Use of coping strategies in multiple sclerosis: Association with demographic and disease-related characteristics

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Abstract

Background

Coping positively and negatively influences psychosocial and other outcomes in multiple sclerosis (MS), but there is conflicting evidence about the use of different coping strategies and their associations with demographic and disease characteristics. Our aims were to examine which coping strategies are used by a large sample of people with MS, then to identify any associations between demographic and disease related factors with use of individual coping strategies.

Methods

Participants in the Trajectories of Outcomes in Neurological Conditions (TONiC) study completed the Coping Orientations to Problems Experienced (COPE60) questionnaire. Relationships between demographic and clinical characteristics and coping strategies were examined by multiple ordinal logistic regression to assess the effect of each potential predictor after adjustment for other possible covariates.

Results

From 722 patients, the most commonly used strategy was Acceptance, followed by Active Coping, Planning and Positive Reinterpretation and Growth. All but two strategies showed significant associations with demographic and clinical characteristics. The most marked effects were found for Restraint, with people in employment 2.1 times as likely to utilise this strategy compared to those unemployed, and Seeking of Emotional Social Support and Focus on and Venting of Emotions, which were utilised twice as much by

women compared to men. Behavioural and Mental Disengagement were highly associated with greater

disability and not being in employment.

Conclusion

Clinicians should be aware of several disease and demographic characteristics that are associated with use

of potentially maladaptive coping strategies.

Highlights

- People with MS mostly utilise a mix of active problem- and emotion-focused coping strategies

- Older age, presence of a partner and shorter disease duration associated with adaptive strategies

- Younger age, being male and having RRMS are associated with higher Substance Use

- Being female associated with greater use of emotion-focused strategies

- Unemployment and greater disability associated with higher use of avoidance strategies

Keywords

Cross-Sectional Studies; Multiple Sclerosis; Surveys and Questionnaires; Quality of Life; Adaptation,

Psychological; Coping Strategies

Abbreviations: MS – Multiple Sclerosis; RRMS – Relapsing-remitting Multiple Sclerosis; RERRMS – Rapidly-Evolving Relapsing-Remitting Multiple Sclerosis; COPE60 – Coping Orientations to Problem Experienced 60-item questionnaire; TONiC - Trajectories of Outcomes in Neurological Conditions; EDSS – Expanded Disability Status Scale

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1. Introduction

Multiple Sclerosis (MS) is an incurable neurodegenerative disease with a range of physical and psychological impacts. Coping processes involve cognitive and behavioural efforts to manage specific external and internal demands that are appraised as taxing or exceeding one's resources (Folkman and Lazarus, 1988) and are important determinants of adjustment to life with MS (Dennison et al, 2009). Being life-long and unpredictable, the MS trajectory is highly individual and as such it is interesting to study how people with MS cope in order to adapt. Many studies delineate three main groups of coping strategies, problem-focused: solving, reconceptualising or minimising effects of stressors; emotion-focused: affect regulation; and avoidant: wishful thinking, escapism and efforts to distract oneself (Folkman and Lazarus, 1988; Zeidner and Saklofske, 1996). A combination of problem- and emotion-focused strategies, flexible to the person-environment transaction and appraisal, has been suggested to represent 'adaptive' coping (Zeidner and Saklofske, 1996).

Several studies have shown people with MS utilise more avoidant or emotion-focused coping strategies (Jean et al, 1997; McCabe et al, 2004; Grytten et al, 2017) linked to poorer psychosocial adjustment, such as emotional distress, poorer global health (Pakenham et al, 1997) and depressive symptoms (Lode et al, 2009; Milanlioglu et al, 2014). Of interest to MS clinicians is identifying individual and clinical characteristics that predict use of adaptive or maladaptive coping. Previous research in this area is mixed. Several studies find higher emotion-focused or avoidant coping associated with demographics including increased age (McCabe et al, 2009; Lorefice et al, 2017) or unemployment (Grytten et al, 2017), and disease-related factors including higher disability and secondary progressive forms of MS (Lode et al, 2010; Milanlioglu et al, 2014; Lorefice et al, 2017), whilst others find no impact of these characteristics

(Beatty et al, 1998; Ratsep et al, 2000; Montel and Bungener, 2007; Tan-Kristanto and Kiropoulos, 2015).

Others report more emotion-focused strategies in females (Montel and Bungener, 2007; McCabe et al, 2009; Milanlioglu et al, 2014), yet also higher planning/active coping (Goretti et al, 2009), and most studies do not report marital status or employment (Pakenham et al, 1997; McCabe et al, 2004; Arnett and Randolph, 2006; Lode et al, 2007; Goretti et al, 2009; Lode et al, 2009; Pakenham and Fleming, 2011; Milanlioglu et al, 2014; Tan-Kristanto and Kiropoulos, 2015; Grytten et al, 2017).

Diversity of findings may reflect variation in utilisation of coping strategies among different samples. However, there is significant variation between studies in the choice of coping measurement tool, whilst across studies using the same tool, there is heterogeneity in higher order groupings of coping strategies (Ratsep et al, 2000; Arnett and Randolph, 2006; Lode et al, 2007; Milanlioglu et al, 2014; Tan-Kristanto and Kiropoulos, 2015; Grytten et al, 2017). Studies also vary in demographic or clinical features: some include participants with several forms of MS (Pakenham et al, 1997; Montel and Bungener, 2007; Milanlioglu et al, 2014), almost solely Relapsing-Remitting MS (Moreau et al 2009; Tan-Kristanto and Kiropoulos, 2015) or do not report clinical form (McCabe et al, 2004). Others include only recently diagnosed patients (Lode et al, 2009; Moreau et al 2009; Tan-Kristanto and Kiropoulos, 2015) or lower levels of disability (Moreau et al 2009; Tan-Kristanto and Kiropoulos, 2015). These factors may also explain diversity of results, whilst making collation of past research difficult.

