Profiles of resilience in multiple sclerosis family care-partners: A Canadian cross-sectional study

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Abstract

Background: Psychological resilience may play an important role in protecting multiple sclerosis care-partners from the negative effects of their support role. However, predictors of resilience in this population have yet to be identified.

Objectives: To identify characteristics predictive of psychological resilience in multiple sclerosis care-partners as informed by the Ecological Model of Resilience.

Methods: Informal multiple sclerosis care-partners (n = 540) completed an online survey. Psychological resilience was measured using the 25-item Connor-Davidson Resilience Scale. Sociodemographic and care-context predictors of resilience were analyzed using hierarchical regression.

Results: The mean resilience score was 59.0 (SD = 7.6) out of a possible 100. Sociodemographic variables accounted for 31% of the variance in resilience scores in multiple sclerosis care-partners. When care-context variables were incorporated into the model, 55% of variance was explained (F[7,320] = 26.824, p < 0.001). Each group of variables remained significant in both low disability and high disability models. Social support was the only individual variable that remained significant across all models (p < 0.05).

Conclusions: Multiple sclerosis care-partners differ strikingly from other caregiving populations. Both sociodemographic and care-context variables were found to promote or hinder resilience in multiple sclerosis care-partners. Social support, in particular, may be an important target for promoting resilience in multiple sclerosis care-partners and could be leveraged in future initiatives.

Keywords: Informal caregivers, psychological resilience, quality of life, social support, regression analysis, cross sectional survey

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Introduction

Informal multiple sclerosis (MS) care-partners play an essential role in the health and wellbeing of people living with MS. As disability accumulates throughout the disease course, an estimated 30% of people with MS will rely on family members or friends (i.e. care-partners) to provide assistance with mobility, household management, and daily activities.1 Fulfillment of this role often exerts a negative impact on care-partners’ mental, emotional, and physical health.2 Indeed, MS care-partners report higher levels of stress, anxiety, and depression than the general population3 and can be more stressed than care-partners of other chronic neurological conditions.4 Uncertainty and loss of control due to symptom unpredictability and disease progression are associated with elevated levels of psychological distress and worry in MS care-partners.3,5 Additionally, the early age of disease onset means that both people with MS and their care-partners often navigate major life milestones together (e.g. career-building, parenthood), while managing the disease.5 Changes in personal and professional roles required to provide care can culminate in additional stress linked to feelings of grief, helplessness, and loss of self-esteem.5 However, some MS care-partners report benefits of providing care, such as feelings of strength, pride, and enhanced self-esteem.5 One factor contributing to this difference in care-partner experience may be psychological resilience.
Resilience is generally defined as the process of adaptation to stress or trauma, or “bouncing back” from adversity. In care-partner literature specifically, psychological resilience is characterized by experiencing high demands of care, while maintaining relatively good psychological wellbeing. Resilience has been positively correlated with quality of life in various caregiving populations. Moreover, high levels of resilience have been associated with reduced negative caregiving outcomes including burden and psychological distress.

The Ecological Model of Resilience identifies that facilitators of and barriers to psychological resilience exist at individual, community, and societal levels. The model recognizes that resilience is a result of not only personal characteristics, but also environmental factors and their interactions with the individual. In various caregiving populations, individual factors such as age, sex, and race have been associated with resilience. Previous studies have reported that younger male dementia caregivers often demonstrate higher levels of resilience than older or female caregivers, while Caucasian dementia caregivers demonstrate lower levels of resilience than caregivers of other ethnicities. On an interpersonal level, social support has been positively associated with care-partner resilience in the Alzheimer’s disease caregiving population.

While resilience-enhancing interventions have been developed for people with MS and their support-partners, existing literature does not identify which factors influence MS care-partner resilience. The vast majority of resilience literature in family caregivers focuses on dementia and aging. Due to the unique disease course (i.e. early age of onset and unpredictability) and distinct characteristics of MS care-partners, research from other caregiving populations may not be generalizable to the MS context. Therefore, the objectives of this study were to: (1) identify predictors of psychological resilience in MS care-partners, as guided by the Ecological Model of Resilience; and (2) examine potential differences in predictors of resilience by care-recipient disability status.

**Methods**

This manuscript reports on baseline data from a longitudinal study of resilience in MS care-partners. The study protocol was approved by the University of Ottawa Science and Health Sciences Research Ethics Board [H-02-20-5338]. Informed consent was provided by all participants.

**Design**

MS care-partners were recruited via online materials distributed by the MS Society of Canada’s (MSSC) Research Portal, regional MSSC Chapters, national care partner organizations, newsletters, and social media outlets. Potential participants were directed to the study’s survey website via a link provided on recruitment materials. After being presented with detailed information about the study and its purpose, individuals were asked to provide consent and then undergo screening. Eligible participants were 18 years of age or older, currently providing physical, emotional, or informational assistance for a person living with MS, a resident of Canada, and agreed to complete an online survey in English annually, for a 3-year period. Individuals who reported difficulty with memory, calculation, or reasoning that significantly interfered with their daily functioning were excluded. Once eligibility was confirmed, participants were invited to complete the online questionnaire. Each participant received up to $10 in online gift cards for survey participation. Online surveys were organized using an institutional SurveyMonkey platform (Momentive Inc., San Mateo, California) and took approximately 30 min to complete.

