

# Resilience Among Caregivers of People With Multiple Sclerosis: Exploring the Influence of Personality Traits, Coping, and Caregiver Burden

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### LEARNING OBJECTIVE:

1. Evaluate how personality traits and caregiver characteristics influence quality of life and burden levels to identify MS caregivers needing additional support.
2. Develop targeted support strategies that consider individual caregiver traits to enhance resilience and reduce caregiver burden.

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## ABSTRACT

**BACKGROUND:** Resilience has been recognized as a vital protective factor in coping with stress and adversity. Multiple sclerosis (MS) caregiving is a complex and demanding role, often characterized by challenges.

**METHODS:** Caregivers of people with MS were recruited through health care professionals affiliated with the Jacobs MS Center for Treatment and Research in Buffalo, New York. Resilience was assessed by the Connor-Davidson Resilience Scale (CD-RISC-25) and the Health-Resilience-Stress Questionnaire (HRSQ). We examined the influence of personality traits (NEO Five-Factor Inventory-3), coping strategies (Brief Coping Orientation to Problems Experienced Inventory), quality of life (Adult Carer Quality of Life Questionnaire), and caregiver burden (Zarit Burden Interview) on resilience.

**RESULTS:** In our study of 98 caregivers (70.4% men; average age, 60 years), 91.8% were partners of people with MS. Out of a maximum score of 100, CD-RISC-25 scores were an average (SD) of 75.5 (14.4) and HRSQ scores were an average of 74.8 (12.9). Quality of life was positively associated with both resilience measures ( $r = 0.60$  for CD-RISC-25;  $r = 0.70$  for HRSQ), whereas higher resilience was linked to lower caregiver burden ( $r = -0.40$  for CD-RISC-25;  $r = -0.49$  for HRSQ). CD-RISC-25 showed higher resilience negatively correlated with neuroticism ( $r = -0.65$ ) and positively with extroversion ( $r = 0.57$ ) and conscientiousness ( $r = 0.59$ ). HRSQ also showed strong negative correlation with neuroticism ( $r = -0.76$ ) and positive correlations with extroversion ( $r = 0.60$ ), conscientiousness ( $r = 0.53$ ), and agreeableness ( $r = 0.24$ ).

**CONCLUSIONS:** Caregivers for people with MS showed relatively high resilience levels, positively correlating with quality of life and reduced caregiver burden. Furthermore, resilience correlated inversely with neuroticism and positively with extroversion and conscientiousness. Future research should target personalized interventions, particularly for caregivers with low resilience.

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**M**ultiple sclerosis (MS) is a chronic demyelinating, inflammatory, and neurodegenerative disorder with a variable disease course, currently affecting more than 2.8 million individuals globally.<sup>1</sup> Despite an early disease onset, people with MS often have a long life expectancy.<sup>1,2</sup> Given its unpredictable course and prolonged disease duration, care is often required over a period of decades. The majority of this care is provided by informal caregivers.<sup>3</sup> In contrast to formal caregivers, those who provide informal care are not financially compensated and are often family members or friends. For the purposes of this paper, we will use the term *caregivers* to refer to informal caregivers.

The responsibilities of informal MS caregivers are diverse, ranging from practical tasks such as transportation and household upkeep to deeply personal care such as assisting with bathing and toileting in addition to providing essential emotional and social support.<sup>4</sup> Managing these responsibilities while navigating the uncertain nature of the disease can create a stressful environment for caregivers.<sup>5</sup> Findings from a recent study by McKenna et al<sup>6</sup> showed that caregivers of people with MS experience various challenges, including feeling overwhelmed by loss, a lack of support from the community and health care systems, and difficulty taking care of themselves due to other responsibilities. These challenges can significantly affect their mental and emotional well-being, heightening the risk of mental health conditions such as depression and anxiety.<sup>7</sup>

One area of interest to combat these challenges is resilience. The term *resilience*, from the Latin *resilire*, meaning "to recoil or spring back,"<sup>8</sup> is commonly defined as the multidimensional capacity to adapt, cope, and thrive in the face of adversity.<sup>8</sup> It has emerged as a central concept related to illness, health, and caregiving.<sup>9</sup> Findings from numerous studies have shown that resilience is associated with a range of positive outcomes, including better physical and mental health, improved quality of life, and increased caregiver satisfaction.<sup>10</sup> With a better understanding of the concept, it has become evident that resilience is not a static characteristic but a set of skills, behaviors, and strategies that can be developed and enhanced over time, with opportunities for improvement through training and active interventions.<sup>11</sup> Results from many studies have shown positive effects of interventions on enhancing resilience, but some found little to no difference.<sup>12,13</sup> One possible explanation for this discrepancy is that individuals who already possess high levels of resilience may find it relatively more challenging to increase it further through an intervention.<sup>14</sup> These findings emphasize the importance of personalized interventions tailored to individual caregiver needs, considering their existing resilience levels and other relevant factors, to optimize the effectiveness of support strategies.