Earlier research has not consistently established whether, within MS, which coping strategies are influenced by patient and disease-related variables. Our aim was to examine the coping strategies of a large

sample of people with MS using a widely regarded assessment tool, and then to investigate any association of demographic or disease variables with individual coping strategies.

2. Materials and Methods

2.1 Participants

Participants with clinically-diagnosed MS were recruited from attendance at adult MS services across the United Kingdom into the ongoing Trajectories of Outcomes in Neurological Conditions (TONiC) study. Following informed consent, participants completed a questionnaire pack. Participants too disabled to write could have assistance from a scribe, where instructions for completion stressed that answers had to record participants' choice of response. We excluded patients suffering from a concomitant serious medical or psychiatric condition other than MS. Ethical approval was granted from the relevant local research committees (reference 11/NW/0743).

2.2 Data Collection

Demographic and disease-specific data were collected in the questionnaire pack. Clinical information was confirmed by healthcare professionals familiar with the patient's case. Clinical diagnosis used criteria pertaining to those in widespread use at the time of diagnosis and was confirmed by a consultant neurologist specializing in MS.

Demographic data included age, gender, marital status (the 'Not Married' category combined participants listing themselves as 'Single', 'Widowed' or 'Divorced') and employment status (only those in full-time or part-time work were listed as 'Working'). Disease-specific data included time from diagnosis,

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current subtype of MS (relapsing remitting (RRMS), Rapidly Evolving Relapsing-Remitting MS (RERRMS), Primary Progressive MS or Secondary Progressive MS) and Expanded Disability Status Scale (EDSS; split into scores 0-4, 4.5-6.5 and ≥7; EDSS ≥7cut-off has been used in other studies) (Mohr et al, 1997). Rapidly Evolving RRMS (RERRMS) is a more aggressive RRMS defined as two or more disabling relapses in the past year, and one or more gadolinium-enhancing lesions on MRI or increase in the T2 lesion load compared with previous MRI (European Medicines Agency, 2014). RERRMS participants were removed from the analysis, as we suspect such patients use a different pattern of coping strategies given their outlook is worse and they qualify for specific treatments, preventing amalgamation with RRMS participants; there were too few RERRMS patients to perform statistical analysis as a distinct group. EDSS was determined at time of study recruitment by an MS clinician with standardized EDSS assessment training.

2.3 Coping

This study assessed 'Dispositional coping' i.e. coping strategies people usually use. Coping strategies were assessed using the validated COPE60 scale (Carver et al, 1989). Participants list their responses on four-point Likert Scales (0="I usually don't do this at all"; 1="I usually do this a little bit"; 2="I usually do this a medium amount"; 3="I usually do this a lot"). The 60-item COPE60 assesses 15 proposed coping strategies, each covered by four items. These 15 strategies can be divided into three categories: Problem-focused strategies (Active Coping, Planning, Suppression of Competing Activities, Restraint and Seeking of Instrumental Social Support), Emotion-focused strategies (Seeking of Emotional Social Support, Positive Reinterpretation and Growth, Acceptance, Denial and Turning to Religion) and Other strategies (Focus on and Venting of Emotions, Behavioural Disengagement, Mental Disengagement, Humour and

Substance Use). These categories of 'Problem-focused' and 'Emotion-focused' strategies, with the

remaining strategies listed as 'Other', arise from the original paper (Carver et al, 1989). They considered

coping strategies to be empirically distinct dependent on the population or circumstances in which they are

measured and did not endorse using *a priori* higher order groupings. The COPE60 generates a score from 0-

12 for each coping strategy by combining the scores of all four scale items. We developed a method for

collapsing these scores into five groups (see Figure 1) to ensure each category was reasonably populated for

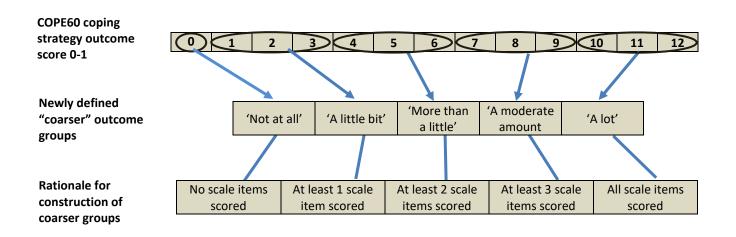statistical testing, whilst preserving the ordinality of the scale.

Figure 1: Method for collapsing COPE60 outcome scores into groups for analysis

2.4 Data Analysis

For the descriptive statistics, mostly non-parametric methods were employed, since all variables were either ordinal and/or not normally distributed, except for age. Medians and inter-quartile ranges were used for summary scores of coping strategies. Relationships between available demographic and clinical characteristics and coping strategies were examined by ordinal logistic regression (OLR) using cumulative logits, assuming proportional odds where this agreed with the available data. The proportional odds assumption was assessed using a likelihood ratio test with the cut-off for significance at $p<0.01$ to ensure that the assumption of proportional odds was only rejected if there was strong evidence against it. Simple OLR was used to examine the effect of each covariate independently, and multiple OLR included all demographic and disease-specific variables to examine the effect of each potential predictor after adjustment for all other recorded covariates. For coping strategies where one or more covariates did not have a proportional odds structure, a partial proportional odds model was fitted in the multiple regression. which again adjusted for all other recorded covariates. Statistical significance was assessed using the Wald test and $p<0.05$.