**Measurements**

The questionnaire battery involved participant demographics including age, sex, race, and marital status, care-partner general health status, relationship with their care-recipient, and whether they lived with their care-recipient. Socioeconomic information was reported as current employment status (full-time, part-time, and unemployed), annual household income, and highest level of education obtained. Caregiving context variables included social support using the Interpersonal Support Evaluation Checklist (ISEL-12), caregiving tasks using the Caregiving Tasks in Multiple Sclerosis Scale (CTMSS), and minutes per day spent providing care. The selection of these variables was informed by existing resilience literature among other caregiving populations. The Patient Determined Disease Steps (PDDS) scale was used to characterize the disability level of the care-recipient as reported by the care-partner. Scores on the PDDS are strongly correlated with scores on the clinically-administered Expanded Disability Status Scale (EDDS).

The outcome of this study was care-partner psychological resilience, assessed using the 25-item
Connor-Davidson Resilience Scale (CD-RISC 25), which is well-represented in the caregiving literature. While there are no recognized subscales for the CD-RISC 25, scale items assess psychological resilience as it relates to personal competence, tolerance of negative affect, positive acceptance of change, control and spiritual factors. Each item on the CD-RISC 25 is scored on a five-point scale (0 = not true at all to 4 = true nearly all the time) with total scores ranging between 0 and 100. Higher scores indicate greater levels of psychological resilience.

Statistical analysis
Descriptive statistics were used to summarize all demographic and caregiving variables. The sample was divided into two groups according to PDDS scores of care-recipients as PDDS<3 (i.e. lower disability) and PDDS≥3 (i.e. higher disability). Cut-points for disability were based on the presence of mobility disability. Two participants failed to report the PDDS score of their care recipient and therefore were not included in analyses conducted by disability level. Disability groups were compared on demographic and care-partner variables using independent samples t-tests and Chi-square tests. Pearson's correlation coefficients were used to examine associations between resilience and caregiving-context variables. Correlational effect size was evaluated using Cohen’s criteria with small, medium, and large effects attributed to coefficients of 0.1, 0.3, and 0.5, respectively. Following an assessment of normality, variance, and multicollinearity, multivariate hierarchical regression was conducted using care-partner resilience scores as a continuous outcome variable. Categorical variables were recoded into binary dummy variables to accommodate their inclusion in regression models. Variables were added to the model in two steps. The first step included demographic and socioeconomic variables. The second step added caregiving context variables into the model. Hierarchical regression analyses were conducted for the sample overall and per disability group. Variable categories with too few responses to be statistically significant within the models were automatically removed. The effect size of each model was interpreted using $F^2$ values with small, medium, and large effects attributed to values of 0.02, 0.15, and 0.35, respectively. Data analysis was conducted using SPSS version 28.0 (IBM SPSS Statistics, Armonk, NY).

Results

Participant characteristics
Recruitment yielded 613 initial responses, of whom 563 completed eligibility screening. A total of 540 care-partners from across Canada met eligibility criteria and were included in the analysis (Figure 1). A summary of the sample characteristics overall and by care-recipient disability level is presented in Table 1. Overall, participants were on average 39.4 (6.6) years old and 60.1% male. Over half of the sample (57.6%) identified as being of North-American descent. Almost all participants were married/common-law (96.7%) and living with their care-recipient with MS (98.7%). The majority of care-partners were either spouses (58.2%) or parents (38.8%) of their care-recipients. The mean resilience score of the sample was 59.0 (7.6).

When examining participant characteristics by disability level, care-partners of people with MS with higher disability were significantly older ($p<0.01$), less often employed ($p<0.01$) and more often the parent of their care-recipient ($p<0.01$) than lower disability care-partners. Care-partners of people with MS with higher disability also provided significantly more care ($p<0.01$), completed more caregiving tasks ($p<0.01$), and received less social support ($p<0.01$) than those in the lower disability group. There was no significant difference in sex ($p=0.13$) or resilience score ($p=0.76$) between disability groups.

Correlates of resilience in MS care-partners
Correlation coefficients between resilience and caregiving-context variables for the overall sample and by disability level are presented in Table 2. Resilience was positively correlated with social support ($r=0.42, p<0.01$) and caregiving tasks ($r=-0.24, p<0.01$) in the overall sample. Both the magnitude and direction of correlation between caregiving variables and resilience varied by disability levels, with only social support maintaining a moderate, positive correlation with resilience in both low and high disability groups ($r=0.48$ and 0.41, respectively).

