

## ORIGINAL ARTICLE

# Keeping it together: The role of social integration on health and psychological well-being among individuals with multiple sclerosis

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## Abstract

Research indicates that people with multiple sclerosis (MS) are more likely to report poorer health and well-being than their peers without MS. Fortunately, it is also known that an individual's social and lifestyle factors play a great role on maintaining and promoting one's health and overall well-being. The present study aimed to examine the role that social integration and social support, in particular have on health and psychological well-being (PWB) among individuals with MS. One hundred and eighty three individuals with MS completed measures of social and lifestyle factors, personality, physical and mental health, MS disease symptomatology and PWB. Cross sectional, regression analyses were conducted to determine the role of social and other lifestyle factors (e.g., diet/exercise) on health and PWB. A subset of this sample (108) completed a follow-up assessment. Longitudinal analyses of this sample were also conducted. Consistent with previous findings, the presence of social integration and social support were significant predictors of health and PWB even when taking into account other lifestyle factors (i.e., diet/exercise, substance use, smoking), cardiovascular risk, demographics (i.e., gender, age, education, relationship status) and personality. The role of social integration and support on health and PWB is well established. Present findings confirmed these associations among individuals with MS. These findings suggest that social integration and social support should be a crucial part of MS management and that further interventional studies aimed at improving social integration and reducing social isolation are warranted in an effort to promote and maintain overall health and well-being.

## KEYWORDS

health, lifestyle factors, multiple sclerosis, psychological well-being, social integration, social support

## 1 | INTRODUCTION

Multiple sclerosis (MS) is the most common and disabling neurologic disease in young adults with a mean age onset of 30 years of age (Rejda et al., 2010). As such, MS affects individuals who are in their

prime of their lives and is known to have a grave impact through both the symptoms that transpire and the uncertainty that comes with the disease. Primary symptoms include changes in gait, tremors, visual problems, bladder and bowel incontinence, numbness/tingling in extremities, spasticity, abnormal somatic sensations, sexual

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dysfunction and speech disturbances (Smith et al., 1993). Secondary symptoms include fatigue, depression, sleep disturbance and pain, which occur at extremely high rates. In particular, fatigue is reported in approximately 37% to 78% of individuals with MS (Oliva Ramirez et al., 2021) and is reported by many as their worst symptom (Fisk et al., 1994). Rates of lifetime depression in MS are as high as 50%, with point prevalence rates varying between about 15% and 50% (Boeschoten et al., 2017; Cetin et al., 2007; Patten et al., 2017) and available research suggests that individuals with MS are three times more likely to experience sleep difficulties than controls, with prevalence rates ranging from 36% to 70% (Bamer et al., 2008; Merlino et al., 2009; Siengsukon et al., 2020). Finally, pain has been reported in upwards of 92% (Ferraro et al., 2018). In sum, there is a host of symptoms associated with MS that have been shown to significantly contribute and predict reductions in health and psychological well-being (PWB) and have been shown to contribute to social isolation or withdrawal, resulting in an increased vulnerability for loneliness and poor social integration or connectedness (Hakim et al., 2000; Kratz et al., 2017; MS-UK, 2020; Rincon et al., 2019).

More specifically, factors associated with MS, including mobility issues, functional limitations, uncertainty of symptoms and disease exacerbations, unemployment, stigma, inadequate accommodation and assistive devices, disease progression and a feeling of being misunderstood are known predictors of social isolation and subsequent poor social integration (MS-UK, 2020; Rincon et al., 2019). For instance, Hakim et al. (2000) found social withdrawal and a shrinking circle of friends to be common among individuals with MS, particularly those with severe disability. In particular, one out of four individuals reported that they stopped visiting friends and family due to poor mobility. Reports of pain, fatigue, cognitive difficulties and bladder incontinence (and the uncertainty of such symptoms) have all been shown to contribute to social isolation (Kratz et al., 2017; Rincon et al., 2019). Unemployment is also a major contributing factor to loneliness. This is particularly important in MS, as rates of unemployment range from 12% to 80%, (Dorstyn et al., 2019; Julian et al., 2008) with many leaving the workforce fairly prematurely (within the first 3 to 5 years of diagnosis) (Federation, 2010; Kornblith et al., 1986; Strober et al., 2018). Finally, individuals with MS frequently express a feeling of a lack of understanding or knowledge of those not familiar with MS, which results in further social withdrawal or isolation. In fact, 78% of individuals with MS report that a lack of understanding about MS was by far the biggest issue they faced (MS-UK, 2020). In sum, individuals with MS are at a significant risk for loneliness or poor social connectedness and integration, which can further exacerbate their already existing poor health given what we know of the social determinants of health.

Social connectedness or support has been purported to be a protective or promoting factor of health (Cassel, 1976; Cobb, 1976). Many contend that the relative risk associated with a lack of social connections or social isolation is as great, if not greater than the risk associated with smoking, alcohol use, obesity and CVD factors (Holt-Lunstad et al., 2010, 2015). For instance, in 1988, House

### What is known about this topic

- Social integration or connectedness are known predictors of health and well-being.
- Risk of poor health or mortality is actually greater for social factors than many of the suspected risk factors (e.g., smoking, exercise, poor diet).
- Efforts to assure that individuals maintain (or modify) their social interactions has become a priority in the medical field, with some countries even prescribing social activity to assist in improving one's health.