Analyses were conducted using R version 3.3.2 and the vglm function of the VGAM package (Yee, 2010) with the 'cumulative' VGAM family function option and reverse=TRUE. The analysis was only conducted on participants for whom complete data on all demographic and disease characteristics were available. We did not require all individuals to have data on all the coping strategies, therefore study populations varied slightly between coping strategies (See Supplementary Material Figure 2).

3. Results

3.1 Clinical and demographic details

By the end of 2014, 722 people with MS had completed and returned the questionnaire. 40 of these

participants had had RERRMS and so were removed from the analysis. See Table 1 for demographic and

disease-specific data.

Demographic data		Missing data
Age in years (Mean (SD; Range))	49 (11.6; 17-82)	27 (3.7%)
Gender = Female (%)	519 (72.5)	6 (0.8%)
Employment = No (%)	410 (59.1)	28 (3.9%)
Marital Status = Married (%)	516 (73.7)	22 (3.1%)
Disease-specific data		
Disease Duration in years (Median (IQR))	9 (5-17)	26 (3.6%)
Disease type (%)		32 (4.4%)
Relapsing-remitting	418 (57.9)	
Rapidly Evolving Relapsing-remitting	40 (5.5)	
Secondary progressive	161 (22.3)	
Primary Progressive	71 (9.8)	
EDSS (%)		12 (1.7%)
0-4	267 (37)	
4.5-6.5	346 (47.9)	
7+	97 (13.4)	

Table 1: Demographic and disease-specific characteristics of the study population

	0	1	2	3	4	5	6	7	8	9	10	11	12
Active Coping					▒	▒	■	▒	▒	░			
Planning					▒	▒	■	▒	▒				
Suppression of Competing Activities				▒	▒	■	▒						
Restraint				▒	▒	■	▒	▒					
Seeking of Instrumental Social Support			▒	▒	■	▒	▒	▒					
Seeking of Emotional Social Support			▒	▒	■	▒	▒						
Positive Reinterpretation and Growth					▒	▒	■	▒	▒	░			
Acceptance						▒	▒	■	▒	▒			
Denial	▒	■	▒	▒									
Turning to Religion	■	▒	▒	▒									
Focus on and Venting of Emotions			▒	▒	■	▒	▒						
Behavioural Disengagement		▒	■	▒	▒								
Mental Disengagement		▒	■	▒									
Humour			▒	▒	■	▒	▒	▒					
Substance Use	■	▒											

Key	░ = Minimum to maximum response	▒ = First to third quartile	■ = Median

Table 2: Overall use of the 15 coping strategies

All coping strategies were used at least 'A little' by at least half of participants, except for Turning to Religion and Substance Use. The most commonly used strategy was Acceptance, followed by Active Coping, Planning and Positive Reinterpretation and Growth, then Restraint and Suppression of Competing Activities, followed by Seeking of Instrumental Social Support, Seeking of Emotional Social Support, Focus on and Venting of Emotion, and Humour. Both Behavioural and Mental Disengagement, along with Denial, were less common, with under half of participants using these strategies more than 'A little' (Table 2 summarises overall usage).

3.2.1 Predictors for use of individual Coping Strategies

Results are presented as Odds Ratios with 95% confidence intervals (see Tables 3, 4 and 5). Statistically significant simple OLR results are discussed in the text, except where significance of results changed following adjustment in multiple OLR.

3.2.2 Problem-Focused Strategies

Greater use of Active Coping was predicted by increasing age (1.01 [1-1.03]) and, following adjustment, shorter disease duration (0.98 [0.96-1]). Higher utilisation of Planning was, following adjustment, predicted by increasing age (1.02 [1-1.04]). Participants with greater disability and those married were more likely to utilise higher levels of Suppression of Competing Activities; those at EDSS 4.5-6.5 were 1.8 times as likely to utilise higher levels of this strategy as those at EDSS 0-4 (1.8 [1.28-2.54]), whilst those not married were 1.9 times as likely as those married to utilise 'more than a little' or less compared to utilising it 'moderately' or 'a lot' (1.88 [1.12-3.19]).

Higher use of Restraint (holding back one's coping attempts until they can be of use) was predicted by increasing age (1.02 [1.01-1.04]), being out of work (0.48 [0.35-0.67]) and, following adjustment, shorter disease duration (0.97 [0.95-0.99]) and not being married (0.66 [0.46-0.95]), with those not in employment 2.1 times as likely as those in employment, and those not married 1.5 times as likely as those married, to utilise this strategy at higher levels. We also found greater use of Restraint at lower EDSS scores, though the strength and size of association depended on the response category (See Table 5). Notably, those at EDSS 4.-5-6.5 were 6.9 times as likely as those at EDSS 0-4 to utilise Restraint 'not at all' compared to higher usage (6.92 [1.52-31.54), whilst those with EDSS ≥7 were 2.9 times as likely as those with EDSS 0-4 to utilise Restraint 'more than a little' or less compared to 'moderately' or 'a lot' (2.88 [1.55-5.34]).

Greater use of Seeking of Instrumental Social Support was predicted by female gender (1.79 [1.27-2.51]), with women 1.8 times as likely to utilise higher levels of this strategy compared to men.