Building upon the substantial body of research in caregiving for people with MS, as documented in comprehensive review studies,<sup>5,15-17</sup> this study delves into a spectrum of influential factors. These factors include personality traits, coping strategies, and caregiver burden that may significantly shape and bolster caregiver resilience. By conducting this study, we aimed to provide a detailed perspective on the challenges and strengths of MS caregivers. Additionally, research on caregiver resilience can help to identify individuals who may be at increased risk of negative health outcomes due to their caregiving role. By identifying these individuals, health care providers can offer targeted support and interventions to help mitigate the negative impacts of caregiving on patients and caregivers alike.

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## METHODS

### Study Participants

Inclusion criteria for participation in the study were as follows: Participants needed to be 18 years or older, provide at least 10 hours of weekly care to people with MS, understand and respond in written English, and have an email address and access to an electronic device (eg, computer, tablet, or phone) for survey completion. Exclusion criteria included receiving nonfederal monetary compensation for caregiving services.

Caregivers were recruited through health care professionals affiliated with Jacobs MS Center for Treatment and Research in Buffalo, New York, during clinical appointments where they accompanied their partner, family member, or acquaintance with MS. Potential participants were identified by inquiring whether they provided any type of care for the patient with MS, which was then confirmed by the patient. For each patient, only their self-identified primary caregiver was included in the study to avoid potential duplication. An email address was collected upon confirmation of their caregiving role. These email addresses were then recorded in the REDCap system that hosted the survey. REDCap is a secure, web-based software platform designed to support data capture for research studies.<sup>18,19</sup> Participants were subsequently contacted via email and received an initial invitation, followed by 3 reminders sent at 4-day intervals. They were encouraged to complete the entire survey in 1 session, although they had the option to save their progress and resume at their convenience. A total of 231 caregivers were approached for potential inclusion in the study. Of these, 105 participants completed the informed consent process, 98 initiated the online questionnaire, and 95 completed it. Data collection and participant recruitment for the study took place from August 2020 through March 2023, which coincided with the COVID-19 pandemic. The study was approved by the institutional review board of the University at Buffalo, and informed consent was obtained from all participants. Participants received \$25 upon study completion.

### Questionnaires

Resiliency was measured using the Connor-Davidson Resilience Scale (CD-RISC-25) and the Health-Resilience-Stress Questionnaire (HRSQ). The CD-RISC-25<sup>20</sup> employs a 5-point scale, where participants indicate the extent to which they agree with 25 statements, ranging from 0 (not true at all) to 4 (true nearly all the time). Cumulative scores are computed, with 100 representing the highest level of resilience.

Sections A and B of the HRSQ<sup>21</sup> were used as an additional measure of resilience. The HRSQ evaluates how well someone can handle and recover from stress and explores their resilience in the context of challenges arising from adversities and stress-related disturbances. Caregivers were tasked with evaluating 20 statements on a scale from 1 to 5. Cumulative scores were tallied, with 100 signifying the highest level of resilience.

This study used sections C through E as well as portions of sections F and G from the Institute for Medical Technology Assessment Valuation of Informal Care Questionnaire (iVICQ)<sup>22</sup> to evaluate caregiver demographics and to measure the objective

**TABLE 1.** Participant Demographics and Caregiver Characteristics

Demographic	n (%) or mean (SD)
Gender, caregiver	
Female	29 (29.6%)
Male	69 (70.4%)
Gender, person with MS	
Female	75 (77.3%)
Male	22 (22.7%)
Age in years, caregiver	60.0 (12.2)
Age in years, person with MS	59.2 (12.3)
Education	
<High school diploma	3 (3.1%)
High school diploma/GED	16 (16.5%)
College degree of 1-3 years	25 (25.8%)
College/university degree	26 (26.8%)
Postgraduate degree	27 (27.8%)
Caregiver relationship to person with MS	
They are my partner	89 (91.8%)
They are my parent	4 (4.1%)
They are my child	2 (2.1%)
They are another family member	2 (2.1%)
Have children	82 (84.5%)
Have paid work	
No	45 (46.4%)
Yes (36 hours or more per week)	44 (45.4%)
Yes (part-time)	8 (8.2%)
Years of care provided	16.1 (10.8)
Additional (professional) caregiver present	5 (5.4%)

GED, General Educational Development; MS, multiple sclerosis.

and subjective burdens associated with caregiving as well as the health and well-being effects of caregiving. Quality of life was assessed using the Adult Carer Quality of Life Questionnaire (AC-QOL)<sup>23</sup> through 8 separate domains—support for caring, caring choice, caring stress, money matters, personal growth, sense of value, ability to care, and caring satisfaction—in addition to using a total sum score.

