive style relates to specific deficits: impaired ability to extract useful information due to lack of internal awareness, reduced perspective-taking¹⁰ and poor reflective functioning³². Hence, it is apparent how high externally-oriented thinking may decrease the person's ability to partake in an effective exchange of meaningful information. In particular, the reduced understanding of the emotions prompted by negative situations¹⁰ may significantly impact the couple's confrontation of stressful topics, ultimately hindering the formation of a clear idea of what MS is. What may seem mere speculations, acquire more value in light of the previously cited CTM, whereby the effective couple's communication plays a crucial role¹². Identifying alexithymia as possibly associated with IPs might enrich the already existing theoretical frameworks highlighting the importance of couple's communication.

Our findings have clinical implications. Firstly, they highlight the need to assess alexithymia in neurological settings. Indeed, if alexithymic traits should be investigated even just because they are frequent among PwMS⁷, our findings (relationship between higher alexithymic features and negative IPs) stress the clinical value of alexithymia in MS, further enriched by our dyadic perspective. From a therapeutic point of view, the results of our study encourage the implementation of tailored psychotherapeutic interventions aimed at reducing alexithymic traits in PwMS and/or their partners, thus facilitating the shaping of functional IPs. For example, bearing in mind the complex relationship between alexithymic features, impaired spousal communication and negative IPs, emotionally-focused interventions dedicated to couples may be useful to promote functional communication patterns, ultimately improving marital adjustment³³.

Our study represents the starting point for future research on this topic, involving individuals with MS or other chronic conditions. Indeed, due to the preliminary nature of our study, the results are far from being conclusive and caution should be used when transferring them to chronic illnesses other than MS. For example, concerns have been raised regarding the content validity in relation to the IP dimensions "personal control" and "treatment control" among non-dialysis chronic kidney disease persons, particularly in relation to the relevance and comprehensibility of such dimensions among asymptomatic patients³⁴. Indeed, a large proportion of individuals with kidney disease are asymptomatic till the later stages of the disease, whereby dialysis is seen as a tardive option, reserved to more severe cases. As far as PwMS are considered, their symptom experience is completely different: they typically present with symptoms at the very beginning of the illness and intensive therapy is an early choice. Hence, it is apparent how the perception of control may considerably vary across illnesses with different core features.

Our study has some limitations. Firstly, its cross-sectional design does not allow to infer causation.

Moreover, our sensitivity analysis suggested that other aspects (i.e. relationship quality) may play a role in the link between alexithymia and IPs. Indeed, it would be naive to reduce the complex mechanisms underlying the formation of IPs to a linear and monocausal process. The assessment of other variables, such as quality of life (i.e. social dimension), would have provided other elements for interpreting our findings. Hence, many questions remain unanswered and further studies are recommended to disentangle the involved factors and their contribution.

Data availability

Research data will be preserved for 10 years in the Lancaster University Publications and Research electronic repository (PURE) but will not be made publicly available in order to not raise concerns about confidentiality for the participants, as foreseen in the research protocol and approved by the study participants. Corresponding author for any data or questions regarding the study: Dr Maria Luca.

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Author contributions

1. Research project: (A) Conception, (B) Organization, (C) Execution and design, (D) Supervision. 2. Statistical analysis: (A) Design, (B) Execution, (C) Review and critique. 3. Manuscript: (A) Writing of the first draft, (B) Review and Critique. ML: 1 A, 1B, 1 C, 2 A, 2B, 2 C, 3 A. AL: 2 C, 3B. FP: 1B, 1D, 3B. FJRE: 1 A, 1D, 2 A, 2 C, 3B. GPA: 1 A, 1D, 2 A, 2 C, 3B.

Declarations

Competing interests

The authors declare no competing interests.

Financial disclosures

none.

Ethical considerations

The study was approved by the Ethics Committee of the University Hospital “Policlinico-San Marco” of Catania, Italy (protocol: 96/2021/PO) and the Faculty of Health and Medicine Research Ethics Committee of Lancaster University, UK (protocol: FHMREC20186) and was performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments. Participants did not receive any form of compensation for taking part in the study.

Additional information

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Abbreviations

APIM	Actor-Partner Interdependence Model
CTM	Cognitive-Transactional Model of couples’ adaptation to chronic illness
DAS	Dyadic Adjustment Scale
DDF	Difficulty in Describing Feelings; DIF: Difficulty in Identifying Feelings
EDSS	Expanded Disability Status Scale
EOT	Externally-Oriented Thinking
IPs	Illness Perceptions
IPQ-R	Illness Perception Questionnaire Revised
MoCA	Montreal Cognitive Assessment
MS	Multiple Sclerosis
MSIS-29v2	Multiple Sclerosis Impact Scale-29 version 2
PHQ-4	Patient Health Questionnaire-4
PwMS	Persons with Multiple Sclerosis
TAS-20	Toronto Alexithymia Scale-20