3.2.3 Emotion-Focused Strategies

Higher use of Seeking of Emotional Social Support was predicted by female gender (2.02 [1.44-2.83]), with women twice as likely to utilise this strategy at higher levels compared to men. Greater use of Acceptance was predicted by gender (0.61 [0.44-0.86]), with men 1.5 times as likely to utilise higher levels of this strategy compared to women. Higher utilisation of Turning to Religion was predicted by increasing age (1.03 [1.02-1.05]), being out of employment (0.53 [0.38-0.75]) and, following adjustment, female gender (1.48 [1-2.19]), with those not in employment 1.9 times as likely as those in employment, and women 1.5 times as likely as men, to utilise higher levels of this strategy. Use of Positive Reinterpretation and Growth and Denial were not significantly associated with any of our covariates.

3.2.4 Other Strategies

Greater use of Focus on and Venting of Emotions was predicted by younger age (0.98 [0.97-1]) and female gender (2.16 [1.53-3.05]), with women 2.2 times as likely to utilise this strategy at higher levels compared to men. Greater utilisation of Behavioural Disengagement was predicted by being out of employment (0.45 [0.33-0.62]) and higher EDSS score (2.85 [1.74-4.65]), with those not in employment 2.2 times as likely as those in employment, and those at EDSS ≥7 2.9 times as likely as those at EDSS 0-4, to utilise this strategy at higher levels. Similarly, higher use of Mental Disengagement was predicted by being out of employment (0.5 [0.36-0.7]) and higher EDSS score (EDSS 4.5-6.5: 1.61 [1.14-2.28]; EDSS ≥7: 2.57 [1.55-4.25]); those not in employment were 2.0 times as likely as those in employment to utilise this strategy at higher levels, whilst those at EDSS 4.5-6.5 were 1.6 times as likely as those at EDSS 0-4, and those at EDSS ≥7 were 2.6 times as likely as those at EDSS 0-4, to utilise this strategy at higher levels.

Greater use of Humour was predicted by younger age (0.98 [0.96-0.99]) and male gender (0.63 [0.45-0.88]), with men 1.6 times as likely to utilise higher levels of this strategy compared to women. Higher utilisation of Substance Use was predicted by younger age (0.97 [0.95-0.99]), RRMS disease type (Secondary Progressive: 0.36 [0.21-0.61]) and, following adjustment, male gender (0.51 [0.33-0.79]) and longer disease duration (1.04 [1.01-1.07]); those participants with RRMS were 2.8 times as likely as those with Secondary Progressive MS, and men 1.9 times as likely as women, to utilise this strategy at higher levels.

Coping Strategy (Number included in analysis)	Age (Years)	Sex [Ŧ]	Marital Status [Δ]	Employ-ment [θ]	EDSS[¥] 4.5-6.5	7+	Disease Type [δ] PP	SP	Duration (Years)
Active Coping (552)	**1.01* (1-1.03)**	1.01 (0.72-1.43)	1.14 (0.81-1.61)	1.07 (0.79-1.46)	1.13 (0.81-1.57)	0.95 (0.59-1.53)	1.27 (0.77-2.09)	1.07 (0.75-1.54)	0.99 (0.98-1.01)
Planning (555)	1.01 (1-1.02)	1.1 (0.79-1.55)	1.12 (0.8-1.58)	1.06 (0.78-1.44)	1.13 (0.82-1.56)	0.81 (0.51-1.31)	0.88 (0.53-1.44)	0.98 (0.68-1.4)	0.99 (0.97-1.01)
Suppression of Competing Activities (555)	**1.02* (1-1.03)**	0.95 (0.67-1.35)	-	**0.73* (0.53-1)**	**1.8*** (1.28-2.54)**	1.1 (0.67-1.8)	**1.68* (1-2.82)**	1.09 (0.75-1.59)	1 (0.99-1.02)
Restraint (554)	**1.02*** (1.01-1.04)**	0.93 (0.66-1.31)	0.71 (0.5-1.02)	**0.48*** (0.35-0.67)**	-	-	1.26 (0.75-2.1)	**1.65** (1.14-2.4)**	1 (0.98-1.01)
Seeking of Instrumental Social Support (557)	0.99 (0.98-1.01)	**1.79*** (1.27-2.51)**	1.17 (0.83-1.64)	0.95 (0.7-1.28)	1.05 (0.76-1.44)	0.82 (0.51-1.31)	0.76 (0.47-1.25)	0.77 (0.53-1.1)	0.99 (0.97-1)
Seeking of Emotional Social Support (560)	0.99 (0.98-1)	**2.02*** (1.44-2.83)**	1.14 (0.81-1.61)	0.93 (0.69-1.26)	1 (0.72-1.38)	0.84 (0.53-1.35)	0.7 (0.43-1.16)	0.82 (0.57-1.17)	0.99 (0.98-1.01)
Positive Reinterpretation and Growth (555)	0.99 (0.98-1.01)	1.34 (0.95-1.87)	1.21 (0.86-1.71)	1.32 (0.98-1.8)	0.99 (0.71-1.37)	0.64 (0.4-1.04)	0.72 (0.44-1.18)	0.79 (0.55-1.13)	0.99 (0.98-1.01)
Acceptance (557)	1.01 (0.99-1.02)	**0.61** (0.44-0.86)**	0.94 (0.67-1.33)	0.81 (0.6-1.11)	1.12 (0.81-1.55)	1.22 (0.75-1.96)	1.48 (0.89-2.44)	**1.48* (1.03-2.12)**	1 (0.98-1.01)
Denial (557)	1 (0.99-1.02)	**0.68* (0.48-0.96)**	1.05 (0.74-1.49)	0.91 (0.67-1.25)	1.12 (0.8-1.56)	1.24 (0.76-2.02)	1.11 (0.67-1.85)	1.32 (0.91-1.91)	0.99 (0.98-1.01)