### What this paper adds

- While well known among the elderly and other conditions (e.g., cancer), the role of social integration or connectedness on health and well-being among individuals with multiple sclerosis (MS) has been less investigated.
- The present paper adds to the literature by identifying the role of MS symptoms on social integration as well as the role of social integration or support on health and psychological well-being in MS.
- Moreover, the present paper examines the role that personality also contributes to reports of health, while considering social determinants as both have been proven to be significant predictors and are likely highly correlated.

et al. suggested that the evidence supporting social relationships on health was stronger than the role of Type A behaviour on CVD and approximated the risk of smoking (House et al., 1988). Two decades later, Holt-Lunstad et al. (2010) found social support and integration to have larger effects sizes in predicting mortality than smoking, alcohol consumption, physical activity, obesity, CVD risk and whether someone received a flu vaccine (Holt-Lunstad et al., 2010). They offered the idea that future medical screening should include assessment of social well-being and that medical care should promote social connections. Today, researchers have urged that social connectedness be considered a public health priority in the US (Holt-Lunstad et al., 2017) and medical professionals in the UK have taken to social prescribing to improve health and well-being (Bickerdike et al., 2017; Wakefield et al., 2020).

Among individuals with MS, social support has been long known to be a primary predictor of depression (McIvor et al., 1984; Mohr et al., 2004) and an important aspect of well-being and health-related quality of life (HRQOL) (D. C. Costa et al., 2017). Social integration, or the extent to which individuals engage in social or community activities, has also been shown to be a significant predictor of HRQOL in MS. Specifically, the number of relatives and friends, participation in sports groups, civic meetings and engagement in volunteer work are significant correlates of mental HRQOL (D. C. Costa et al., 2017). Social connectedness, or one's sense of belonging, has also been

shown to be a factor in 'aging successfully' with a potentially disabling condition such as MS. When asked about ageing well, individuals identified four themes, including resilience and adaptation, autonomy, physical health, and finally, social connectedness. With regard to the latter, participants explained that having support and assistance and interacting often with friends and family as well as with others who shared their disability helped them achieve 'successful ageing'. These sentiments are consistent with previous studies that have implicated social connectedness and support as a key factor to living well and 'the good life' and its ability to be a vital part of one's health and PWB.

Thus, given what we know of social determinants of health and the reduction of such among those with MS, the present investigation examines the role of: (1) MS symptomatology on social integration; and (2) the subsequent contribution of social integration and support on health and PWB among individuals with MS. The inclusion of the latter was deemed important as health is not merely the *absence* of illness or symptomatology. Specifically, Ryff et al. (2004) describe that the "route to advancing health, construed as the presence of wellness, is to focus on what it means to flourish, such as having a sense of purpose and direction in life, good quality relationships with others, and opportunities to realise one's potential." (p. 1383) (Ryff et al., 2004).

Consistent with the past literature examining social connectedness and support on health, the following factors of health/function in MS were included: demographics (gender, age, education, relationship status); disease variables (disease course, disease duration); factors affecting health and function in MS (presence of CVD risk factors [hyperlipidemia, hypertension, diabetes]); and health and lifestyle factors (diet/exercise, social/intellectual activities, smoking, alcohol use, visit to primary care physician in the last year).

Finally, we have previously shown personality, namely the presence of a Type D personality, which is a synergistic combination of neuroticism and social discomfort, to be predictive of health in MS. Individuals who endorsed having Type D personality traits were found to report more fatigue, pain, depression and anxiety (Strober, 2017). Thus, we include this important person-specific factor of health, which has not been previously included in studies examining social determinants of health.

We hypothesise that MS symptomatology (e.g., fatigue) will significantly contribute to reports of lower social integration. In turn, reduced social integration and support will have detrimental effects on health and PWB.

## 2 | METHODS

### 2.1 | Participants

All participants had enrolled in a prospective, longitudinal, national investigation examining the disease and person-specific factors associated with employment status in MS. Eligibility criteria included age ranging from 20 to 64, diagnosis of definitive MS as confirmed by their neurologist, presently working and absence of

other neurological disorders. Participants were asked at the onset of the investigation if they were willing to enroll in the longitudinal component of the investigation. The majority of participants (172) completed their baseline assessments between 2014 and 2015 with a few participants (11) who completed their assessments in 2016–2018. Repeat assessments were completed at 6 months, 1 year, 2 years and 3 years. The data within are from individuals' 6-month follow-up as baseline as those are the individuals who agreed to the longitudinal study and their 3-year follow up. The average time between assessments was 2.54 years. In an effort to reduce attrition, participants were sent information about employment issues in MS and other relevant references as well as contacted every year and followed up with for their annual assessment. Participants were also reimbursed for their time and participation.

### 2.2 | Procedures

All participants completed an online survey consisting of questionnaires assessing general health, MS symptomatology, PWB, health and lifestyle factors, personality, social support, and social integration. All study procedures were approved by the Institutional Review Board and informed consent was obtained from all participants.