Regression analysis
Results for the hierarchical regression models overall and by disability level are presented in Table 3. In the overall sample, sociodemographic characteristics explained 31% of the variance in resilience in MS care-partners ($R=0.590$, $R^2=0.348$, Adj.$R^2=0.308$). When caregiving-context variables were added, the total model explained 55% of the variance in resilience ($R=0.767$, $R^2=0.589$, Adj.$R^2=0.554$, $F(7,320)=26.824$, $p<0.001$). This pattern was consistent across disability groups, with 61% of the variance in resilience explained in the total model in care-partners of people with MS with lower disability ($R=0.800$, $R^2=0.641$, Adj.$R^2=0.609$, $F(6,238)=...
19.414, \( p < 0.001 \), and 52% of the variance explained in the total model in care-partners of people with MS with higher disability (\( R = 0.817, R^2 = 0.668, \text{Adj.R}^2 = 0.518, F[7,60] = 7.002, p < 0.001 \)). F² values for each model ranged from 0.214 to 0.761 indicating medium-to-large effect sizes.21

Being of Latin American (\( \beta = -0.478, p = 0.009 \)), European (\( \beta = -0.417, p = 0.026 \)), North African (\( \beta = -0.315, p = 0.009 \)), or other African or Caribbean (\( \beta = -0.336, p = 0.001 \)) descent was negatively associated with resilience, as was reporting part-time employment (\( \beta = -0.253, p < 0.001 \)) or an annual income of less than $150,000 (\( \beta \) between -0.744 and -0.146, \( p = 0.004-0.047 \)). Being female (\( \beta = 0.096, p = 0.042 \)) displayed a weak, positive association with resilience. These were the only significant sociodemographic variables in the first step of the regression model, and all remained significant in the total model. Within the caregiving-context variables, being a parent care-partner was negatively associated with resilience (\( \beta = -0.154, p = 0.003 \)), while being an offspring care-partner was positively associated with resilience (\( \beta = 0.290, p < 0.001 \)). Other significant variables were social support (\( \beta = 0.260, p < 0.001 \)) and care-recipient disability level (\( \beta = 0.172, p = .015 \)). A complete list of regression coefficients for the overall sample is presented in Table 4.

Regarding care-partners of people with MS with lower disability, race (\( p \) between 0.010 and 0.073) and full-time employment (\( p < 0.001 \)) also demonstrated significant, negative associations with resilience. Further, higher education was positively associated with resilience (\( \beta = 0.165, p = 0.002 \)). When caregiving-context variables were introduced into the model, only associations with race (\( p < 0.001-0.006 \)) and education (\( p = 0.035 \)) remained significant. Reporting an annual income over $150,000 also became significant (\( \beta = 0.148, p < 0.001 \)). Being a parent was no longer significant (\( \beta = -0.135, p = 0.103 \)), while being an offspring of the care-recipient displayed a significant, positive association (\( \beta = 0.128, p = 0.003 \)). Similar to the overall sample, social support (\( \beta = 0.168, p = 0.001 \)) and minutes per day spent providing care (\( \beta = -0.433, p < 0.001 \)) were the only other significant caregiving-context variables within the low-disability group.

Within care-partners of people with MS with higher disability, no single demographic variable had a significant association with resilience. However, when caregiving-context variables were introduced, part-time employment became significant (\( \beta = -0.307, p = 0.003 \)). Regarding caregiving-context variables, being an offspring of the care-recipient (\( \beta = 0.373, p = 0.002 \)) and social support (\( \beta = 0.357, p < 0.001 \)) were significantly associated with resilience. A complete list of regression

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**Figure 1.** Flow of participants through the study.
Table 1. Care-partner characteristics of the overall sample, and for care-partners of people with MS with low disability (PDDS < 3) and high disability (PDDS ≥ 3). Values are presented as mean (SD) and p-values were derived from t-tests, unless otherwise noted.