The NEO Five-Factor Inventory-3 (NEO-FFI-3)<sup>24</sup> assesses personality traits based on the 5-factor model and measures 5 primary dimensions of personality: neuroticism, extroversion, openness to experience, agreeableness, and conscientiousness. To allow a standardized comparison, standardized *t* scores (with a mean of 50 and an SD of 10) were computed from the NEO-FFI-3 questionnaire raw scores; the *t* scores were based on published population norms for each sex.<sup>24</sup> Based on previous literature,<sup>25</sup> scores between 45 and 54 were considered average, scores of 44 or below were categorized as low, and scores of 55 or above were considered high.

**TABLE 2.** Correlations Between Resilience Measures and Demographics, Quality of Life, and Personality Traits in Caregivers of People With Multiple Sclerosis

	CD-RISC-25		HRSQ	
	<i>r</i>	<i>P</i>	<i>r</i>	<i>P</i>
<b>iVICQ</b>				
Age, caregiver	0.10	.347	0.03	.795
Age, person with MS	0.12	.263	0.08	.467
Number of years as caregiver	0.01	.946	−0.04	.731
Health rating, caregiver	0.32	.002	0.40	< .001
Health rating, person with MS	0.33	.001	0.38	< .001
Happiness rating, caregiver	0.51	< .001	0.56	< .001
Caregiving situation rating	0.39	< .001	0.50	< .001
Takeover happiness rating	−0.19	.083	−0.24	.023
<b>AC-QOL</b>				
Total score	0.60	< .001	0.70	< .001
Support for caring score	0.53	< .001	0.59	< .001
Caring choice score	0.39	< .001	0.49	< .001
Caring stress score	0.40	< .001	0.55	< .001
Money matters score	0.40	< .001	0.51	< .001
Personal growth score	0.38	< .001	0.39	< .001
Sense of value score	0.30	.004	0.35	.001
Ability to care score	0.55	< .001	0.53	< .001
Caregiver satisfaction score	0.48	< .001	0.57	< .001
<b>NEO-FFI</b>				
Neuroticism	−0.65	< .001	−0.76	< .001
Extroversion	0.57	< .001	0.60	< .001
Openness	0.00	.990	0.03	.762
Agreeableness	0.12	.249	0.24	.022
Conscientiousness	0.59	< .001	0.53	< .001

AC-QOL, Adult Carer Quality of Life Questionnaire; CD-RISC-25, Connor-Davidson Resiliency Scale; HRSQ, Health-Resilience-Stress Questionnaire; iVICQ, Institute for Medical Technology Assessment Valuation of Informal Care Questionnaire; MS, multiple sclerosis; NEO-FFI, NEO Five-Factor Inventory-3.

Note: The correlation coefficients presented in the table are calculated using Pearson *r*.

Caregiver perceived burden and coping were assessed using the Zarit Burden Interview (ZBI).<sup>26</sup> This 22-item questionnaire assesses the perceived burden experienced by caregivers in relation to their caregiving responsibilities. Lastly, the Brief Coping Orientation to Problems Experienced Inventory (Brief-COPE) questionnaire<sup>27</sup> was used to assess coping strategies across 3 distinct categories: problem-focused coping, emotion-focused coping, and avoidant coping.

### Statistical Analyses

Caregiver characteristics were summarized using descriptive statistics with means and SDs calculated. Correlations were carried out using Pearson *r*. Independent sample *t* tests and 1-way analysis of variance tests were used to examine the associations between personality traits and resilience. A 2-sided *P* of less than .05 was considered statistically significant. All

statistical analyses were performed using IBM's SPSS Statistics 28. Matplotlib version 3.7.1 was used for data visualization.

## RESULTS

### Caregiver Characteristics

Of the 98 caregivers, 29 (29.6%) identified as women and 69 (70.4%) identified as men. Their average (SD) age was 60 years (12.2), similar to the average age of the patient with MS for whom the caregiver provided care, which was 59.2 years (12.3). The majority of caregivers (*n* = 89; 91.8%) indicated that they were a partner of the person with MS. The mean duration of caregiving was 16.1 years (10.8). A significant portion of caregivers (80.4%) held a college degree or higher level of education; 52 caregivers (53.6%) reported current employment in paid positions. Many caregivers fell into higher-income brackets, with 28.3% reporting an annual



household income of \$100,000 or greater, representing the highest proportion within the income ranges. See [TABLE 1](#).