Turning to Religion (559)	**1.03*** (1.02-1.05)**	1.29 (0.89-1.87)	1.09 (0.75-1.58)	**0.53*** (0.38-0.75)**	**1.45* (1.01-2.06)**	1.47 (0.88-2.45)	1.44 (0.85-2.43)	**1.63* (1.12-2.38)**	1.01 (1-1.03)
Focus on and Venting of Emotions (555)	**0.98** (0.97-1)**	**2.16*** (1.53-3.05)**	1.15 (0.82-1.62)	0.96 (0.71-1.3)	1.04 (0.75-1.44)	1.04 (0.65-1.68)	0.65 (0.4-1.07)	0.71 (0.49-1.02)	0.99 (0.97-1)
Behavioural Disengagement (547)	1.01 (1-1.03)	0.97 (0.69-1.37)	0.75 (0.53-1.07)	**0.45*** (0.33-0.62)**	**1.78*** (1.27-2.49)**	**2.85*** (1.74-4.65)**	1.36 (0.81-2.26)	**1.78** (1.23-2.58)**	1.01 (1-1.03)
Mental Disengagement (547)	1.01 (1 -1.02)	0.952 (0.67-1.36)	0.71 (0.49-1.02)	**0.5*** (0.36-0.7)**	**1.61** (1.14-2.28)**	**2.57*** (1.55-4.25)**	1.06 (0.63-1.78)	1.38 (0.95-2.02)	1.01 (0.99-1.03)
Humour (552)	**0.98*** (0.96-0.99)**	**0.63** (0.45-0.88)**	**0.67* (0.48-0.95)**	1.22 (0.9-1.65)	1.02 (0.74-1.41)	0.98 (0.61-1.57)	0.78 (0.47-1.28)	0.86 (0.6-1.23)	**0.98* (0.97-1)**
Substance Use (557)	**0.97*** (0.95-0.99)**	0.72 (0.48-1.08)	0.89 (0.59-1.36)	1.03 (0.71-1.51)	0.91 (0.62-1.36)	**0.44* (0.22-0.89)**	0.6 (0.31-1.15)	**0.36*** (0.21-0.61)**	0.99 (0.97-1.02)

*p=<0.05; **p=<0.01; ***p=<0.001

Ŧ: Females compared to Males; θ: Employed compared to those Not in Employment; Δ: Married compared to those Not Married; δ: Primary Progressive (PP) MS compared to Relapsing-Remitting MS, Secondary progressive (SP) MS compared to Relapsing Remitting MS; ¥: EDSS 4.5-6.5 compared to EDSS 0-4, and EDSS 7+ compared to EDSS 0-4

Table 3: Odds ratios and 95% confidence intervals for univariable OLR where proportional odds could be assumed. All figures are rounded to 3 significant digits and significant results are highlighted

Coping Strategy (Number included in analysis)	Age (Years)	Sex ᵀ	Marital Status ᐞ	Employ-ment ᶿ	EDSS¥ 4.5-6.5	7+	Disease Type ᵟ PP	SP	Duration (Years)
Active Coping (552)	**1.03** (1.01-1.04)**	1.08 (0.76-1.53)	1.08 (0.76-1.54)	1.25 (0.86-1.8)	1.09 (0.74-1.62)	0.97 (0.52-1.82)	1.04 (0.59-1.84)	1.08 (0.67-1.75)	**0.98* (0.96-1)**
Planning (555)	**1.02* (1-1.04)**	1.13 (0.8-1.6)	1.07 (0.76-1.51)	1.13 (0.78-1.62)	1.19 (0.81-1.75)	0.92 (0.49-1.72)	0.77 (0.43-1.35)	1.03 (0.64-1.65)	0.98 (0.96-1)
Suppression of Competing Activities (555)	1.02 (1-1.03)	0.98 (0.68-1.42)	-	0.92 (0.63-1.35)	**1.6* (1.06-2.41)**	0.96 (0.5-1.84)	1.24 (0.68-2.23)	0.86 (0.52-1.42)	1 (0.98-1.02)
Restraint (554)	**1.03** (1.01-1.05)**	1.05 (0.73-1.51)	**0.66* (0.46-0.95)**	**0.64* (0.44-0.94)**	-	-	0.66 (0.36-1.18)	1.14 (0.7-1.86)	**0.97** (0.95-0.99)**
Seeking of Instrumental Social Support (557)	1 (0.98-1.02)	**1.78** (1.25-2.52)**	1.2 (0.85-1.69)	0.81 (0.57-1.17)	1.13 (0.77-1.67)	1.08 (0.58-2)	0.81 (0.46-1.43)	0.87 (0.54-1.39)	0.98 (0.96-1)
Seeking of Emotional Social Support (560)	0.99 (0.97-1.01)	**2.01*** (1.41-2.85)**	1.21 (0.86-1.71)	0.78 (0.54-1.12)	1.06 (0.73-1.56)	0.99 (0.54-1.84)	0.86 (0.49-1.51)	0.98 (0.61-1.57)	0.99 (0.97-1.01)
Positive Reinterpretation and Growth (555)	1 (0.98-1.02)	1.27 (0.9-1.81)	1.19 (0.84-1.69)	1.26 (0.87-1.82)	1.17 (0.8-1.72)	0.84 (0.45-1.56)	0.83 (0.47-1.46)	0.95 (0.59-1.52)	1 (0.98-1.02)
Acceptance (557)	1.01 (0.99-1.02)	**0.67* (0.47-0.96)**	0.97 (0.69-1.38)	0.86 (0.6-1.25)	0.9 (0.61-1.32)	0.85 (0.45-1.59)	1.32 (0.74-2.34)	1.51 (0.94-2.42)	0.99 (0.97-1.01)
Denial (557)	1 (0.99-1.02)	0.71 (0.5-1.02)	1.1 (0.77-1.57)	0.93 (0.64-1.35)	1.03 (0.69-1.53)	1.12 (0.59-2.13)	0.98 (0.55-1.76)	1.31 (0.8-2.14)	0.98 (0.96-1)