| Variable                                      | Total (n = 540) | PDDS < 3 (n = 360) | PDDS ≥ 3 (n = 178) | p-value for disability group comparison |
|-----------------------------------------------|-----------------|--------------------|--------------------|----------------------------------------|
| Age                                           | 39.4 (6.6)      | 37.2 (5.0)         | 44.0 (12.2)        | <0.01                                  |
| Sex, n female (%)                             | 220 (40.9)      | 139 (38.6)         | 80 (45.5)          | 0.13*                                  |
| Race                                          |                 |                    |                    | <0.01*                                 |
| North American, n (%)                         | 308 (57.6)      | 248 (69.1)         | 60 (34.5)          |                                        |
| Latin American, n (%)                        | 74 (13.8)       | 42 (11.7)          | 32 (17.2)          |                                        |
| European, n (%)                               | 65 (12.0)       | 24 (6.7)           | 41 (23.0)          |                                        |
| North African, n (%)                         | 38 (7.0)        | 20 (5.6)           | 18 (10.1)          |                                        |
| Other African, Afro-Caribbean, or Afro-Canadian, n (%) | 23 (4.3)   | 12 (3.3)           | 11 (6.3)           |                                        |
| General Health Status                         |                 |                    |                    | <0.01*                                 |
| Excellent, n (%)                              | 25 (4.7)        | 11 (3.1)           | 14 (7.9)           |                                        |
| Very Good, n (%)                              | 406 (75.2)      | 285 (79.2)         | 119 (66.9)         |                                        |
| Fair, n (%)                                   | 104 (19.3)      | 60 (16.7)          | 44 (24.7)          |                                        |
| Poor, n (%)                                   | 2 (0.4)         | 1 (0.3)            | 1 (0.6)            |                                        |
| Relationship Status                           | <0.01*          |                    |                    |                                        |
| Married/Common-law, n (%)                    | 518 (96.7)      | 351 (97.8)         | 167 (94.4)         |                                        |
| Single/Never married, n (%)                  | 11 (2)          | 8 (2.2)            | 3 (1.7)            |                                        |
| Separated/Divorced/Widowed, n (%)             | 7 (1.3)         | 0 (0.0)            | 7 (4.0)            |                                        |
| Highest Level of Education                   | <0.01*          |                    |                    |                                        |
| High School/GED, n (%)                       | 31 (5.8)        | 5 (1.4)            | 26 (14.7)          |                                        |
| College/CEGEP, n (%)                         | 278 (51.6)      | 192 (53.3)         | 84 (47.5)          |                                        |
| Technical/Trade School, n (%)                | 129 (23.9)      | 103 (28.6)         | 26 (14.7)          |                                        |
| Bachelor’s Degree, n (%)                     | 84 (15.6)       | 55 (15.3)          | 29 (16.4)          |                                        |
| Master’s Degree, n (%)                       | 13 (2.4)        | 4 (1.1)            | 9 (5.1)            |                                        |
| Doctoral Degree, n (%)                       | 3 (0.6)         | 1 (0.3)            | 1 (1.1)            |                                        |
| Employment                                   | <0.01*          |                    |                    |                                        |
| Full-time, n (%)                              | 431 (80.1)      | 328 (91.4)         | 103 (58.2)         |                                        |
| Part-time, n (%)                              | 82 (15.6)       | 30 (8.4)           | 52 (29.4)          |                                        |
| Unemployed, n (%)                             | 23 (4.3)        | 1 (0.3)            | 22 (12.4)          |                                        |
| Annual Household Income                      | <0.01*          |                    |                    |                                        |
| <$20,000, n (%)                               | 1 (0.2)         | 0 (0.0)            | 1 (0.6)            |                                        |
| $20,000–$49,999, n (%)                       | 209 (38.8)      | 182 (50.6)         | 27 (15.3)          |                                        |
| $50,000–$99,999, n (%)                       | 294 (54.5)      | 166 (46.1)         | 126 (71.2)         |                                        |
| $100,000–$149,999, n (%)                     | 26 (4.8)        | 11 (3.1)           | 15 (8.5)           |                                        |
| >$150,000, n (%)                             | 3 (0.6)         | 1 (0.3)            | 2 (1.1)            |                                        |
| Relationship with Care-recipient             | <0.01*          |                    |                    |                                        |
| Spouse, n (%)                                 | 312 (58.2)      | 238 (66.5)         | 73 (41.5)          |                                        |
| Parent, n (%)                                 | 208 (38.8)      | 117 (32.7)         | 90 (51.1)          |                                        |
| Offspring, n (%)                              | 14 (2.6)        | 5 (0.8)            | 11 (6.3)           |                                        |
| Sibling, n (%)                                | 2 (0.4)         | 0 (0.0)            | 2 (1.1)            |                                        |

(continued)
coefficients for care-partners of people with MS with low-disability and high-disability are reported in Tables 5 and 6, respectively.

**Discussion**
This study identified cross-sectional factors associated with resilience in a large sample of Canadian MS care-partners, and examined differences in predictors of resilience based on care-recipient disability level. Overall, both demographics and caregiving-context characteristics were significantly associated with care-partner resilience. In particular, social support was identified as a consistent predictor of resilience across MS care-partners.
Table 3. Regression coefficients for the care-partner sample overall, and for care-partners of people with MS with low (PDDS < 3) and high disability (PDDS ≥ 3).

| Step | Overall | PDDS < 3 | PDDS ≥ 3 |
|------|---------|---------|---------|
| R    | 0.590   | 0.682   | 0.629   |
| R²   | 0.348   | 0.465   | 0.396   |
| ΔR²  | 0.308   | 0.432   | 0.216   |
| p-value of change | 0.445   | 0.761   | 0.276   |

| Step 2 | Overall | PDDS < 3 | PDDS ≥ 3 |
|---------|---------|---------|---------|
| R    | 0.767   | 0.800   | 0.817   |
| R²   | 0.589   | 0.641   | 0.668   |
| ΔR²  | 0.554   | 0.609   | 0.518   |
| p-value of change | 0.241 (p < 0.001) | 0.176 (p < 0.001) | 0.272 (p < 0.001) |

Dependent variable: CD-RISC 25 score; R: Coefficient of correlation; R²: Coefficient of determination; PDDS: Patient Determined Disease Steps.