### Caregiver Resilience and Well-Being

The assessment of resilience using the CD-RISC-25 showed a mean (SD) score of 75.5 (14.4) among the caregivers in our study; the mean score on the HRSQ was 74.8 (12.9). There was a significant correlation between the 2 resiliency questionnaires ( $r = 0.78$ ;  $P < .001$ ). The resiliency scores of the CD-RISC-25 and the HRSQ were not significantly associated with age or sex ( $r = 0.10$ ,  $P = .347$ ; and  $r = 0.03$ ,  $P = .795$ , respectively).

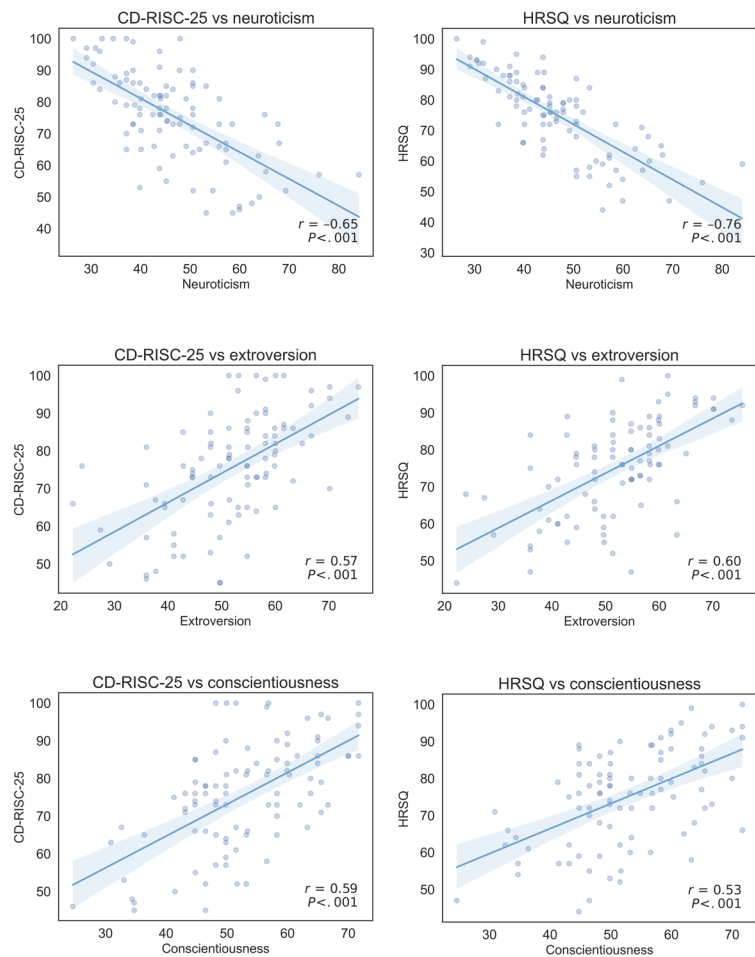
Caregivers reported a mean (SD) happiness level of 75.7 (20.3) out of 100 and rated their caregiver situation at a mean happiness level of 82.3 (19.3) out of 100. However, the prospect of someone else taking over all caregiver tasks was met with lower average happiness, with a mean score of 35.8 (33.0) out of 100 (see [FIGURE S1](#) for box plots with medians). Caregivers rated their own health with an average score of 79.9 (14.8) out of 100 and gave the health of the person with MS a mean score of 58.5 (19.9).

[TABLE S1](#) shows how caregivers responded to questions regarding their well-being and the challenges they face. A substantial proportion of caregivers expressed high levels of fulfillment from their care tasks ( $n = 47$ ; 50.0%), with the majority ( $n = 71$ ; 75.5%) reporting no relational problems with the care receiver. Significant financial problems due to care tasks were reported by only a few caregivers ( $n = 2$ ; 2.1%), whereas 17 (17.9%) reported some financial problems. Approximately half of the caregivers reported facing some challenges in their own mental ( $n = 47$ ; 49.5%) or physical health ( $n = 46$ ; 49.6%). Moreover, a considerable number of caregivers ( $n = 41$ ; 44.1%) reported receiving no support from others in carrying out their MS care tasks.

### Quality of Life and Caregiver Resiliency

The AC-QOL Questionnaire, measuring quality of life, had strong correlations with both the CD-RISC-25 ( $r = 0.60$ ;  $P < .001$ ) as well as the HRSQ ( $r = 0.70$ ;  $P < .001$ ), indicating that higher levels of resilience were associated with better quality of life for caregivers. Similarly, strong positive correlations were observed between resilience scores and specific domains of caregiver quality of life. The AC-QOL subdomains had somewhat stronger correlations with the HRSQ compared with the CD-RISC-25,

**FIGURE 1.** Relationship Between NEO-FFI Personality Traits and Resilience Measures



CD-RISC-25, Connor-Davidson Resiliency Scale; HRSQ, Health-Resilience-Stress Questionnaire.  
Note: Trend line shows the best fitting linear regression line.

especially in the caring stress score subdomain ( $r = 0.40$  for CD-RISC-25 vs  $r = 0.55$  for HRSQ). See [TABLE 2](#).