### 2.3 | Measures

#### 2.3.1 | Health (Overall general physical health, medical comorbidity, physical functioning, and mental health functioning)

The 36-Item Short Form (SF-36) (Ware et al., 1994) was used to assess an individuals' overall general health. The SF-36 is a 36-item scale, which measures eight domains of health status: *physical functioning* (10 items); *physical role limitations* (four items); *bodily pain* (two items); *general health perceptions* (five items); *energy/vitality* (four items); *social functioning* (two items); *emotional role limitations* (three items) and *mental health* (five items). A scoring algorithm is used to convert the raw scores into the eight dimensions listed above. The transformed scores range from zero where the respondent has the worst possible health to 100 where the respondent is in the best possible health. Component analyses showed that there are two distinct concepts measured by the SF-36: a physical dimension, represented by the *Physical Component Summary* (PCS), and a mental dimension, represented by the *Mental Component Summary* (MCS). The PCS and MCS are transformed to a t-score where the mean is 50 and the standard deviation is 10. For the purposes of the present study, the composite t-scores of PCS and MCS and perceived overall general health were used as indicators of functioning and general health status, respectively. A Chronbach's alpha of 0.85 or higher and reliability coefficient of 0.75 or higher has been found with all subscales with the exception of social functioning (Brazier et al., 1992).

Physician care & cardiovascular disease (CVD) risk. Participants were asked if they: (1) had a primary care visit within the last year; and (2) if they were under the care for any medical conditions besides their MS. Individuals who indicated receiving treatment for hyperlipidaemia, hypertension, diabetes and/or cardiac issues were classified as having CVD risk factors.

### 2.3.2 | Psychological Well-being (Multidimensional construct of positive experiences and relationships, purpose and direction in life, self-acceptance and making use of one's potential)

The Ryff Psychological Well-Being Scales consists of 84 items rated on a 6-point Likert scale (1–6) and is comprised of six subscales (Ryff & Keyes, 1995). The *Positive Relationships* subscale assesses the depth of connection an individual feels with others. How one feels they are living their life in accordance with their own convictions is assessed by the *Autonomy* subscale. The extent to which individuals feel they are living to their full potential and taking advantage of their talents is rated by the *Personal Growth* subscale. The *Purpose in Life* subscale measures how one feels regarding their life's meaning and purpose and direction in life. The *Environmental Mastery* subscale measures how well an individual feels they can manage life situations. Finally, the *Self-acceptance* subscale assesses one's knowledge and acceptance of themselves and their limitations. Internal consistency of the subscales ranges from 0.83 to 0.91 and test-retest reliability has been shown to be 0.81 to 0.88 among the 'parent' 20-item subscales, which the 14-item subscales are highly correlated with ( $r$ 's = 0.97–0.99) (Ryff, 1989).

### 2.3.3 | Disease Symptomatology (Assessment of secondary factors associated with MS)

The Modified Fatigue Impact Scale (MFIS), a modified version of the FIS (Fisk et al., 1994), consists of 21 items derived from interviews with MS patients concerning how fatigue impacts their lives. It consists of three subscales: *physical*, *cognitive*, and *psychosocial* functioning. Items are rated on a 5-point Likert scale (0–4) with a range of scores from 0 to 84. Chronbach's alphas of 0.81, 0.95, and 0.81 have been found for the cognitive, physical, and psychosocial subscales, respectively. For brevity, only the physical fatigue subscale was used in the present study.

The Pittsburgh Sleep Quality Index (PSQI) (Buysse et al., 1989) ascertained sleep quality assessing several domains of sleep. The PSQI consists of 24 items. Of which, 20 items are rated on a 4-point Likert scale (0–3), while 4 items are open-ended, 19 of which are self-reported and 5 of which require secondary feedback from a room or bed partner. Only the self-reported items are used for quantitative evaluation of sleep quality as perceived by the patient with scores ranging from 0 to 21. The PSQI has an internal consistency of 0.83.

The MOS-Pain Effects Scale (PES) (Ritvo et al., 1997) assessed the experience and impact of pain. The PES consists of 6-items and assesses how pain and other unpleasant sensations affect one's mood, movement, recreation, and overall QOL. Patients rate themselves on a 5-point Likert scale ranging from 1 to 5, with the total score ranging from 6 to 30. Higher scores indicate a larger effect of pain on QOL. The PES has a Chronbach's alpha of 0.86. (Society).

The Chicago Multiscale Depression Inventory (CMDI) (Nyenhuis & Luchetta, 1998) was developed specifically for us in with medical populations. It consists of 42 items of negatively valenced mood (i.e., sad, cheerless), evaluative (i.e., useless, resented), and vegetative (i.e., sluggish, unable to concentrate) symptoms, which constitute three subscales (*Mood*, *Evaluative*, and *Vegetative*) of 14 items each that may be interpreted separately or in combination. Items are rated on a 5-point Likert scale (1–5). Scores for the subscales range from 0 to 70. The total score and mood scale demonstrated high internal consistency (0.89 and 0.91, respectively), while the evaluative and vegetative had a Chronbach's alpha of 0.77. The mood subscale was used as the primary indicator of depression in the present study.