Turning to Religion (559)	**1.02** (1.01-1.04)**	**1.48* (1-2.19)**	1.08 (0.73-1.58)	**0.63* (0.42-0.95)**	0.98 (0.63-1.51)	0.8 (0.41-1.58)	1.13 (0.62-2.06)	1.43 (0.86-2.37)	0.99 (0.97-1.01)
Focus on and Venting of Emotions (555)	**0.98* (0.96-1)**	**2.14*** (1.5-3.06)**	1.24 (0.87-1.75)	0.78 (0.54-1.13)	1.31 (0.89-1.93)	1.85 (0.99-3.46)	0.73 (0.41-1.29)	0.74 (0.46-1.2)	0.99 (0.97-1.01)
Behavioural Disengagement (547)	1 (0.98-1.02)	1.06 (0.74-1.52)	0.79 (0.55-1.13)	**0.54** (0.37-0.79)**	1.47 (0.99-2.19)	**2.25* (1.18-4.26)**	0.84 (0.46-1.51)	1.1 (0.68-1.8)	0.99 (0.97-1.01)
Mental Disengagement (547)	1 (0.98-1.02)	0.97 (0.67-1.41)	0.73 (0.51-1.06)	**0.58** (0.39-0.85)**	**1.53* (1.02-2.31)**	**2.7** (1.4-5.23)**	0.61 (0.34-1.12)	0.77 (0.47-1.28)	0.99 (0.97-1.01)
Humour (552)	**0.98** (0.96-0.99)**	**0.62** (0.44-0.88)**	0.74 (0.52-1.05)	1.09 (0.76-1.57)	1.36 (0.93-1.99)	1.63 (0.88-3.02)	0.78 (0.44-1.38)	0.86 (0.54-1.38)	0.99 (0.97-1.01)
Substance Use (557)	**0.96*** (0.94-0.99)**	**0.51** (0.33-0.79)**	1.03 (0.66-1.61)	0.7 (0.45-1.1)	1.16 (0.73-1.85)	0.72 (0.3-1.71)	0.63 (0.3-1.34)	**0.29*** (0.15-0.56)**	**1.04** (1.01-1.07)**

*p=<0.05; **p=<0.01; ***p=<0.001

Ŧ: Females compared to Males; θ: Employed compared to those Not in Employment; Δ: Married compared to those Not Married; δ: Primary Progressive (PP) MS compared to Relapsing-Remitting MS, Secondary progressive (SP) MS compared to Relapsing Remitting MS; ¥: EDSS 4.5-6.5 compared to EDSS 0-4, and EDSS 7+ compared to EDSS 0-4

Table 4: Odds ratios and 95% confidence intervals from multiple OLR for covariates for which a proportional odds structure could be assumed. Covariates for which proportional odds could not be assumed were included in the model but estimates are given in Table 5. All figures are rounded to 3 significant digits and significant results are highlighted

Coping Strategy (Number included in analysis) Suppression of Competing Activities (555)	Marital Status[Δ]		Marital Status[Δ]	
'Not at all' [Ŧ]	0.75 (0.24-2.29)		0.73 (0.24-2.22)	
'Not at all' or 'A little' [θ]	0.71 (0.46-1.11)		0.68 (0.44-1.07)	
'Not at all', 'A little' or 'More than a little' [δ]	**1.88* (1.12-3.19)**		**1.81* (1.07-3.09)**	
'Not at all', 'A little', 'More than a little' or 'A moderate amount'[§]	6.61 (0.88-49.96)		6.36 (0.84-47.95)	
Restraint (554)	EDSS[¥]		EDSS[¥]	
	4.5-6.5	7+	4.5-6.5	7+
'Not at all' [Ŧ]	**6.92* (1.52-31.54)**	0.62 (0.22-1.75)	**5.7* (1.24-26.22)**	0.5 (0.17-1.53)
'Not at all' or 'A little' [θ]	**2.16*** (1.43-3.25)**	1.27 (0.72-2.23)	**1.79* (1.13-2.85)**	1.01 (0.5-2.04)
'Not at all', 'A little' or 'More than a little' [δ]	**3.01*** (1.89-4.79)**	**2.88*** (1.55-5.34)**	**2.55*** (1.52-4.27)**	**2.4* (1.14-5.08)**
'Not at all', 'A little', 'More than a little' or 'A moderate amount'[§]	1.4 (0.5-3.92)	3.01 (0.94-9.65)	1.15 (0.4-3.33)	2.65 (0.77-9.15)
*p=<0.05; **p=<0.01; ***p=<0.001				
Δ: Married compared to those Not Married; ¥: EDSS 4.5-6.5 compared to EDSS 0-4, and EDSS 7+ compared to EDSS 0-4. Ŧ: Compared to 'a little', 'more than a little', 'a moderate amount' or 'a lot'; θ: Compared to 'more than a little', 'a moderate amount' or 'a lot'; δ: Compared to 'a moderate amount' or 'a lot'; §: Compared to 'a lot'.				