Furthermore, caregiver resiliency demonstrated a positive correlation with the overall happiness score measured by the happiness slider of the iVICQ ( $r = 0.51$ ,  $P < .001$  for CD-RISC-25;  $r = 0.56$ ,  $P < .001$  for the HRSQ). This suggests that higher levels of resiliency are associated with increased overall happiness among caregivers.

### Burden of Care and Caregiver Resiliency

To assess the association between caregiver resilience and caregiver's perceived care burden, the CD-RISC-25 and the HRSQ were correlated to the ZBI. The mean sum (SD) of the ZBI was 19.9 (14.4). A score of 21 has been used as a cutoff to differentiate between low and high burden.<sup>28,29</sup> Within this caregiver sample, 53 individuals (56.4%) scored below the cutoff, indicating low burden, whereas 41 individuals (43.6%) scored above the cutoff, indicating high burden. Significant



## PRACTICE POINTS

Understanding the resilience levels among caregivers of people with multiple sclerosis (MS) provides clinicians with valuable insights into the factors influencing caregiver well-being and the quality of care provided to people with MS.

Clinicians should be attentive to the impact of personality traits, such as the negative influence of neuroticism, on caregiver resilience. This awareness can inform personalized interventions to enhance caregiver support and well-being.

Clinicians should tailor resilience support strategies to account for variations in caregiver demographics, including gender, spousal status, and income level. ■

differences in resilience levels were observed between the low burden group (CD-RISC-25:  $69.8 \pm 14.1$ ; HRSQ:  $68.4 \pm 12.7$ ) and the high burden group (CD-RISC-25:  $79.9 \pm 13.0$ ; HRSQ:  $80.2 \pm 10.6$ ; all  $P < .001$ ). Furthermore, a negative correlation was found between the total burden score and the resiliency measures ( $r = -0.40$ ,  $P < .001$  for CD-RISC-25;  $r = -0.49$ ,  $P < .001$  for HRSQ). This suggests that higher levels of caregiver resilience are associated with lower perceived burden of care.

### Coping and Caregiver Resiliency

The Brief-COPE categorized caregivers' coping into 3 areas, with scores ranging from 1 to 4. In problem-focused coping, which reflects a practical, problem-solving approach, caregivers scored an average (SD) of 2 (0.7). For emotion-focused coping, which entails coping strategies aimed at regulating emotions, caregivers scored 1.8 (0.5). The lowest scores were found in avoidant coping, with a mean of 1.4 (0.4), which is characterized by denial, behavioral disengagement, substance use, and self-distraction.

Both the CD-RISC-25 and the HRSQ showed no significant correlations with problem-focused coping ( $r = 0.07$ ,  $P = .486$ ; and  $r = -0.09$ ,  $P = .409$ , respectively). Similarly, the CD-RISC-25 had no significant correlation with emotion-focused coping ( $r = -0.06$ ;  $P = .602$ ). However, the HRSQ did display a modest negative correlation with emotion-focused coping ( $r = -0.29$ ;  $P = .006$ ), indicating that higher resilience scores are associated with lower emotion-focused coping scores. Stronger negative correlations were observed between both the CD-RISC-25 and the HRSQ with the avoidant-coping measure ( $r = -0.36$ ,  $P < .001$ ; and  $r = -0.37$ ,  $P < .001$ , respectively).

### Personality Theme and Caregiver Resiliency

There were no significant differences between male and female caregivers in mean  $t$  scores for any of the 5 personality traits. Many caregivers ( $n = 46$ ; 48.9%) scored below average on neuroticism, with only 21 (22.3%) scoring high. A large majority of caregivers demonstrated average or high levels of extroversion ( $n = 73$ ; 77.7%). Similarly, the trait of openness was found to be at an average or above average level in 62 caregivers (66.0%). High levels of agreeableness were seen in 35 caregivers (37.2%), similar to the proportion of caregivers scoring high on conscientiousness ( $n = 39$ ; 41.5%).