### 2.3.4 | Health & Lifestyle Behaviours (Assessment of individuals' engagement in physical and social activity, diet, exercise and lifestyle factors associated with greater cognitive health)

The Cognitive Health Questionnaire (CHQ) (Randolph et al., 2014; Strober et al., 2018) was developed in an earlier study to assess individuals' engagement in lifestyle factors that may maintain or promote cognitive health. Items assess levels of mild and moderate physical activity, alcohol use, smoking, social activity, intellectual activity including compensatory strategy use, sleep habits and steps taken to maintain adequate nutrition (e.g., frequency of eating fruits and vegetables; frequency of eating meals and taking nutritional supplements). The CHQ has two factor-analytically derived indices that were used in this paper: (1) a nutrition/exercise factor; and (2) a social/intellectual activities factor. The nutrition/exercise factor consists of items assessing one's frequency of eating breakfast and lunch, frequency of eating fruits and vegetables, use of vitamins and supplements, and frequency of light and moderate physical activity. The social/intellectual factor assesses one's frequency of socialising with family and friends, engagement in intellectual activities and use of memory/organisational techniques. Alcohol use was categorised as: no use, one drink/day, or more than one drink per day.

### 2.3.5 | Type D Personality (As defined as a synergistic combination of high neuroticism and social discomfort)

Personality was assessed with the NEO-Five Factor Inventory-3 (NEO-FFI-3) (P. T. Costa & McCrae, 1992) and includes subscales of Openness, Conscientiousness, Extraversion, Agreeableness and

Neuroticism (Denollet et al., 1995). The NEO-FFI-3 consists of 60 items (12 items per subscale) and is rated on a 5-point Likert scale (0–4). Scores are transformed into gender corrected t-scores with a mean of 50 and a standard deviation of 10. Individuals also completed the International Personality Item Pool (IPIP) Social Discomfort Scale, (Goldberg et al., 2006) which assesses one's discomfort in social situations and tendency to be reclusive or avoidant of social situations. To determine the presence of Type D Personality, the NEO Neuroticism scale and IPIP Social Discomfort scale were used. A median split was utilised to separate individuals into two groups on the IPIP social discomfort scale. Individuals who were found to be high on the IPIP social discomfort scale and had a T-score greater than 60 on the NEO Neuroticism were identified as having Type D Personality.

### 2.3.6 | Social Support and Social Integration

Modified Social Support Scale (MSSS). The MSSS is a modification of the Social Support Survey developed as part of the Medical Outcomes Study in order to assess perceived social support (Sherbourne & Stewart, 1991). The MOS-SS is comprised of 19 items scored on a 5-point Likert (1–5). It assesses several domains of social support including (1) Emotional/informational support (the expression of positive affect, empathetic understanding and the encouragement of expressions of feelings/the offering of advice, information, guidance or feedback), (2) Tangible support (the provision of material aid or behavioural assistance), (3) positive social interactions (the availability of other persons to do fun things with you), and (4) affectionate support (involving expressions of love and affection). Scores are transformed to have a possible range of 0 to 100, with higher scores indicating greater support. Chronbach's alphas range from 0.91 to 0.96 for the four subscales and is 0.97 for the total score.

Community Integration Questionnaire (CIQ) (Willer et al., 1993) was initially developed to provide a measure of community integration after traumatic brain injury. It consists of 15 items relevant to participation, or more formally: (1) Home integration (active participation of the person in the activities of the home); (2) *Social integration* (participation in a variety of activities outside the home and interpersonal relations); and (3) *Productivity* (involvement in employment, education and volunteer activities). The total score ranges from 0 to 29 with 12 points for home integration, 12 points for social integration and 7 points for productivity. The social integration subscale was used in the present study and assesses an individual's social engagement such as shopping, leisure activities, visiting friends/family, having a close friend they can confide in and how often one does their leisure activities solo or with others. Greater frequency of activity and doing such with others results in a higher score.

## 2.4 | Statistical analyses

All statistical analyses were conducted using SPSS version 26.0. Stepwise linear regression analyses were conducted with MS

symptomatology (i.e., fatigue, sleep, pain) and disease duration as predictors of social integration. Subsequent stepwise linear regression analyses were conducted with health (perceived general health, physical health and mental health) and PWB as dependent variables. The following served as independent (predictor) variables: demographics (gender, age, education, relationship status), disease variables (disease course, disease duration), health status (presence of CVD factors), health and lifestyle factors (diet/exercise, social/intellectual activities, smoking, alcohol use, visit to primary care physician in the last year), Type D personality and social factors (social support, social integration).

## 3 | RESULTS

A total of 183 individuals with MS (90% Female) were enrolled and completed the baseline assessment. The mean age was 44 years (Range = 25–64) and mean education approached a college education ( $M = 15.79$  (2.17); Range = 9–20). For the most part, individuals were married or in a relationship (81%). The majority had a relapsing-remitting course (95%) and mean disease duration was approximately eight and a half years with a range of 1–32 years. The majority (83%) also indicated that they visited their primary care physician within the past year. Approximately 27% reported that they were under the care of a physician for other medical conditions besides their MS. These included diabetes (2%), hyperlipidaemia (3%), hypertension (6%), cardiac conditions (2%), thyroid disease (9%), lymphoma/leukaemia/cancer (2%), polycystic ovarian syndrome (3%), Chiari 1 malformation (1%) and chronic obstructive pulmonary disease (1%). Twenty-two (13%) were considered to have CVD risk factors. Fourteen individuals (8%) indicated present cigarette use and nearly half of the sample reported drinking either one drink or more than one drink per day. Finally, 33 (18%) endorsed having a Type D personality (See Table 1).