Table 5: Odds ratios and 95% confidence intervals from univariable and multiple OLR for covariates for which a proportional odds structure could not be assumed. All figures are rounded to 3 significant digits and significant results are highlighted

4. Discussion

The majority of our MS respondents utilised an active, positive mix of problem- and emotion-focused coping strategies, namely Acceptance, Planning, Positive Reinterpretation and Growth and Active Coping. These strategies are considered adaptive (Maes et al, 1996; Zeidner and Saklofske, 1996), associated with better psychosocial indicators of adjustment (Brooks and Matson, 1982; Pakenham and Fleming, 2011; Tan-Kristanto and Kiropoulos, 2015) and better mental and overall quality of life in MS (Arnett and Randolph, 2006; Goretti et al, 2009). Both demographic and disease characteristics independently predicted greater or lesser likelihood of use of certain coping strategies.

Increasing age, presence of a partner and shorter disease duration associated with solely adaptive coping strategies. Increasing age of participants made them more likely to use Active Coping and Planning, strategies negatively correlated to psychological disturbance and negative mood profiles in MS (Bianchi et al, 2014; Milanlioglu et al, 2014), as well as Restraint. Married participants were more likely to use Suppression of Competing Activities. A strategy associated with lower depressive symptoms and fatigue (Arnett and Randolph, 2006; Milanlioglu et al, 2014), and which moderates Substance Use (Corbin et al, 2013). Those not married were more likely to use Restraint. Presence of a partner may allow people with MS to share or offload non-disease related stressors to focus their coping efforts, whereas absence of such a partner may require Restraint until active, problem-focused strategies can be employed; such circumstances may be amenable to targeted social or occupational support. Those with shorter disease duration were more likely to use Active Coping, associated with better psychological outcomes in MS (Arnett and Randolph, 2006; Milanlioglu et al, 2014), and Restraint. Early use of active coping may reflect hope and optimism whilst

disease-related limitations are less apparent (Goretti et al, 2009), with Restraint helping to moderate

impulsive actions (Corbin et al, 2013).

Younger age, gender, lack of employment, higher EDSS and clinical form associate with potentially

maladaptive coping strategies. Younger age predicted greater likelihood of using Humour, Focus on and

Venting of Emotion and Substance Use. These strategies link to greater depression, anxiety and fatigue in

MS (Arnett and Randolph, 2006; Lode et al, 2009; Milanlioglu et al, 2014; Tan-Kristanto and Kiropoulos,

2015); males were also more likely to use Humour and Substance Use.   Depression is generally higher in

younger and female populations, whilst this gender difference is not apparent in MS, suggesting males with

MS suffer greater burden of depression (Bove et al, 2016). Whilst males were more likely to use Acceptance,

an adaptive strategy (Brooks and Matson, 1982; Arnett and Randolph, 2006; Pakenham and Fleming, 2011),

previous MS research indicates young men are most at risk of suicide, whilst depression and substance use

both associate with thoughts of suicide (Feinstein and Pavisian, 2017). Interestingly, Restraint appears to

moderate alcohol use, possibly by reducing impulsive behaviour (Corbin et al, 2013), and in our study

younger participants were less likely to utilise Restraint. Lastly, Humour can be negative (disparaging or self-

defeating), providing less emotion regulation to facilitate positive reappraisal of negative events (Samson

and Gross, 2012). We observed coping behaviours in younger people and males with MS that offer less

ability to regulate emotions and may facilitate impulsive, maladaptive coping behaviour. Clinicians might

explore Restraint coping as a means to avoid impulsive behaviour, as well as exploring positive humour

(Samson and Gross, 2012), substance use services and importantly risk assessment.

Females were more likely to use Seeking Social Support, both Instrumental and Emotional, as well as Turning to Religion. Spiritual well-being has been shown to influence adaptation to MS (McNulty et al, 2004). Seeking Social Support seems to facilitate adaptive coping when used in conjunction with other problem-focused coping strategies, whilst It may also support venting of one's feelings, a strategy linked to maladaptive coping (Carver et al, 1989). Seeking Social Support has been linked to less fatigue[9] and better psychosocial adjustment (McCabe and McKern, 2002; McCabe et al, 2004; Bianchi et al, 2014), including negative correlations to depression and anxiety in newly diagnosed MS (Tan-Kristanto and Kiropoulos, 2015). Females were also more likely to use Focus on and Venting of Emotion, a strategy associated with depression in MS (Arnett and Randolph, 2006; Lode et al, 2009), as well as other maladaptive strategies (Carver et al, 1989). Our results suggest that females with MS utilise coping strategies that can support an adaptive style of coping (which our study finds prevalent amongst the MS population), yet clinicians should bear in mind that where other adaptive strategies are not used, there is potential for these strategies to facilitate maladaptive coping. For instance, females report higher rates of anxiety in MS (Bove et al, 2016).