Table 4. Summary of hierarchical regression analyses for predicting resilience within the overall sample of MS care-partners (n = 540). Step 1 R = 0.590, R² = 0.348, Adj. R² = 0.308. Step 2 R = 0.767, R² = 0.589, Adj. R² = 0.554, ΔR² = 0.241 (p < 0.001).

| Variable          | B     | SE of B | β    | p-value | 95% CI for B |
|-------------------|-------|---------|------|---------|--------------|
| Step 1            |       |         |      |         |              |
| Age               | 0.092 | 0.060   | 0.112| 0.126   | –0.026 – 0.209|
| Sex               |       |         |      |         |              |
| Female            | 1.402 | 0.688   | 0.096| 0.042   | 0.049 – 2.755|
| Race              |       |         |      |         |              |
| Latin American    | –11.733| 4.459   | –0.478| 0.009   | –20.504 – 2.962|
| European          | –10.094| 4.504   | –0.419| 0.026   | –18.954 – 1.234|
| North African     | –12.233| 4.665   | –0.315| 0.009   | –21.410 – 3.056|
| Other African/Caribbean | –15.880| 4.904   | –0.336| 0.001   | –25.527 – 6.234|
| Asian             | 1.012 | 8.084   | 0.008| 0.900   | –14.892 – 16.916|
| Indigenous        | 2.359 | 7.277   | 0.018| 0.746   | –11.956 – 16.675|
| General Health Status |       |         |      |         |              |
| Excellent         | 1.115 | 1.659   | 0.035| 0.502   | –2.150 – 4.379|
| Fair              | –0.827| 0.916   | –0.042| 0.367   | –2.628 – 0.974|
| Poor              | 0.957 | 6.249   | 0.007| 0.878   | –11.337 – 13.251|
| Highest Level of Education |       |         |      |         |              |
| Lower level       | 1.168 | 1.577   | 0.039| 0.460   | –1.936 – 4.271|
| Employment        |       |         |      |         |              |
| Part-time         | –5.511| 1.181   | –0.253| <0.001 | –7.834 – 3.188|
| Unemployed        | 2.319 | 2.181   | 0.076| 0.289   | –1.972 – 6.610|
| Annual Household Income |       |         |      |         |              |
| Less than $20,000 | –19.377| 7.164   | –0.146| 0.007   | –33.471 – 5.282|
| $20,000–49,999    | –10.649| 3.758   | –0.744| 0.005   | –18.042 – 3.256|
| $100,000–149,999  | –8.178| 4.110   | –0.227| 0.047   | –16.263 – 3.383|
| $150,000 or more  | –8.341| 5.746   | –0.089| 0.148   | –19.644 – 0.094|

| Step 2            |       |         |      |         |              |
| Age               | 0.067 | 0.056   | 0.081| 0.231   | –0.043 – 0.176|
| Sex               |       |         |      |         |              |
| Female            | 1.311 | 0.556   | 0.090| 0.019   | 0.218 – 2.405|

(continued)
Within the current sample, care-partner demographics differed from informal caregivers of older adults, which are typically the population of interest in family caregiving research. When compared to other Canadian caregiver samples, the present sample of MS care-partners were younger, 1.37 times more likely to be male, and over five times more likely to be caring for a spouse. These findings are consistent with other MS caregiver cohorts which tend to be younger and predominantly male in comparison to dementia caregivers. These trends may be attributable to disease characteristics of MS, such as a young age of disease onset and an over-representation of women diagnosed.

Such discrepancies between our findings and previous reports of caregiver characteristics suggest that MS care-partners reflect a distinct care-partner population (i.e. middle-aged, male, spousal care-partners), and thus may face a unique caregiving experience. This highlights the need for MS-specific caregiver research and suggests that interventions or resources relying on approaches developed for other caregiving populations (i.e. dementia caregivers) may not be appropriate or inherently resonate with MS care-partners.

This sociodemographic distinctiveness was further nuanced by care-recipient disability level. As MS is a neurodegenerative and progressive disease, such as a young age of disease onset and an over-representation of women diagnosed, interventions or resources relying on approaches developed for other caregiving populations (i.e. dementia caregivers) may not be appropriate or inherently resonate with MS care-partners.
Table 5. Summary of hierarchical regression analyses for predicting resilience within care-partners of people with MS with low disability (PDDS < 3) \((n = 360)\). Step 1 \(R = 0.682, R^2 = 0.465, \text{Adj. } R^2 = 0.432\). Step 2 \(R = 0.800, R^2 = 0.641, \text{Adj. } R^2 = 0.609, \Delta R^2 = 0.176 (p < 0.001)\).