Caregivers scoring low on neuroticism had a significantly higher mean (SD) CD-RISC-25 score of 82.6 (11.5) and a mean HRSQ score of 82.8 (9.6), whereas those in the high neuroticism group had a mean CD-RISC-25 score of 60.8 (10.8) and a mean HRSQ score of 58.7 (7.6; all  $P < .001$ ). Conversely, those with high extroversion scores exhibited the highest level of resilience, measuring 82.4 (10.9) on the CD-RISC-25 and 80.9 (10.6) on the HRSQ, whereas those with low extroversion scores displayed a mean resilience level of 62.7 (11.6) on the CD-RISC-25 and 64.8 (12.2) on the HRSQ (all  $P < .001$ ). There were no significant differences in mean level of resilience when looking at the traits of openness or agreeableness (overall group differences:  $P = .268$  and  $P = .505$ , respectively, for the CD-RISC-25;  $P = .145$  and  $P = .168$ , respectively, for the HRSQ). Similar to extroversion, there were significant group differences in low and high conscientiousness scores (low score of  $59.8 \pm 11.9$  vs high score of  $83.5 \pm 10.3$  for the CD-RISC-25; low score of  $62.5 \pm 8.8$  vs high score of  $82.0 \pm 10.7$  for the HRSQ; all  $P < .001$ ).

Table 2 provides an overview of the correlation between the 5 personality traits and caregiver resilience as measured by the CD-RISC-25 and the HRSQ. For the CD-RISC-25, higher levels of resilience were negatively correlated with neuroticism ( $r = -0.65$ ;  $P < .001$ ) and positively correlated with extroversion ( $r = 0.57$ ;  $P < .001$ ) and conscientiousness ( $r = 0.59$ ;  $P < .001$ ). However, no significant correlations were found between resilience and openness or agreeableness. Similarly, the HRSQ showed a strong negative correlation with neuroticism ( $r = -0.76$ ;  $P < .001$ ), positive correlations with extroversion ( $r = 0.60$ ;  $P < .001$ ) and conscientiousness ( $r = 0.53$ ;  $P < .001$ ), and a weaker but still significant positive correlation with agreeableness ( $r = 0.24$ ;  $P = .022$ ). The significant correlations between the 2 resiliency measures and personality themes are depicted in **FIGURE 1**.

### DISCUSSION

The aim of this study was to investigate the resilience of caregivers of people with MS and to identify factors contributing to an elevated level of resilience. The assessment of resilience, quantified by the CD-RISC-25 and HRSQ, showed an average (SD) resilience score of 75.5 (14.4) and 74.8 (12.9) among the caregivers, respectively. The strong positive correlation between these measures ( $r = 0.78$ ;  $P < .001$ ) underscores the consistency in evaluating caregiver resilience. The relatively high levels of resilience among caregivers in this study are on par with general population samples measured in the United States (CD-RISC-25 range, 75.7-82.7).<sup>10</sup>

We found a strong correlation between caregiver resilience and quality of life, as measured by the AC-QOL. Caregivers with higher resiliency scores exhibited higher quality of life, a finding in line with that of prior studies.<sup>30-32</sup> The fact that resilience and quality of life were well correlated was expected. Resilience plays an important role in how caregivers navigate stressors and setbacks. As a result, they may experience less stress and have a more positive outlook compared with their counterparts with lower resilience, leading to an improved overall quality of life. Evidence suggests an association between resiliency and social support, showing that resilient individuals often have strong social support networks.<sup>33</sup> The AC-QOL subdomain of support for caring was also strongly correlated with both resiliency questionnaires. These meaningful social connections may contribute to overall feelings of happiness and satisfaction for caregivers. Interestingly, a substantial subset of caregivers in our study reported a lack of external support in their caregiving responsibilities. This finding brings to light the potential vulnerability of caregivers who might perform their caregiver duties with limited assistance.

The caregivers in this study exhibited a positive evaluation of their overall caregiver situation with high ratings, suggesting a relatively satisfactory experience in their caregiving role. Moreover, their expressed reluctance to the idea of someone else taking over all caregiver tasks indicates a deep commitment and emotional attachment to their caregiving responsibilities. This finding aligns with previous research, which has also noted that caregivers frequently experience a range of positive outcomes from their role, including personal growth, strengthened relationships with loved ones, increased empathy, and a greater appreciation of life.<sup>6,34</sup> The strong sense of personal investment and attachment reported by caregivers aligns well with the demographic data revealing that more than 90% of the respondents were caring for their partners. This underscores the complex and nuanced nature of caregiving, which encompasses not only the practical tasks but also the emotional and relational dimensions that shape caregivers' perceptions and attitudes toward their role.

We found an inverse correlation between the total burden score and both resiliency measures, suggesting a potential link, although further research is needed to explore this association and examine whether other factors are at play. Caregivers with higher resilience scores tended to report a lower burden associated with their caregiving responsibilities. Results from a study by Ong et al<sup>35</sup> on caregivers of older adults in Singapore found a similar negative correlation between caregiver burden and resiliency. They concluded that perceived social support acts as a full mediator between resilience and caregiver burden, indicating that caregivers with higher levels of resilience are likely to perceive stronger social support, in turn reducing their burden. The positive influence of social support on resilience underscores the importance of fostering support systems for caregivers, as it can significantly affect their perceived burden of care and resilience.