Participants not in employment were more likely to use Restraint, as well as Mental and Behavioural Disengagement. Behavioural and Mental Disengagement are passive, avoidance strategies (Carver et al, 1989) positively correlated with depression and anxiety scores in MS (Arnett and Randolph, 2006; Lode et al, 2009; Milanlioglu et al, 2014). Being out of work is consistently shown to associate with higher psychological disturbance (Tan-Kristanto and Kiropoulos, 2015; Grytten et al, 2017), and it is clear to see how it encourages passivity; Lode at al (2010) found as people with MS on disability benefit rose, coping behaviour became more passive. Restraint is also passive, yet one remains focused on a stressor, facilitating

less impulsive strategies and can thus be adaptive (Corbin et al, 2013). Restraint has also been linked to depressive symptoms in MS (Lode et al, 2009), suggesting potential maladaptive applications, perhaps by augmenting avoidance strategies in the dwindling presence of active strategies. People with MS out of work appear to utilise more avoidant coping strategies that are distinctly maladaptive and may reflect an increasing passivity of coping behaviour. We echo recommendations that clinicians encourage perception of the benefit of employment and role of coping (Strober and Arnett, 2016).

RRMS predicted higher Substance Use, an impulsive, avoidant and maladaptive coping strategy that may function as a distraction during relapses or means of dealing with the unpredictability of the RRMS course (Milanlioglu et al, 2014; Tan-Kristanto and Kiropoulos, 2015). It has been suggested that certain emotion-focused strategies allow temporary 'detachment' from uncontrollable stressors, including relapses, facilitating emotional regulation (Zeidner and Saklofske, 1996; Lode et al, 2007). This might explain why higher use of such strategies correlates with satisfaction of information at diagnosis (Lode et al, 2007), an interesting and clinically relevant point to be borne in mind by clinicians and those involved in coping training who may offer alternative detachment strategies.

Higher EDSS predicted greater likelihood to use Behavioural and Mental Disengagement, avoidant strategies linked by several studies to negative psychosocial outcomes in MS (Arnett and Randolph, 2006; Lode et al, 2009; Milanlioglu et al, 2014) and may serve as a form of detachment that risks maladjustment, such as poor work performance (Lode et al, 2010). We found lower likelihood to use Restraint at lower EDSS scores in our study, which is unsurprising given that those less disabled could more readily act to deal with stressors. Our findings of greater use of avoidant, maladaptive strategies in people at higher EDSS is

concerning; such people may benefit from encouragement of adaptive strategies with less physical components, such as Acceptance or Positive Reappraisal.

The close relationship between coping strategies and psychological disturbance has led to suggestions that treatment aimed at improving adaptive coping behaviour may result in a reduction in depression, particularly where advancing physical disability might impair adaptive coping efforts (Mohr et al, 1997). Previous research supports the efficacy of coping skills training to improve psychosocial parameters in MS, including reducing psychosocial role limitations and promoting well-being despite progression of disease (Schwartz, 1999), and reducing symptoms of depression, anxiety and perceived stress (McGuire et al, 2015).

4.1 Limitations

Being cross-sectional, our study cannot ascribe causality to the observed associations. Although we included a large, representative population, we acknowledge factors not reported here may influence coping strategies, including psychological disturbance (Zeidner and Saklofske, 1996; Jean et al, 1997; McGuire et al, 2015), personality factors (McGuire et al, 2015), cognitive representations of the disease, such as changeability (Maes et al, 1996), level of education, socio-economic status, rate of relapse or RERRMS disease type. It is also important to consider inherent problems in the measurement of coping itself. Coping tools are finite, based on theoretical strategies to which respondents must adhere their answers. They examine either dispositional or situational responses, yet dispositional measurements neglect that coping behaviours change with changing stressors, whilst situations considered stressful are subjective and difficult to compare (Kar et al, 2017). Coping instruments are also retrospective, introducing recall error,

and contain many items, particularly the COPE60. This provides many possibilities for missing data; we circumvented this problem by including individuals with complete data for individual coping strategies, rather than excluding all individuals with some form of missing data. Furthermore, problem- and emotion-oriented strategies load onto the same higher-order factors (Zeidner and Saklofske, 1996; Litman, 2006), reflecting that individuals use both types of strategies in certain situations, whilst some coping strategies relate to both approach- and avoidance-motives. Examining individual strategies, as in our study, rather than higher-order groupings may better elucidate the nature of coping (Litman, 2006). Finally, the nature of a stressor (which determines the coping strategies used in its management) is related to one's appraisal of it, influenced by motivations, beliefs and personal resources (Folkman and Lazarus, 1988). Comprehensive coping assessments that address all of these concepts is challenging and represents an area of future development in coping research.

4.2 Conclusions

This study provides clinicians with certain characteristics they can readily assess in people with MS that influence use of individual coping strategies, including those evidently maladaptive. Younger age, being male and having RRMS were associated with higher Substance Use, whilst younger people and males also associated with higher use of strategies that may impair emotion regulation and facilitate maladaptive coping. Females with MS associated with greater utilisation of emotion-focused strategies that can be maladaptive in the absence of other adaptive strategies, whilst being out of employment and having greater disability associated with higher use of disengagement strategies that appear distinctly maladaptive. These results were found within a multivariate analysis after adjustment for all other demographic and disease-

specific variables. Clinicians should be aware of these associations, which may better facilitate counselling and use of targeted advice on coping in MS. Further work should include development of more comprehensive coping measurements, as well as longitudinal assessment of coping and markers of disease adjustment to elucidate any causal relationships.

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7. Declaration of Conflicting Interests

Holland DP, Young CA, Schlüter DK and collaborating authors Mills RJ, Rog DJ, Orchard K and Ford HL declare no conflicts of interest for this work. Any further data enquiries should be emailed to the corresponding author.

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