Of the 183, 108 completed a follow-up assessment two and a half years later. The mean age of this subsample was 47.03 (10.07) with 16.06 (2.28) mean years of education. The majority were female (90%) and had a relapsing-remitting course (94%) with a mean disease duration of 11.01 (7.10) years. Once again, most were married or in a relationship (91%) and had visited their primary care physician in the past year (88%). A small number (6%) reported smoking. More than half reported drinking one drink per day (20%) or more than one drink per day (36%). Finally, 14 (13%) had CVD risk factors and 15 (14%) endorsed having Type D personality traits (See Table 2).

### 3.1 | Findings with regard to MS symptomatology and social integration

When examining the contribution that disease symptomatology and duration have on social integration, pain and fatigue were found to be significant contributors, accounting for 18% of the variance (See Table 2).

**TABLE 1** Participant demographics, health and lifestyle behaviours and risk factors at baseline and follow-up assessment

Baseline (N = 183)	Mean (SD) or frequency			Range
Age	44.09 (9.51)			25–64
Education	15.79 (2.17)			9–20
Disease duration (years)	8.63 (6.66)			1–32
Gender	Female	Male		
	164 (90%)	19 (10%)		
Disease course	Relapsing Remitting	Progressive		
	173 (94%)	10 (6%)		
Currently in a relationship	Yes	No		
	148 (81%)	35 (19%)		
Physician visit in past year	Yes	No		
	151 (83%)	31 (17%)		
Smoking	Yes	No		
	14 (8%)	169 (92%)		
Type D personality	Type D +	Type D -		
	33 (18%)	150 (82%)		
CVD risk factor	Risk +	Risk -		
	22 (12%)	161 (88%)		
Daily alcohol use	None	1/day	>1/day	
	88 (48%)	39 (21%)	56 (31%)	
Follow-up (N = 108)				Range
Age	47.03 (10.067)			28–67
Education	16.06 (2.275)			11–20
Disease duration (years)	11.0139 (7.10032)			3–34
Gender	Female	Male		
	98 (91%)	10 (9%)		
Currently in a relationship	Yes	No		
	86 (80%)	22 (20%)		
Physician visit in past year	Yes	No		
	95 (88%)	13 (12%)		
Smoking	Yes	No		
	6 (6%)	102 (94%)		
Daily alcohol use	None	1/day	>1/day	
	47 (43.5%)	22 (20.4%)	39 (36.1%)	
CVD risk factor	Risk +	Risk -		
	14 (13%)	94 (87%)		
Type D personality	Type D +	Type D -		
	15 (13.9%)	93 (86.1%)		

Abbreviations: CVD, cardiovascular disease; Prog, progressive; RR, relapsing remitting.

**TABLE 2** Stepwise linear regression of disease symptomatology and duration predicting social integration

		B	Exp ( $\beta$ )	t	Sig.	R <sup>2</sup>
Step 1	Pain	-0.14	-0.38	-5.58	0.000	0.15
Step 2	Pain	-0.09	-0.23	-2.56	0.011	
	Fatigue	-0.05	-0.23	-2.47	0.015	0.18

### 3.2 | Cross sectional findings of social integration with health and PWB

When examining the predictors of perceived general health at individuals' baseline assessment, engagement in healthy eating and exercise was the greatest predictor followed by social integration, CVD risk factors, and age, accounting for 27% of the variance. Predictors of good physical health/functioning included social integration, having a relapsing-remitting course, absence of CVD risk factors, and diet and exercise, which accounted for 20% of the variance. When examining mental health/functioning, greater mental health was predicted by the absence of a Type D personality, greater social integration and social support, age, and diet and exercise, accounting for 39% of the variance. (See Table 3 for final model and Table S1 for complete stepwise regression).

As stated earlier, PWB was measured by the six domains of the Ryff PWB Scales: Personal relationships, autonomy, personal growth, purpose in life, environmental mastery and self-acceptance. As can be seen in Table 4, social integration, social support and/or engagement in social and intellectual activities played a role in all aspects of PWB. Least surprising was that having positive personal relationships was associated with all three aspects of socialisation, with greater social support being the greatest predictor followed by social integration, absence of Type D personality, engagement in social and intellectual activities, being single, less alcohol use, and surprisingly, smoking. Together, these variables accounted for more than half of the variance ( $R^2 = 0.59$ ). One's sense of autonomy was associated negatively with Type D personality and positively with social support and age ( $R^2 = 0.15$ ). Personal growth or feeling as if one is living to one's full potential was predicted by greater social integration and engagement in social and intellectually activities, absence of Type

D personality and higher education ( $R^2 = 0.20$ ). Absence of Type D personality, greater social integration, engagement in social and intellectual activities, older age, higher education and social support were also predictive of a general sense of purpose in life, accounting for nearly half the variance ( $R^2 = 0.43$ ). Environmental mastery was predicted by greater social support and social integration, absence of Type D personality, older age, higher education, and surprisingly, presence of CVD risk factors, accounting for over half the variance ( $R^2 = 0.53$ ). Finally, self-acceptance was associated with absence of Type D personality, greater social integration and social support, older age, and higher education ( $R^2 = 0.44$ ) (See Table 4 for final model and Table S2 for complete stepwise regression).