Results of coping strategies as measured by the Brief-COPE show a significant negative correlation between resiliency

and an avoidant coping style. Avoidant coping (such as distraction, disengagement, or substance use) is associated with poor physical and mental health outcomes.<sup>36,37</sup> Contrary to findings from a study by Séoud et al,<sup>38</sup> we found no association between problem-focused coping and either of the resiliency measures and only a modest negative correlation between emotional coping and resilience as measured by the HRSQ. This indicates that caregivers with higher resilience levels may be less likely to rely on emotion-focused coping strategies. Results from the study by Séoud et al found significant association between resilience and both problem-focused coping strategies as well as emotion-focused coping strategies in a group of caregivers of aging relatives. Of note is that the caregivers in our study were predominantly men, contrary to the sample of all female caregivers in the study by Séoud et al. Given that gender differences are well documented in preferred coping styles,<sup>39,40</sup> this gender distinction might reflect divergent approaches to coping, with male caregivers in our study demonstrating lower reliance on emotion-focused coping as their resilience increased.

Personality traits have been recognized as major factors influencing happiness and psychological well-being.<sup>41</sup> Personality traits are relatively stable and tend to remain consistent throughout one's life.<sup>42</sup> Caregivers scoring high on neuroticism, which is characterized by tendencies toward anxiety, worry, and negative emotionality, displayed lower levels of resilience. Individuals with high levels of neuroticism have a predisposition to feeling overwhelmed by stress.<sup>43</sup> This suggests that caregivers with a higher disposition toward negative emotions might not be as well equipped to manage the demands of caregiving. This is in line with findings from previous studies, which have reported strong negative correlations between resilience and neuroticism.<sup>44,45</sup> In contrast, extroversion is often linked with increased mental well-being, happiness, and quality of life.<sup>41,46</sup> As expected, caregivers scoring high on extroversion in our study showed high levels of resilience. This finding highlights the potential association between extroversion and coping with the stressors and challenges that caregivers might face.

Conscientiousness is characterized by self-discipline, goal-oriented behavior, and the tendency to follow socially prescribed norms for impulse control. Research has consistently linked conscientiousness with numerous positive outcomes, including higher quality of life, better physical and mental health, and longer life expectancy.<sup>47</sup> Results from our study found a nearly 40% increase in resilience scores as assessed by CD-RISC-25 when comparing caregivers in the lowest conscientiousness tertile with those in the highest. It is thought that conscientious individuals tend to engage in healthier behaviors, make more informed life choices, and experience reduced stress through increased coping abilities, ultimately leading to higher levels of resilience and overall well-being.<sup>45,47,48</sup> Modest or nonsignificant differences were found between caregiver resilience and the personality domains of agreeableness and openness, which is in line with findings from other studies.<sup>45</sup> Overall, these findings indicate

that factoring in personality traits may be beneficial when examining resilience in caregivers, supporting the development of personalized support strategies.

Although this study took a comprehensive approach to investigating the interplay between resilience and various measures, the sample may not fully generalize to the broader caregiver population. Less than half of invited caregivers participated in the survey, a rate similar to the average of 44.1% reported in the meta-analysis by Wu et al<sup>49</sup> of more than 1000 published studies using online surveys. Although no definitive threshold exists, lower response rates limit generalizability and may introduce selection bias if nonrespondents differ systematically. Caregivers experiencing high levels of burden or those with lower resilience may have been less inclined to participate, biasing the sample toward those coping relatively well. However, of those who initiated the survey, 97% completed it, suggesting good engagement among participants.

Caregivers in our study were mostly men, and the average age was 60 years. The age and gender distribution is consistent with previous research on caregivers of people with MS<sup>17</sup> but different from that of caregivers for other illnesses.<sup>50</sup> Moreover, caregivers in this study were primarily spouses of patients with MS and a notable proportion of them reported relatively high incomes. This raises important questions about the well-being and support systems for people with MS who lack a significant other or those with lower incomes.

The absence of data on disease severity of patients with MS limits our ability to explore potential correlations between caregiver resilience and the specific challenges posed by varying degrees of illness. The lack of race and ethnicity data is another limitation of this study. An individual's racial and ethnic background can shape life experiences, including potential exposure to discrimination and social stressors that may affect resilience and caregiver burden.<sup>51</sup> Future studies should include these data, as they could reveal disparities across groups and inform tailored interventions among underserved caregiver groups. Expanding the sample's diversity and incorporating patient health data may provide a more nuanced understanding of the caregiver experience in the context of MS.