| Variable                      | B    | SE of B | β     | p-value | 95% CI of B       |
|-------------------------------|------|---------|-------|---------|-------------------|
| **Step 1**                    |      |         |       |         |                   |
| Age                           | 0.127| 0.068   | 0.109 | 0.061   | −0.006 to 0.260   |
| Sex                           |      |         |       |         |                   |
| Female                        | 0.558| 0.539   | 0.052 | 0.301   | −1.620 to 2.600   |
| Race                          |      |         |       |         |                   |
| Latin American                | −7.341| 4.073  | −0.374| 0.073   | −15.364 to 0.683  |
| European                      | −9.642| 4.295  | −0.326| 0.026   | −18.103 to −1.181 |
| North African                 | −11.109| 4.252 | −0.327| 0.010   | −19.484 to −2.733 |
| Other African/Caribbean       | −11.575| 4.529 | −0.311| 0.011   | −20.495 to −2.655 |
| General Health Status         |      |         |       |         |                   |
| Excellent                     | −0.336| 1.767   | −0.011| 0.849   | −3.143 to 3.143   |
| Fair                          | −0.738| 0.706   | −0.050| 0.297   | −2.129 to 0.653   |
| Highest Level of Education    |      |         |       |         |                   |
| Higher level                  | 7.901| 2.463   | 0.165 | 0.002   | 3.050 to 12.752   |
| Employment                    |      |         |       |         |                   |
| Full-time                     | 6.262| 1.320   | 0.267 | <0.001  | 3.661 to 8.863    |
| Unemployed                    | 7.690| 5.119   | 0.093 | 0.134   | −2.393 to 17.773  |
| Annual Household Income       |      |         |       |         |                   |
| $50,000–99,999                | −1.147| 0.646   | −0.103| 0.077   | −2.421 to 0.126   |
| $100,000–149,999              | −1.619| 2.046   | −0.044| 0.430   | −5.649 to 2.411   |
| $150,000 or more              | 5.267| 3.915   | 0.064 | 0.180   | −2.445 to 12.979  |
| Relationship with Care-recipient|      |         |       |         |                   |
| Parent                        |      |         |       |         |                   |
| Offspring                     | 10.566| 3.564  | 0.128 | 0.003   | 3.545 to 17.587   |
| (continued)                   |      |         |       |         |                   |
caregivers of people with MS who have higher levels of neurological disability were more likely to be older and their care-recipients were more inclined to require a higher demand of daily care when compared to less impaired individuals.\textsuperscript{25} Therefore, differences in age, minutes per day of care, and caregiving tasks between low and high disability groups were expected. This increased need for care often results in struggles with maintaining employment\textsuperscript{26} and cultivating a meaningful social life.\textsuperscript{2} This is reflected in the current findings, as a higher proportion of care-partners of people with MS with high disability reported unemployment and lower perceived social support in comparison to their low-disability counterparts. These variations by disability level may be indicative of the increasingly complex nature of MS caregiving over the disease course and suggests that at high levels of disability, accessible and specialized supports may be even more essential to care-partner wellbeing.

Herein, MS care-partners reported low resilience scores when compared to the general public,\textsuperscript{16} and to other caregiving populations, such as dementia\textsuperscript{27} and Alzheimer’s caregivers.\textsuperscript{28} Notably, mean resilience scores were not different based on care-recipient disability level, despite significant differences in most sociodemographic and caregiving-context variables between groups. A similar phenomenon has been reported in dementia caregivers where the severity of dementia did not affect reported caregiver resilience.\textsuperscript{29} This finding underscores the importance of the cumulative effect of the care-partner context in facilitating or discouraging resilience, in addition to individual factors, as supported by the Ecological Model of Resilience.\textsuperscript{5}

Findings from the regression analyses revealed that both sociodemographic and caregiving context variables explained significant variance in psychological resilience in MS care-partners. The effect of sociodemographic variables was greater in care-partners of people with MS with lower disability, whereas caregiving-context variables were more impactful in care-partners of people with MS with higher disability. This finding demonstrates that while levels of resilience are similar across disability groups, the predictive strength of demographic versus contextual factors appears to differ. Thus, when identifying care-partners at risk for low resilience, both demographic and caregiving-context variables need to be examined; however, the weight of these factors might be considered differently in the context of their care-recipient’s disability level.

Many of the sociodemographic associations with resilience identified in this study contradict existing literature in other caregiving populations. Among dementia caregivers, resilience has been negatively associated with being a woman,\textsuperscript{6} older,\textsuperscript{6} and Caucasian.\textsuperscript{10} Despite these previous findings, in the current sample we found no such link between resilience and sex or with age. Moreover, we observed a negative association between resilience and being an ethnic minority. This suggests that patterns in resilience observed in other caregiving populations are not necessarily mirrored in MS care-partners, further establishing them as a distinct caregiving population.