### 3.3 | Longitudinal findings of social integration with health and PWB

While cross-sectional data are useful in better understanding the role of social factors on health, utilising longitudinal data allows for some sense of the long-term consequences and causation when examining these constructs. We were able to follow 108 individuals over a time span of approximately two and a half years. There were no differences in age, gender, education, disease course or disease duration between the 108 seen for follow-up and the 76 lost to follow-up. In our subsample who completed a follow-up assessment, we found changes in physical health/functioning ( $t = -1.31$ ,  $p = 0.043$ ) and depression ( $t = -2.16$ ,  $p = 0.033$ ) over time, with decreases in the former and increases in the latter. There were no other significant changes in mental health, MS symptomatology and PWB. Nonetheless, we found that one's prior social integration, social support, and engagement in social and intellectual activities

TABLE 3 Final models of stepwise linear regressions predicting health at baseline

	B	Exp ( $\beta$ )	Confidence intervals		t	Sig.	$R^2$
			Lower	Upper			
SF-36 perceived general							
Diet/exercise	0.95	0.30	0.549	1.36	4.70	0.000	0.27
Social integration	2.53	0.27	1.31	3.74	4.10	0.000	
CVD risk+	-13.62	-0.23	-21.07	-6.16	-3.60	0.000	
Age	0.44	0.22	0.19	0.70	3.40	0.001	
SF-36 physical health functioning							
Social integration	1.35	0.33	0.79	1.91	4.78	0.000	0.20
CVD risk+	-4.84	-0.19	-8.22	-1.45	-2.82	0.005	
MS course	-6.53	-0.18	-11.37	-1.69	-2.66	0.009	
Diet/exercise	0.23	0.16	0.04	0.41	2.41	0.017	
SF-36 mental health functioning							
Type D +	-11.53	-0.39	-15.01	-8.06	-6.58	0.000	0.39
Social integration	1.07	0.19	0.35	1.79	2.84	0.005	
Social support	0.10	0.21	0.26	0.04	0.17	0.001	
Age	0.19	0.16	0.06	0.33	2.73	0.007	
Diet/exercise	0.23	0.12	0.01	0.45	2.04	0.043	

TABLE 4 Final model of stepwise linear regressions predicting psychological well-being at baseline

	B	Exp ( $\beta$ )	Confidence intervals		t	Sig.	R <sup>2</sup>
			Lower	Upper			
<b>Personal relationships</b>							
Social support	0.23	0.43	0.17	0.30	7.54	0.000	0.59
Social integration	1.75	0.28	1.08	2.43		0.000	
Type D +	-9.76	-0.30	-12.91	-6.60	-6.10	0.000	
Social/intellectual	0.78	0.20	0.40	1.17	4.00	0.000	
In a relationship	-4.49	-0.14	-7.82	-1.17	-2.67	0.008	
Alcohol use	-1.93	-0.13	-3.29	-0.57	-2.79	0.006	
Smoking	5.26	0.11	0.70	9.83	2.28	0.024	
<b>Autonomy</b>							
Type D +	-7.65	-0.29	-11.28	-4.01	-4.15	0.000	0.15
Social support	0.09	0.19	0.03	0.15	2.80	0.006	
Age	0.15	0.14	0.01	0.30	2.09	0.038	
<b>Personal growth</b>							
Social integration	1.28	0.26	0.59	1.98	3.62	0.000	0.20
Type D +	-4.88	-0.19	-8.38	-1.39	-2.76	0.006	
Social/intellectual	0.56	0.18	0.14	0.99	2.61	0.010	
Education	0.62	0.13	0.01	1.23	1.99	0.048	
<b>Purpose in life</b>							
Type D +	-9.74	-0.32	-13.21	-6.27	-5.54	0.000	0.43
Social integration	1.38	0.24	0.65	2.11	3.73	0.000	
Social/intellectual	0.64	0.18	0.22	1.06	2.98	0.003	
Education	0.98	0.18	0.37	1.58	3.2	0.002	
Age	0.20	0.17	0.07	0.34	2.92	0.004	
Social support	0.09	0.18	0.03	0.15	2.86	0.005	
<b>Environmental mastery</b>							
Social support	0.18	0.33	0.12	0.24	6.00	0.000	0.53
Type D +	-11.53	-0.35	-14.91	-8.14	-6.73	0.000	
Social integration	1.87	0.30	1.18	2.56	5.34	0.000	
Age	0.22	0.17	0.08	0.36	3.18	0.002	
Education	0.70	0.12	0.12	1.29	2.37	0.019	
CVD +	4.02	0.10	0.04	7.99	1.99	0.048	
<b>Self-acceptance</b>							
Type D +	-14.06	-0.38	-18.26	-9.85	-6.6	0.000	0.44
Social integration	1.80	0.25	0.94	2.66	4.13	0.000	
Social support	0.16	0.26	0.09	0.24	4.32	0.000	
Age	0.25	0.17	0.09	0.42	2.97	0.003	
Education	0.95	0.14	0.22	1.69	2.57	0.011	