The reliance on self-report measures for personality traits, resilience, and other variables might introduce response bias or social desirability bias. To mitigate this to some extent for our primary outcome, we employed 2 assessments to measure resilience levels, the CD-RISC-25 and the HRSQ. The robust correlation and consistent results observed when analyzing either scale indicate the reliability of the resiliency scales. Furthermore, our study did not have a structured way of measuring social support among caregivers of people with MS. Given the importance of social support on caregiver burden<sup>52</sup> and its mediating effect on resilience,<sup>35</sup> the inclusion of a validated measure would have been beneficial. Another limitation involves the cross-sectional, correlational design of this study, preventing causal inferences and accounting for potential confounders that may influence the observed

relationships. Future longitudinal studies should use more advanced statistical models to elucidate causal pathways, potential mediators, and how resilience among caregivers evolves over time.

## CONCLUSIONS

This study deepens our understanding of caregiver resilience by exploring its associations with caregiver characteristics, well-being, quality of life, burden of care, coping mechanisms, and personality traits. Caregivers of people with MS showed relatively high resilience levels, which positively correlated with their quality of life and reduced caregiver burden. Our findings identified potential associations between personality traits and resilience in caregivers. Neuroticism was found to be negatively correlated with resilience, whereas extroversion and conscientiousness showed positive correlations. Future research should focus on the development and evaluation of personalized caregiver interventions, especially among caregivers with low baseline scores of resilience. These interventions could be designed with the specific aim of enhancing resilience and equipping caregivers with effective stress-coping strategies, thereby providing support for both caregivers and their care recipients.

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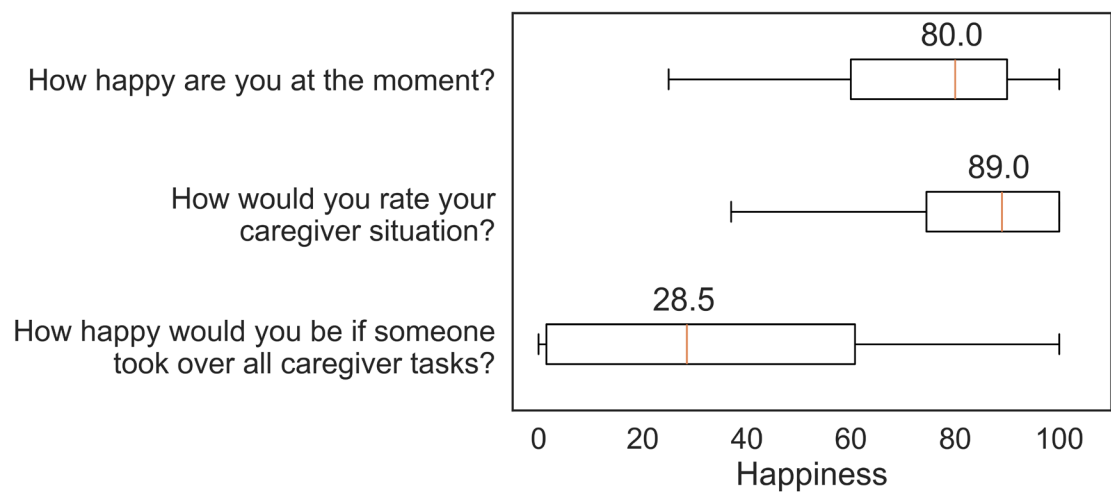
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FIGURE S1. Caregivers’ Reported Happiness Levels



CD-RISC-25, Connor-Davidson Resiliency Scale; HRSQ, Health-Resilience-Stress Questionnaire.  
Note: Trend line shows the best fitting linear regression line.

TABLE S1. Caregiver Perspectives on Well-Being and Challenges

"I have..."	No n (%)	Some n (%)	A lot of n (%)
Fulfillment from carrying out my care tasks	12 (12.8%)	35 (37.2%)	47 (50.0%)
Relational problems with the care receiver	71 (75.5%)	21 (22.3%)	2 (2.1%)
Problems with my own mental health	48 (50.5%)	42 (44.2%)	5 (5.3%)
Problems combining care tasks with daily activities	53 (55.8%)	41 (43.2%)	1 (1.1%)
Financial problems due to care tasks	76 (80.0%)	17 (17.9%)	2 (2.1%)
Support with carrying out my care tasks	41 (44.1%)	35 (37.6%)	17 (18.3%)
Problems with my own physical health	47 (50.5%)	42 (45.2%)	4 (4.3%)

Note: N = 95 for questions regarding mental health problems, combining tasks, and financial problems; N = 94 for fulfillment and relationship problems questions; and N = 93 for support and physical health questions.