Most caregiving context variables were not associated with resilience throughout the regression models. Unlike quality of life which has been negatively associated with increased care demands in MS care-partners,\textsuperscript{30} resilience was not predicted by caretaking time spent providing care, or care-recipient disability level. Alternatively, social support remained the most consistent predictor of resilience in the overall sample and by disability level. The association between resilience and social support has been well

| Variable                        | B       | SE of B | β       | p-value | 95% CI of B |
|---------------------------------|---------|---------|---------|---------|-------------|
| Minutes per Day of Care         | -0.077  | 0.019   | -0.433  | <0.001  | -0.114 -0.040 |
| CTiMSS Score                    | -0.012  | 0.032   | -0.033  | 0.711   | -0.075 0.051 |
| ISEL Score                      | 0.174   | 0.053   | 0.168   | 0.001   | 0.070 0.279 |
| PDDS of Person with MS          | -0.331  | 0.520   | -0.026  | 0.526   | -1.356 0.695 |

Note. B: Unstandardized regression coefficient; β: Standardized regression coefficient; CTiMSS: Caregiving Tasks in Multiple Sclerosis Scale; ISEL: Interpersonal Support Evaluation Checklist; PDDS: Patient Determined Disease Steps. Categorical comparison groups: Sex, Male; Race, North American; Health Status, Very Good; Education, Lower level (No post-secondary); Employment, Full-time; Income, $20,000–49,999; Relationship with care-recipient, Spouse.
Table 6. Summary of hierarchical regression analyses for predicting resilience within care-partners of people with MS with high disability (PDDS ≥ 3) (n = 178). Step 1 R = 0.629, R² = 0.396, Adj. R² = 0.216. Step 2 R = 0.817, R² = 0.668, Adj. R² = 0.528, ΔR² = 0.272 (p < 0.001).

| Variable                                | B    | SE of B | β     | P-value   | 95% CI for B |
|------------------------------------------|------|---------|-------|-----------|--------------|
| **Step 1**                               |      |         |       |           |              |
| Age                                      | 0.062| 0.133   | 0.073 | 0.644     | −0.196 to 0.331 |
| Sex                                      | 4.264| 2.292   | 0.193 | 0.067     | −0.311 to 8.839 |
| Race                                     |      |         |       |           |              |
| Latin American                           | −15.824 | 10.791 | −0.508 | 0.147     | −37.362 to 5.715 |
| European                                 | −10.552 | 10.578 | −0.431 | 0.322     | −31.665 to 10.561 |
| North African                            | −12.417 | 11.262 | −0.283 | 0.274     | −34.896 to 10.062 |
| Other African/Caribbean                  | −15.700 | 12.211 | −0.258 | 0.203     | −40.073 to 8.672 |
| Asian                                    | 2.524 | 15.262  | 0.024 | 0.869     | −27.940 to 32.988 |
| Indigenous                               | 1.805 | 14.167  | 0.017 | 0.899     | −26.472 to 30.082 |
| General Health Status                    |      |         |       |           |              |
| Excellent                                | 1.336 | 3.810   | 0.038 | 0.727     | −6.269 to 8.941 |
| Fair                                     | −1.302 | 2.943   | −0.045 | 0.660     | −7.175 to 4.572 |
| Poor                                     | 4.193 | 10.671  | 0.040 | 0.696     | −17.106 to 25.493 |
| Highest Level of Education               |      |         |       |           |              |
| Higher level                             | −3.365 | 3.070   | −0.123 | 0.277     | −9.492 to 2.763 |
| Employment                               |      |         |       |           |              |
| Part-time                                | −3.978 | 2.714   | −0.171 | 0.147     | −9.395 to 1.439 |
| Unemployed                               | 2.182 | 4.230   | 0.081 | 0.608     | −6.262 to 10.626 |
| Annual Household Income                  |      |         |       |           |              |
| Less than $20,000                        | −16.662 | 12.235 | −0.160 | 0.178     | −41.083 to 7.759 |
| $20,000–49,999                           | −10.361 | 6.864   | −0.393 | 0.136     | −24.062 to 3.339 |
| $100,000–149,999                         | −3.444 | 7.563   | −0.095 | 0.650     | −18.541 to 11.653 |
| $150,000 or more                         | −7.133 | 12.393  | −0.068 | 0.567     | −31.870 to 17.604 |
| **Step 2**                               |      |         |       |           |              |
| Age                                      | 0.141 | 0.133   | 0.167 | 0.294     |              |
| Sex                                      | 1.900 | 1.871   | 0.086 | 0.314     | −1.842 to 5.643 |
| Race                                     |      |         |       |           |              |
| Latin American                           | −2.271 | 9.397   | −0.073 | 0.810     | −21.067 to 16.525 |
| European                                 | −3.862 | 9.136   | −0.158 | 0.674     | −22.136 to 14.412 |
| North African                            | −4.452 | 9.667   | −0.102 | 0.647     | −23.789 to 14.886 |
| Other African/Caribbean                  | −3.471 | 10.320  | −0.057 | 0.738     | −24.114 to 17.172 |
| Asian                                    | 18.527 | 13.508  | 0.178 | 0.175     | −8.494 to 45.547 |
| Indigenous                               | 5.059 | 11.952  | 0.049 | 0.674     | −18.848 to 28.966 |
| General Health Status                    |      |         |       |           |              |
| Excellent                                | 1.727 | 3.202   | 0.050 | 0.592     | −4.678 to 8.132 |
| Fair                                     | 3.634 | 2.534   | 0.127 | 0.157     | −1.435 to 8.703 |
| Poor                                     | −8.884 | 11.414 | −0.085 | 0.439     | −31.715 to 13.947 |
| Highest Level of Education               |      |         |       |           |              |
| Higher level                             | −2.354 | 2.500   | −0.086 | 0.350     | −7.354 to 2.646 |
| Employment                               |      |         |       |           |              |
| Part-time                                | −7.161 | 2.345   | −0.307 | 0.003     | −11.852 to −2.470 |
| Unemployed                               | 0.153 | 3.586   | 0.006 | 0.966     | −7.020 to 7.326 |