at their baseline assessment continued to predict these health outcomes over time. More specifically, social integration was the greatest predictor of general health at follow-up followed by older age and absence of CVD risk factors ( $R^2 = 0.21$ ). Predictors of physical health/functioning over time included social integration and relapsing-remitting course ( $R^2 = 0.11$ ). Meanwhile, greater mental health was associated with greater social integration, followed by absence of Type D personality, lower alcohol use and greater social

support, accounting for 35% of the variance (See Table 5 for final model and Table S3 for complete stepwise regression).

Consistent with findings at baseline, all social factors (integration, engagement in social & intellectual activities, and social support) were predictive of positive personal relationships at follow-up, along with the absence of Type D personality ( $R^2 = 0.38$ ). Autonomy was the only outcome variable that was not associated with social factors. Absence of Type D personality, presence of CVD risk factors



and female gender were most predictive, but accounted for a small amount of the variance ( $R^2 = 0.09$ ). Personal growth at follow-up was predicted nearly comparably by engagement in social and intellectual activities and higher education ( $R^2 = 0.16$ ). Engagement in social and intellectual activities, social integration, absence of Type D personality, presence of CVD risk factors, and higher education accounted for 33% of the variance in predicting purpose in life at follow-up. Environmental mastery was predicted by social integration, absence of Type D personality, higher education, greater social support, CVD risk factors, and engagement in social and intellectual activities ( $R^2 = 0.39$ ). Finally, the absence of Type D personality, greater social integration, higher education, greater social support and CVD risk factors predicted self-acceptance, accounting for 37% of the variance (See Table 6 for final model and Table S4 for complete stepwise regression).

## 4 | DISCUSSION

The aim of this investigation was to examine the role of MS symptomatology on social integration and the subsequent role that social integration and support have on general health and PWB among individuals with MS. Consistent with previous contentions, fatigue and pain contributed to reductions in social integration (Kratz et al., 2017; Rincon et al., 2019). Results also suggested that despite the possible reduction in social integration due to MS symptomatology and other factors related to one's MS, increased engagement in healthy socialisation is in fact related to better perceived general health, physical functioning and mental health in MS. These findings are consistent with the existing literature when examining the role of socialisation over time. For instance, women who were more socially engaged were found to have significantly greater self-rated health, physical functioning and less anxiety and depression than those less engaged (Fothergill et al., 2011). This is particularly important given the high percentage of women with MS. The same has been found among the

elderly, who similar to individuals with MS, are also known to be vulnerable to loneliness and social isolation. More specifically, social ties and community interaction predicted greater self-rated health and life satisfaction and less depression over time (Fuller & Fiori, 2017). These findings may implore MS practitioners to pay greater attention to individuals' social engagement and prioritise such in their assessments and treatment plans. As stated earlier, social prescribing has been done in the UK and there is much greater awareness in the US with regard to the role that social connectedness has on health and that it should be considered a public health priority. It is quite evident in the present study that social integration and support are important factors for maintaining health among individuals with MS.

Results also suggest that social integration and support plays a positive role in all domains of PWB, including positive personal relationships, sense of autonomy, individuals' personal growth, one's purpose in life, environmental mastery (or self-efficacy), and overall self-acceptance among individuals with MS. These relationships were observed in both cross-sectional and longitudinal analyses. Together, these findings support the contention that social integration and support are significant factors in the lives of those with MS and holds promise in promoting individuals' health, emotional functioning and PBW.

The finding that social support and integration was predictive of health is not entirely surprising given the known association between social connectedness and overall health. Again, it has previously been proposed that social connectedness and integration are crucial to promoting and maintaining good health. What is perhaps more novel to the present study is the examination of social integration and support on PWB. While there is a burgeoning area of research examining psychological well-being in MS, the majority of studies to date have focused on health and subjective well-being (e.g., depression). Placing a greater emphasis on PWB and what it means to flourish despite one's illness are important aspects of 'living a good life'. In the present study, we found that social integration played as great if not larger role on PWB than it had on health.

	B	Exp ( $\beta$ )	Confidence intervals		t	Sig.	$R^2$
			Lower	Upper			
SF-36 perceived general health							
Social integration	4.63	0.40	2.67	6.60	4.67	0.000	0.21
Age	0.45	0.22	0.10	0.80	2.55	0.012	
CVD risk +	-12.96	-0.22	-23.41	-2.50	-2.46	0.016	
SF-36 physical health functioning							
Social integration	1.35	0.26	0.40	2.29	2.83	0.006	0.11
MS course	-8.82	-0.22	-16.05	-1.60	-2.42	0.017	
SF-36 mental health functioning							
Social integration	2.50	0.41	1.52	3.49	5.03	0.000	0.35
Type D +	-10.35	-0.33	-15.18	-5.51	-4.24	0.000	
Alcohol use	-2.25	-0.19	-4.14	-0.36	-2.36	0.020	
Social support	0.09	0.18	0.01	0.17	2.16	0.033	

TABLE 5 Final model of stepwise linear regressions predicting health over time

**TABLE 6** Final model of stepwise linear regressions predicting psychological well-being over time

	B	Exp ( $\beta$ )	Confidence intervals		t	Sig.	R <sup>2</sup>
			Lower	Upper			
<b>Personal relationships</b>							
Social integration	2.00	0.315	0.99	3.02	3.93	0.000	0.38
Social/intellectual	1.1	0.302	0.53	1.67	3.84	0.000	
Type D +	-8.64	-0.268	-13.54	-3.75	-3.50	0.001	
Social support	0.10	0.188	0.02	0.18	2.39	0.019	
<b>Autonomy</b>							
Type D	-7.09	-0.22	-12.97	-1.20	-2.39	0.019	0.09
CVD risk +	8.36	0.25	2.13	14.58	2.66	0.009	
Gender	7.16	0.20	0.26	14.06	2.06	0.042	
<b>Personal growth</b>							
Social/intellectual	1.04	0.30	0.44	1.64	3.42	0.001	0.16
Education	1.3	0.28	0.48	2.11	3.15	0.002	
<b>Purpose in life</b>							
Social/Intellectual	1.08	0.28	0.46	1.70	3.44	0.001	0.33
Social integration	1.68	0.25	0.60	2.76	3.08	0.003	
Type D +	-9.01	-0.27	-14.37	-3.66	-3.34	0.001	
CVD risk +	8.84	0.26	3.30	14.39	3.16	0.002	
Education	0.91	0.18	0.10	1.73	2.23	0.028	
<b>Environmental mastery</b>							
Social integration	1.87	0.26	0.73	3.00	3.27	0.001	0.39
Type D +	-12.41	-0.35	-17.86	-6.95	-4.51	0.000	
Education	1.28	0.23	0.45	2.11	3.05	0.003	
Social support	0.10	0.19	0.02	0.20	2.38	0.019	
CVD risk +	7.33	0.20	1.69	12.98	2.58	0.011	
Social/intellectual	0.74	0.18	0.11	1.38	2.32	0.023	
<b>Self-acceptance</b>							
Type D +	-14.95	-0.38	-21.05	-8.86	-4.86	0.000	0.37
Social integration	2.11	0.27	0.86	3.35	3.35	0.001	
Education	1.51	0.25	0.58	2.45	2.31	0.002	
Social support	0.14	0.21	0.04	0.24	2.66	0.009	
CVD risk +	8.31	0.20	2.01	14.61	2.62	0.010	

Another unique approach to this study was the inclusion of personality as a predictor of health and well-being when studying social determinants of health. We have previously shown personality, specifically a Type D personality, is predictive of health and PWB. Despite the significant contribution of personality, social factors still reigned as significant predictors of health and well-being. What is also striking is the differential impact that personality had on the mental health aspects of health and PWB than compared with physical health, which as would be expected was more predicted by diet and exercise and CVD risk factors. These findings suggest that social factors play a role across all domains but perhaps a specificity for personality on mental health and lifestyle factors and CVD risk factors on physical health.

Taken together, our findings help to clarify how social integration, lifestyle factors and personality influence varying aspects of functioning in MS and suggest that a holistic approach that takes

into account these wellness domains is most ideal. Further, affirming the importance of social support and integration should be considered important components of MS management, and further interventional studies aimed at discovering its impact are needed.

While the present findings are illuminating, they are tempered by a few limitations of the study. For one, the cross-sectional, correlational study design, which renders it difficult to identify causative factors. However, we did have a subsample in which we could examine the factors over time, and the findings suggest that there are some causative effects over a brief period of time (2.5 years). Investigations examining social determinants of health typically employ longer time periods and even aim to predict mortality. Future studies examining social determinants of health in MS should include longer longitudinal designs. Another limitation is that the sample was comprised of relatively young

and otherwise healthy individuals living with MS. Inclusion of older individuals and/or those with a progressive course and possible greater medical comorbidity would be ideal. Related to this, 81% at baseline and 91% of the sample at follow-up were married or partnered. It is conceivable that single individuals are likely to report greater levels of loneliness and poor social support or integration. Further studies examining social determinants of health and well-being in MS should attempt to include more individuals who are not partnered up. Related to this, given that this was a study examining work factors in MS, individuals needed to be employed to be enrolled in the study. Work is a significant outlet for socialisation and may have inflated the sample in some way. Nonetheless, we still found notable differences and associations with social integration and support with health and well-being in the sample. Finally, the study was entirely survey based and there were no objective markers of health employed in the study. Future studies should aim to include greater, objective biomarkers of health.

Despite these limitations, the present study highlights the importance of having adequate social support and being socially integrated. Assessment of one's social network and integration appears relevant to clinical care for those with MS and interventions aimed at improving social integration, warranted to assist in promoting and maintaining health and well-being for those living with MS, particularly as they age and socialisation tends to decline.

## CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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## SUPPORTING INFORMATION

Additional supporting information may be found in the online version of the article at the publisher's website.

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