(continued)
established in the caregiving literature. This study further confirms this positive association in MS care-partners, even after controlling for sociodemographic variables. Thus, future resilience-building initiatives for MS care-partners should strive to target and foster high-quality social support.

Results from this study demonstrate that many variables warrant consideration when examining resilience in MS care-partners. Our findings have implications for targeting MS care-partners who may be at risk of low levels of resilience. Specifically, care-partners who are ethnic minorities, partially employed, or the parents of their care-recipient may be at risk for low resilience. Contrarily, care-partners who are offspring of their care-recipient and receive ample social support may be more likely to achieve high resilience. Care-partners identifying with these higher risk groups and their healthcare providers should be aware of the potential negative health outcomes associated with low resilience, and care-partners should be encouraged to engage in opportunities that can bolster and enhance resilience.

This study possesses several strengths. First, this is the first study to explore factors predicting resilience in a large Canadian sample of MS care-partners. By including care-partners from across Canada, and the MS disability spectrum, we were able to describe a large, representative sample. Second, we used the established Ecological Model of Resilience to guide the structure of the survey questions and data analysis. Finally, we assessed the effect of many potential confounders when examining resilience.

One limitation of this study is that disability level of the care-recipient was reported by care-partners. It has been reported that care-partners often underestimate the health and function of their care-recipients; therefore, it is possible that the disability levels of care-recipients are reported as higher than actuality. Further, recruitment and data collection for this study occurred completely online and was voluntary. In Canada, internet compatible device ownership and reliable internet access is consistently less prevalent among individuals of low socioeconomic status, older adults, and those living in rural areas. It is possible that these groups may have had less access to the online survey and may be under-represented in the sample. In addition, voluntary surveys have been reported to elicit responses more commonly from individuals who feel they will perform well on them. Care-partners who felt they were not highly resilient may not have participated, and may be under-represented in our sample.

In conclusion, factors contributing to resilience in MS care-partners differ strikingly from other caregiving populations. Both sociodemographic and caregiving-context variables were important contributors to resilience, with caregiving-context variables exerting a greater influence at higher disability levels. Across disability levels, perceived social support was the most

| Variable | B | SE of B | β | P-value | 95% CI for B |
|----------|---|---------|---|---------|--------------|
| Annual Household Income | | | | | |
| Less than $20,000 | −13.081 | 9.863 | −0.126 | 0.190 | −32.810 | 6.648 |
| $20,000–49,999 | −2.911 | 6.114 | −0.110 | 0.636 | −15.141 | 9.320 |
| $100,000–149,999 | −3.985 | 6.454 | −0.109 | 0.539 | −16.896 | 8.925 |
| $150,000 or more | 1.622 | 10.258 | 0.016 | 0.875 | −18.897 | 22.141 |
| Relationship with Care-recipient | | | | | |
| Parent | −1.761 | 2.509 | −0.069 | 0.486 | −6.781 | 3.259 |
| Offspring | 12.993 | 4.030 | 0.373 | 0.002 | 4.931 | 21.054 |
| Sibling | 1.562 | 6.963 | 0.021 | 0.823 | −12.367 | 15.491 |
| Minutes per Day of Care | 0.011 | 0.011 | 0.147 | 0.286 | −0.010 | 0.033 |
| CTiMSS Score | −0.031 | 0.062 | −0.061 | 0.618 | −0.155 | 0.093 |
| ISEL Score | 0.634 | 0.164 | 0.357 | <0.001 | 0.306 | 0.963 |
| PDDS of person with MS | 0.839 | 0.789 | 0.148 | 0.292 | −0.739 | 2.317 |

Note. B: Unstandardized regression coefficient; β: Standardized regression coefficient; CTiMSS: Caregiving Tasks in MS Scale; ISEL: Interpersonal Support Evaluation Checklist; PDDS: Patient Determined Disease Steps. Categorical comparison groups: Sex, Male; Race, North American; Health Status, Very Good; Education, Lower level (No post-secondary); Employment, Full-time; Income, $50,000–99,999; Relationship with care-recipient, Spouse.
consistent contributor to resilience. Ultimately, this finding justifies leveraging social support to promote resilience via MS care-partner community resources and resilience-based interventions. Future initiatives should recognize MS care-partners as a unique caregiver population and explore the influence of external environmental factors on MS care-partner resilience.

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